SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Fastener Tightening Specifications

Application	Specification	
	Metric	English
Clutch Actuator Cylinder Mounting Bolts	12 N.m	106 lb in
Clutch Pedal Bracket Mounting Nuts	27 N.m	20 lb ft
Clutch Pedal Nut	50 N.m	37 lb ft
Clutch Pressure Plate Bolts[1]	70 N.m	52 lb ft
Cruise Control Release Switch Bracket Retaining Bolts	12 N.m	106 lb in
Driver Foot Rest Bracket Retaining Bolt	8 N.m	71 lb in
Driver Foot Rest Bracket Retaining Nut	10 N.m	89 lb in
Engine Flywheel Inspection Cover Retaining Bolts	25 N.m	18 lb ft
Negative Battery Cable Bolt	15 N.m	11 lb ft
[1] Clutch pressure plate bolts must be tightened in sequence and in even increments over three passes, then tightened to final specification on the fourth pass.		

SEALERS AND LUBRICANTS

Sealers and Lubricants

Application	Type of Material	GM Part Number
Clutch Hydraulic System Fluid	Clutch Hydraulic Fluid	12345347
Clutch Pedal Bushing	Lubricant	1052497

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - CLUTCH

Reviewing the **Clutch System Description and Operation** will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the **Clutch System Description and Operation** will also help you determine if the condition described by the customer is normal operation. Refer to **Symptoms - Clutch** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - CLUTCH

Strategy Based Diagnostics

Review the system operations in order to familiarize yourself with the system functions. Refer to **Clutch System Description and Operation** .

Visual/Physical Inspection

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the clutch master cylinder reservoir for the correct fluid level.
- Inspect the hydraulic clutch lines for dents, kinks or other obvious damage that may affect the clutch system operations.
- Inspect the hydraulic lines for proper installation.
- Inspect the clutch system for contamination of dirt, oil, or other substances that may affect the clutch system operations.
- Inspect for aftermarket parts.

Intermittent

Test the vehicle under the same conditions that the customer reported in order to verify the system is operating properly.

Symptom List

IMPORTANT: Due to the variety of clutch options, there may be components in the mechanical diagnostic tables that are not on a particular vehicle.

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **Clutch Drag Hard Shifting**
- **Clutch Slipping**
- **Clutch Grabbing**
- **Clutch Rattle**
- **Clutch Noisy**
- **Clutch Pedal Spongy Low Pedal Effort**
- **Clutch Pedal Hard to Push**
- **Clutch Frequent Adjustments**
- **Clutch Vibration**

CLUTCH DRAG HARD SHIFTING

Clutch Drag Hard Shifting

Cause	Action
DEFINITION: The clutch does not disengage completely to allow smooth shift operations. It may cause gear clashing while the vehicle is not moving, at idle, and shifting out of neutral, or hard shifting in and	

out of gears while driving the vehicle. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Pedal blocked from full travel	1. Inspect for obstacles that will prevent the pedal from going to the floor. 2. Clear any obstacles from under the pedal area, such as floor mats or interior panels.
Too much travel between pedal and clutch master cylinder	1. Inspect the pedal for worn bushings. 2. Replace the pedal bushings if worn. Refer to **Clutch Pedal Replacement** .
Clutch pedal mounting loose	1. Inspect the clutch pedal mounting bracket for loose or missing fasteners. 2. Replace or repair the fasteners. Refer to **Clutch Pedal Replacement** .
Linkage at pedal worn or damaged	1. Inspect the linkage at the pedal for excessive wear. 2. Repair or replace the linkage as required. Refer to **Clutch Pedal Replacement** .
Clutch master cylinder seized or binding	1. Inspect the master cylinder for the piston being able to move freely and full range of travel. 2. Repair or replace the clutch master cylinder as required. Refer to **Clutch Master Cylinder Replacement** .
Air in the clutch hydraulic system	Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch Bleeding** .
Clutch actuator cylinder seized or binding	1. Inspect the clutch actuator piston for moving freely. 2. Replace the clutch actuator cylinder if the piston is binding. Refer to **Clutch Actuator Cylinder Replacement** .
Clutch master cylinder leaking internally	1. Inspect for proper pedal reserve. 1. Let up halfway on pedal. 2. Apply the pedal a few times. 3. Inspect to ensure there is still the proper pedal reserve. 2. Replace the clutch master cylinder if it will not hold pedal reserve. Refer to **Clutch Master Cylinder Replacement** .
Damaged clutch assembly components	1. Remove the clutch assembly. 2. Inspect the following clutch assembly components for damage: • Damaged clutch disc hub splines • Bent clutch disc • Bent drive straps • Broken or warped pressure plate 3. Replace the clutch assembly if any of the above damage is found. Refer to **Clutch Assembly Replacement** .

Excessive side loading on the release bearing	1. Inspect the following clutch system components: • Worn or damaged pilot bearing • Excessive flywheel runout • Excessive engine to transmission misalignment 2. Repair or replace any faulty components.
Faulty pilot bearing	Replace the pilot bearing. Refer to **Pilot Bearing Replacement** .
Transmission input shaft splines worn or damaged	Replace the transmission input shaft. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed Unit Repair.
Tight or contaminated clutch disc splines	1. Clean the clutch disc and input shaft splines. 2. If the clutch disc will not clean, replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Flywheel housing, engine block to clutch housing, or transmission front case excessively misaligned	1. Inspect the clutch housing or the transmission front case for being faulty. 2. Replace the clutch housing if it is faulty. Refer to **Transmission Replacement** in Manual Transmission - Tremec 6 Speed. 3. Replace the transmission front case half. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed Unit Repair.
Grease or oil contamination on the clutch discs facing	1. Repair the oil leak. 2. Repair the grease leak. 3. Clean the clutch disc facing and the other clutch assembly components. 4. Replace the clutch assembly if it will not clean. Refer to **Clutch Assembly Replacement** .

CLUTCH SLIPPING

Clutch Slipping

Cause	Action
DEFINITION: The clutch does not engage completely after the pedal is released, after shifting gears, or the clutch slips during maximum engine loads, such as climbing hills or high vehicle speeds. Clutch slipping is identified by increase in engine RPM without increase in vehicle speed. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Incorrect clutch pedal height, not allowing the clutch master cylinder to return	Adjust the clutch start switch. Refer to **Clutch Pedal Position Switch Replacement** .
The clutch pedal return spring is broken or missing	Replace the clutch pedal return spring, if equipped. Refer to **Clutch Pedal Replacement** .

The clutch pedal is binding or sticking	1. Clear away any items that may be contacting the pedal. 2. Inspect the pedal bushings for ease of movement. 3. Replace the clutch pedal if it is faulty. Refer to **Clutch Pedal Replacement** .
Clutch master cylinder binding or seized	Replace the clutch master cylinder. Refer to **Clutch Master Cylinder Replacement** .
Clutch actuator cylinder binding or seized	Replace the clutch actuator cylinder. Refer to **Clutch Actuator Cylinder Replacement** .
Kinked or damaged clutch hydraulic hose	1. Inspect for the correct routing of the clutch hydraulic hose. 2. Route the hose properly. 3. Inspect for loose or faulty engine mounts that may allow the hydraulic hose to be kinked or pinched. 4. Repair or replace faulty engine mounts. Refer to **Engine Mount Replacement - Left** and **Engine Mount Replacement - Right** in Engine Mechanical - 5.7L. 5. Repair or replace the clutch hydraulic hose if it is damaged. Refer to **Hydraulic Clutch Hose/Pipe Replacement** .
Grease or oil contamination of the clutch disc	1. Repair the source of the oil leak. 2. Repair the source of the grease leak. 3. Clean the contamination from the clutch components. 4. If contaminates cannot be removed, replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Worn or damaged flywheel	Replace the engine flywheel. Refer to **Engine Flywheel Replacement** in Engine Mechanical - 5.7L.
Worn clutch disc facing	Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Burnt or glazed clutch discs	Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Input shaft splines worn	Replace the input shaft. Refer to Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.
Improper resurfacing of the flywheel	Replace the flywheel if it has been improperly resurfaced, allowing contact of the clutch disc hub or insufficient clamping load of the pressure plate. Refer to **Engine Flywheel Replacement** in Engine Mechanical - 5.7L.

CLUTCH GRABBING

Clutch Grabbing

Cause	Action
DEFINITION: The clutch grabs, or chatters, or the clutch is unable to release without the vehicle jerking. An abrupt engagement of the clutch. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Grease or oil	

contamination on the clutch facings	1. Repair the cause of the oil leak or grease contamination. 2. Clean the clutch facings. 3. Replace the clutch components if they will not clean. Refer to **Clutch Assembly Replacement** .
Loose or faulty engine mounts	1. Inspect the engine mounts for being loose or faulty. Refer to **Engine Mount Inspection** in Engine Mechanical - 5.7L. 2. Repair or replace the engine mounts as required. Refer to **Engine Mount Replacement - Left** and **Engine Mount Replacement - Right** in Engine Mechanical - 5.7L.
Clutch pedal sticking	1. Inspect the clutch pedal for correct operation. 2. Replace the clutch pedal if it is faulty. Refer to **Clutch Pedal Replacement** .
Clutch actuator binding	1. Inspect the clutch actuator for the piston seals binding or sticking on the hub. 2. Replace the clutch actuator if it is binding. Refer to **Clutch Actuator Cylinder Replacement** .
Clutch master cylinder binding	1. Inspect the clutch master cylinder for the piston binding or sticking in the cylinder. 2. Replace the master cylinder if it is faulty. Refer to **Clutch Master Cylinder Replacement** .
Warped Clutch Cover	1. Inspect the clutch cover for distortion caused by improperly tightening the clutch cover bolts. 2. Replace the clutch cover if it is distorted. Refer to **Clutch Assembly Replacement** .
Improper clutch installation	1. Inspect the pressure plate for distortion caused by improperly tightening the pressure plate bolts. 2. Inspect the clutch disc for a bent hub caused by forcing the installation of the transmission. 3. Inspect for the correct clutch disc. 4. Inspect the clutch disc for being installed backwards. 5. Replace the clutch assembly if it is damaged or the wrong components were installed. Refer to **Clutch Assembly Replacement** .
Clutch disc binding on the input shaft	1. Inspect the input shaft for rust dirt or debris. 2. Clean and lubricate the input shaft. 3. Inspect the clutch disc for a bent hub. 4. Replace the clutch assembly if the clutch disc is faulty. Refer to **Clutch Assembly Replacement** . 5. Inspect the input shaft for excessive wear on the splines, causing the clutch disc to bind.

	6. Replace the transmission input shaft if it is worn. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.
Clutch pressure plate damaged	1. Inspect the pressure plate for bent drive straps caused by improper vehicle use. 2. Replace the clutch assembly if the clutch pressure plate is damaged. Inform the customer. Refer to **Clutch Assembly Replacement** .
Flywheel improperly machined	1. Inspect the flywheel for being machined, and causing interference with the clutch disc. 2. Replace the flywheel if it has been machined. Refer to **Engine Flywheel Replacement** in Engine Mechanical - 5.7L.
Flywheel uneven	1. Inspect the flywheel surface for being warped or uneven. 2. Replace the flywheel if it is faulty. Refer to **Engine Flywheel Replacement** in Engine Mechanical - 5.7L.

CLUTCH RATTLE

Clutch Rattle

Cause	Action
DEFINITION: A rattle noise coming from the clutch components with the clutch disengaged or engaged. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Idle rattle clutch engaged	Replace the clutch disc, due to faulty damper springs. Refer to **Clutch Assembly Replacement** .
Clutch is improperly installed	Remove the clutch and install it correctly. Refer to **Clutch Assembly Replacement** .
Clutch disc damper worn or damaged	1. Inspect the clutch disc for a broken or worn damper. 2. Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Clutch disc splines and input shaft splines worn	1. Inspect the clutch disc hub to input shaft splines for excessive clearance. 2. Replace the clutch assembly if the clutch splines are worn. Refer to **Clutch Assembly Replacement** . 3. Replace the input shaft. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.

CLUTCH NOISY

Clutch Noisy

Cause	Action
DEFINITION: A growl or whine noise is coming from the clutch when engaged or disengaged. Review the **Symptoms - Clutch** and perform the necessary inspections.	

Pilot bearing is worn or damaged	Replace the pilot bearing. Refer to **Pilot Bearing Replacement** .
Release bearing damaged or worn	Replace the release bearing. Refer to **Clutch Actuator Cylinder Replacement** .

CLUTCH PEDAL SPONGY LOW PEDAL EFFORT

Clutch Pedal Spongy Low Pedal Effort

Cause	Action
DEFINITION: The clutch pedal may feel spongy, or it requires very little effort to operate. Review **Symptoms - Clutch** and perform the necessary inspections.	
Air in the hydraulic system	Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch Bleeding** .
Master cylinder fluid level low	1. Inspect for leakage in the clutch master cylinder, hose connections, and the clutch actuator. 2. Repair or replace any faulty components.
Incomplete pedal return	1. Inspect the pedal for full return. 2. Clear any obstacles that may interfere with the pedal operation. 3. Replace the clutch pedal return spring, if equipped. Refer to **Clutch Pedal Replacement** . 4. Adjust the clutch pedal position switch. Refer to **Clutch Pedal Position Switch Replacement** .
Clutch incorrectly installed	Remove the clutch and install it correctly. Refer to **Clutch Assembly Replacement** .
Clutch mounting bolts loose or broken	1. Remove the broken bolts. 2. Replace the broken or loose bolts, and tighten. Refer to **Clutch Assembly Replacement** .
Clutch pressure plate not adjusted	Adjust the clutch pressure plate. Refer to **Clutch Pressure Plate Adjustment (Off-Vehicle)** or **Clutch Pressure Plate Adjustment (On-Vehicle)** .
Release bearing worn or damaged	Replace the release bearing. Refer to **Release Bearing Replacement** .
Contaminated hydraulic fluid	1. Inspect the clutch hydraulic fluid for contamination of water. 2. Inspect the reservoir cap for being faulty if water is present. 3. Inspect the clutch hydraulic fluid for dirt or debris. 4. Flush and bleed the clutch hydraulic system if the above conditions are found. Refer to **Hydraulic Clutch Bleeding** .

CLUTCH PEDAL HARD TO PUSH

Clutch Pedal Hard to Push

Cause	Action

DEFINITION: The clutch pedal requires high effort to operate. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Incorrect hydraulic fluid	1. Inspect for the correct fluid in the master cylinder. Refer to **Sealers and Lubricants** . 2. Flush the hydraulic system and fill with the correct fluid.
Contaminated hydraulic fluid	1. Inspect the hydraulic fluid for water. 2. Inspect the hydraulic fluid for dirt or debris. 3. Flush the hydraulic system and fill with the correct fluid. Refer to **Sealers and Lubricants** .
Clutch pedal binding	1. Inspect the pedal for binding. 2. Repair or replace the pedal. Refer to **Clutch Pedal Replacement** .
Clutch pedal spring worn	Replace the clutch pedal spring. Refer to **Clutch Pedal Replacement** .
Kinked or damaged clutch hydraulic pipe	1. Inspect for a kinked or damaged hydraulic hose. 2. Repair or replace the clutch hydraulic hose. Refer to **Hydraulic Clutch Hose/Pipe Replacement** .
Clutch disc worn too thin	Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .

CLUTCH FREQUENT ADJUSTMENTS

Clutch Frequent Adjustments

Cause	Action
DEFINITION: The self-adjusting clutch is constantly adjusting. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Excessive clutch slippage	Refer to **Clutch Slipping** .
Clutch wearing excessively	• Review the vehicle application. • Review the driver practices.

CLUTCH VIBRATION

Clutch Vibration

Cause	Action
DEFINITION: Vibration from the clutch components during disengagement or engagement. Review the **Symptoms - Clutch** and perform the necessary inspections.	
Excessive driveline torsional activity	Review the **Vibration Analysis - Driveline** in Vibration Diagnosis and Correction.
Clutch incorrectly installed	Remove the clutch and install it correctly. Refer to **Clutch Assembly Replacement** .
Pilot bearing worn or damaged	1. Replace the pilot bearing. Refer to **Pilot Bearing Replacement** . 2. Inspect the input shaft pilot bearing journal for wear or damage. 3. Replace the input shaft if it is damaged or worn. Refer to Transmission

	Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.
Transmission input splines worn or damaged	1. Inspect the clutch disc to input splines for wear or damage. 2. Replace the input shaft if the splines are excessively worn. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.
Clutch disc facings damaged	Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .
Flywheel housing to clutch housing excessively misaligned	Replace the faulty clutch housing or transmission front case. Refer to Transmission Disassemble (Y Car) Transmission Disassemble (CTSV) Transmission Disassemble (GTO) in Manual Transmission - Tremec 6 Speed - Unit Repair.
Clutch out of balance	Replace the clutch assembly. Refer to **Clutch Assembly Replacement** .

REPAIR INSTRUCTIONS

CLUTCH PEDAL REPLACEMENT

Removal Procedure

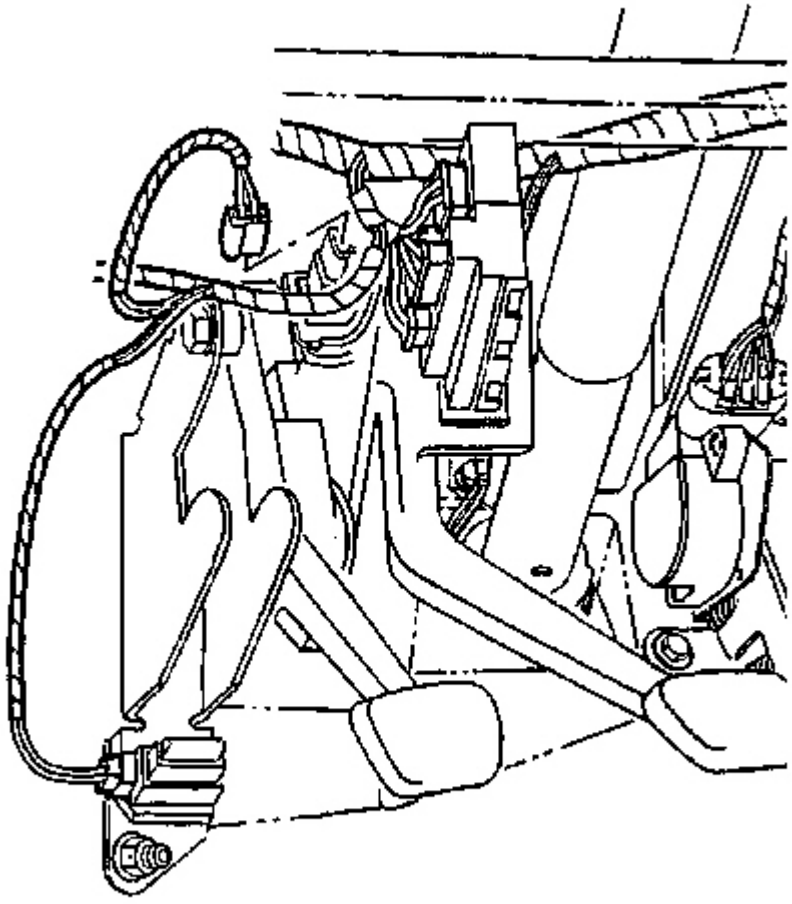


Fig. 1: Cruise Control Release Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Remove the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.
3. Disconnect the cruise control release switch electrical connector.

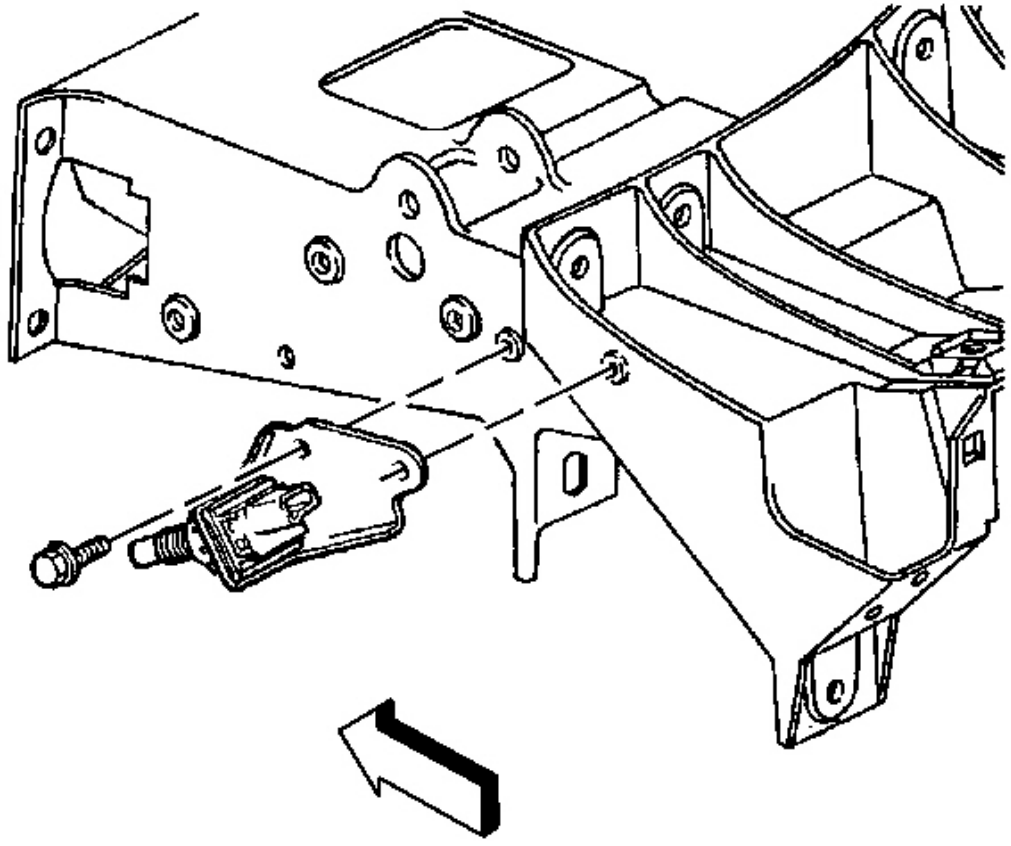


Fig. 2: Cruise Control Release Switch Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

4. Remove the cruise control release switch bracket retaining bolts.
5. Remove the cruise control release switch, with bracket.

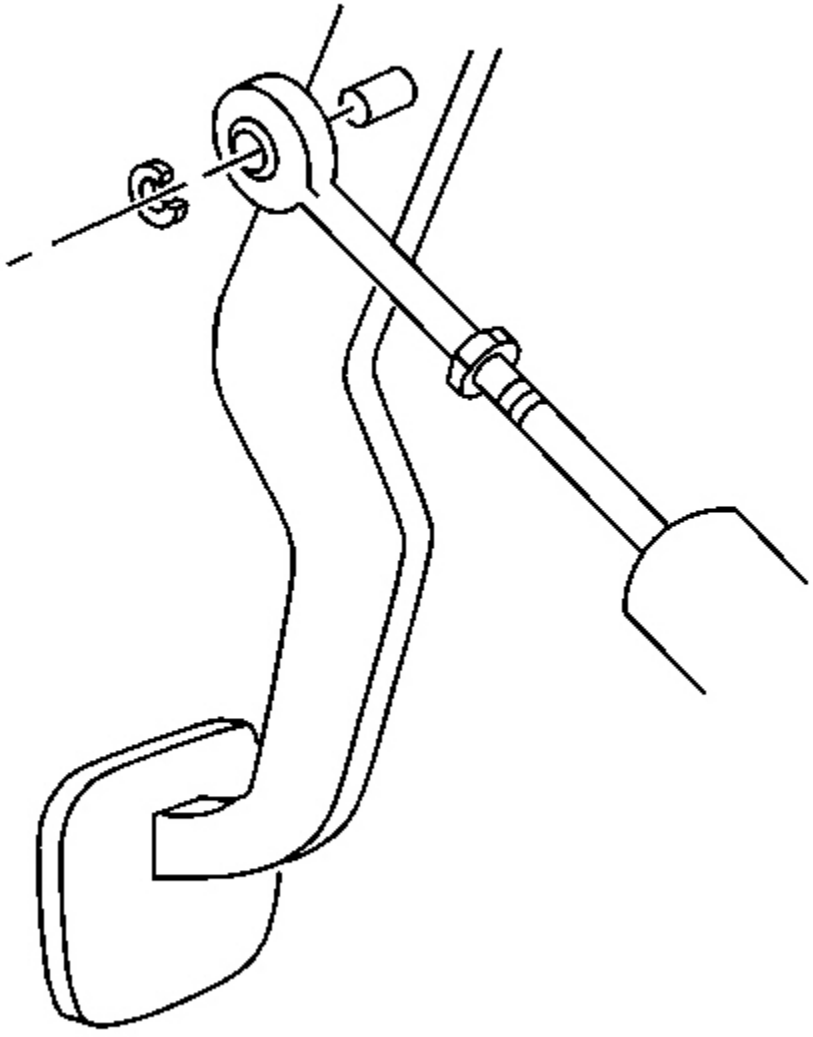


Fig. 3: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

6. Remove the clutch master cylinder rod retainer.
7. Disconnect the clutch master cylinder rod from the clutch pedal.

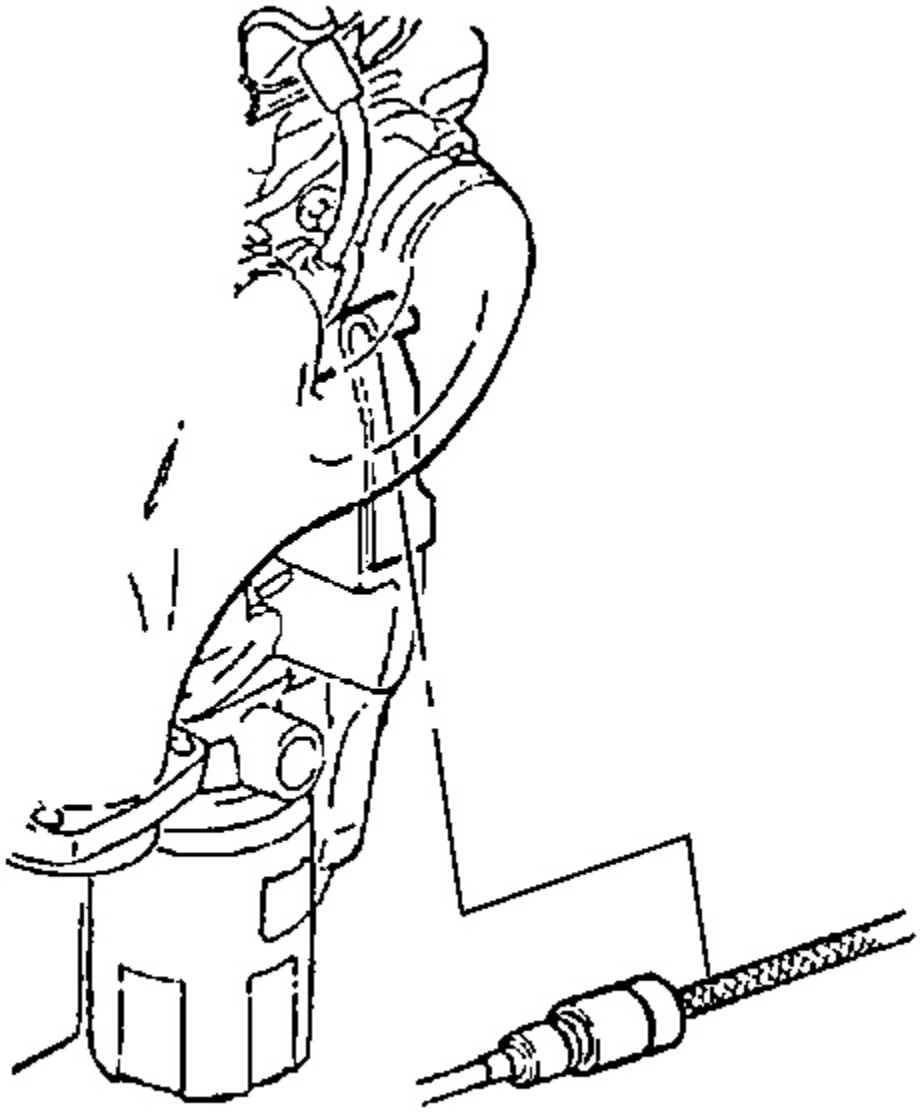


Fig. 4: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

8. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
9. Remove the clutch actuator cylinder hose from the hose retaining clip.

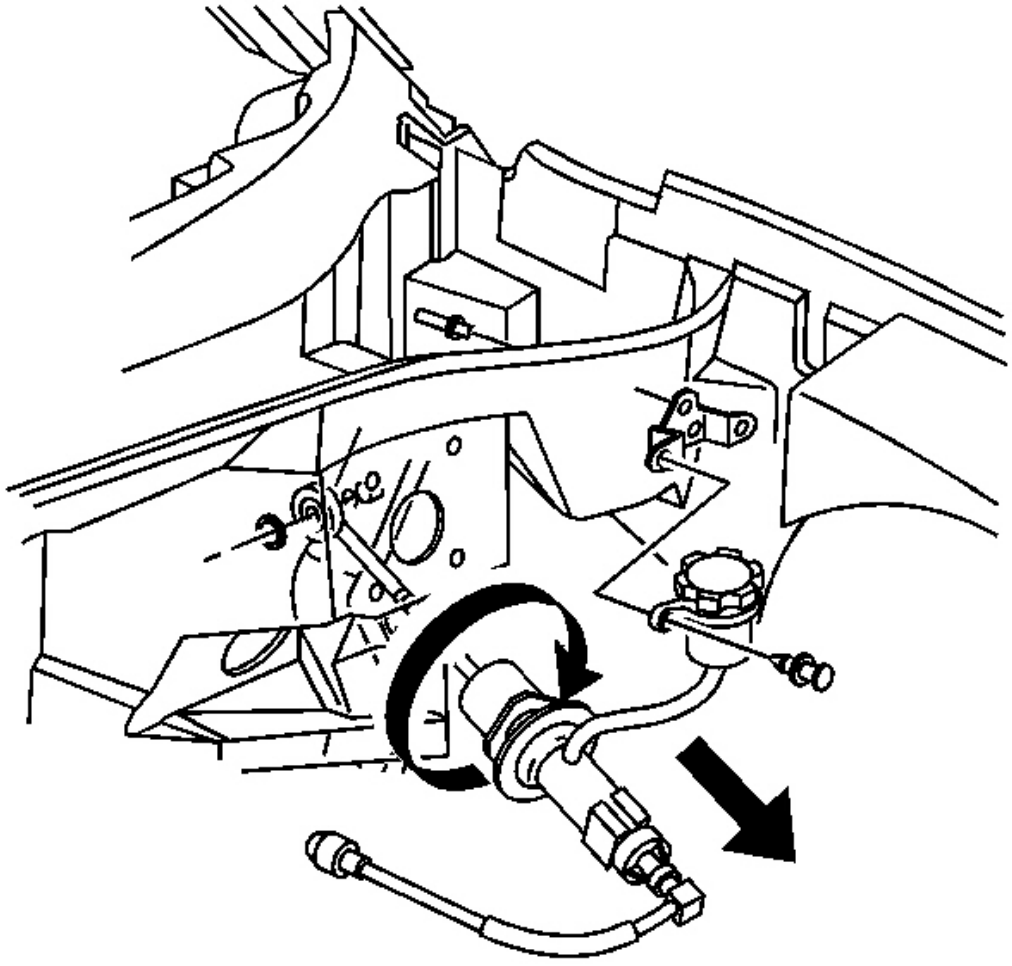


Fig. 5: Clutch Master Cylinder & Dash Panel
Courtesy of GENERAL MOTORS CORP.

10. Lower the vehicle. Leave the vehicle on the hoist.
11. Remove the windshield washer solvent container. Refer to **Washer Solvent Container Replacement** in Wipers/Washer Systems.
12. Rotate the clutch master cylinder counterclockwise 45 degrees.
13. Release the clutch master cylinder from the dash panel.
14. Move the clutch master cylinder away from the dash panel approximately 25 mm (1 in).

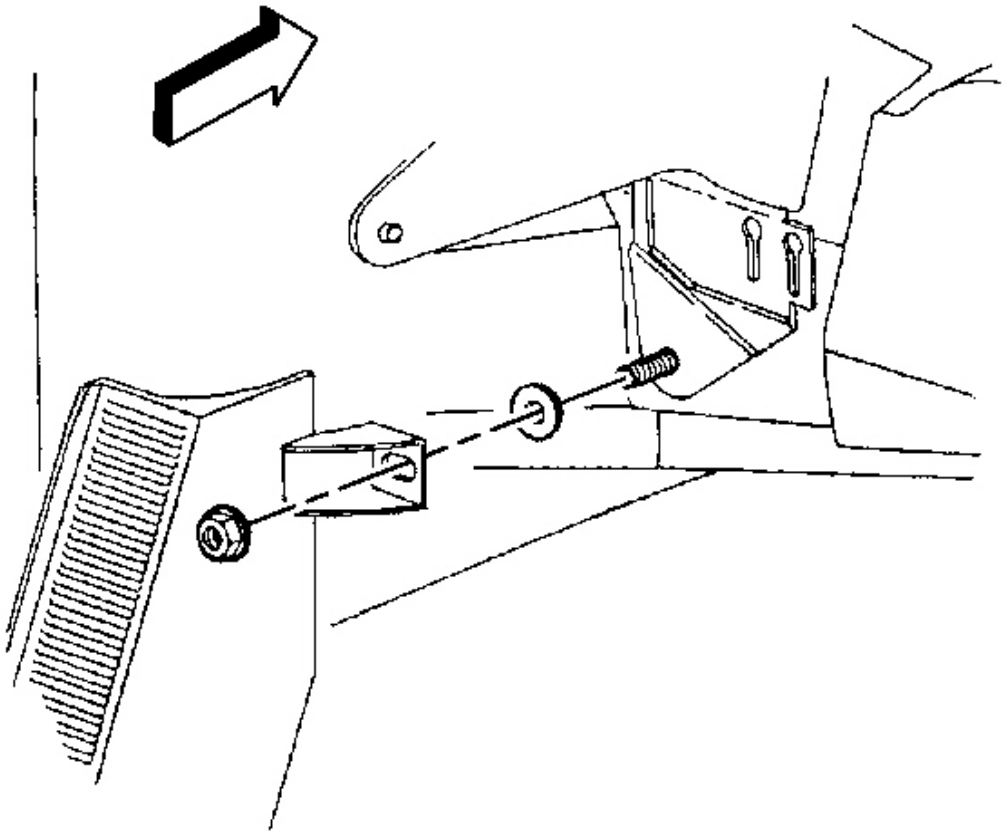


Fig. 6: Driver Foot Rest Bracket, Retaining Bolt & Dash Panel Stud
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: Prior to disassembly take note of the direction of the clutch pedal assist spring and its relationship to the clutch pedal.

15. Push down on the clutch pedal to release the pedal assist spring.
16. Finesse the spring from the clutch pedal bracket.
17. Remove the driver foot rest bracket retaining bolt.
18. Remove the driver foot rest bracket retaining nut.
19. Remove the driver foot rest bracket from the vehicle.
20. Remove the driver foot rest spacer from the dash panel stud.

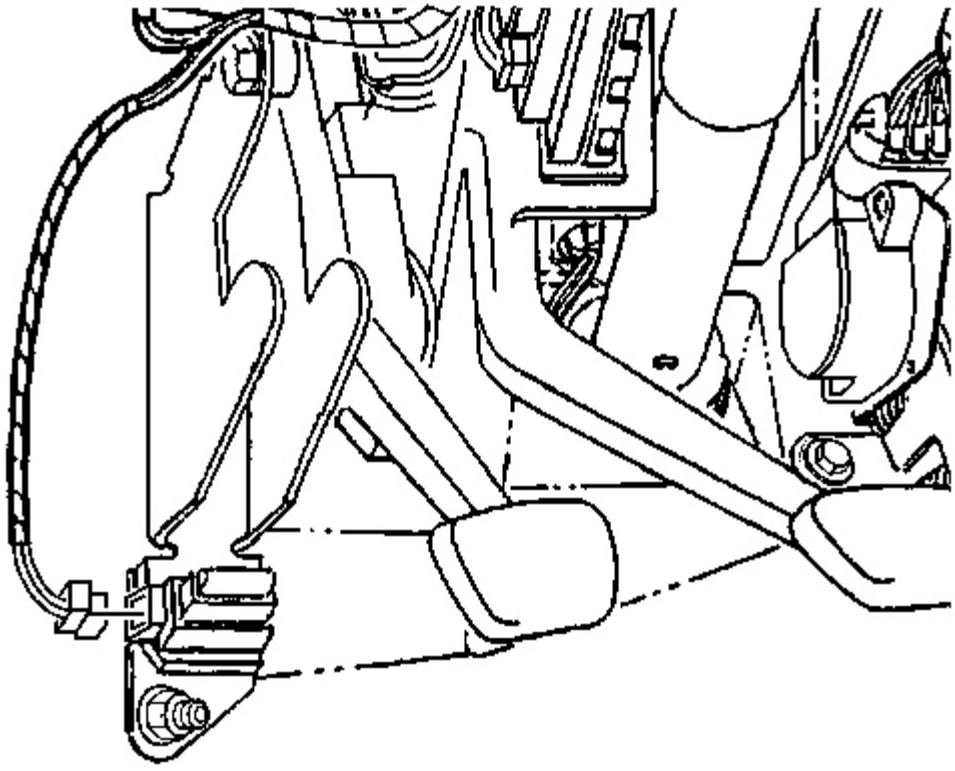


Fig. 7: Clutch Pedal Position Switch & Clutch Start Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

21. Disconnect the clutch pedal position switch, clutch start switch electrical connector.

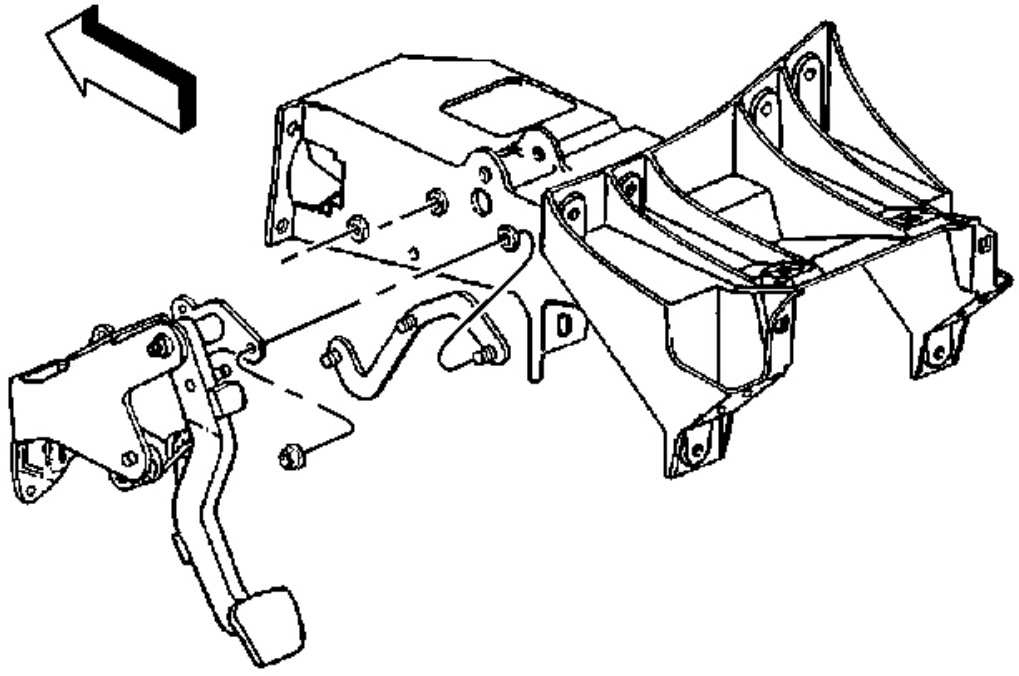


Fig. 8: Clutch Pedal Bracket, Stud & Anchor Plate
Courtesy of GENERAL MOTORS CORP.

22. Remove the clutch pedal bracket mounting nuts.
23. Remove the clutch pedal bracket stud anchor plate.
24. Remove the clutch pedal and bracket assembly from the vehicle.

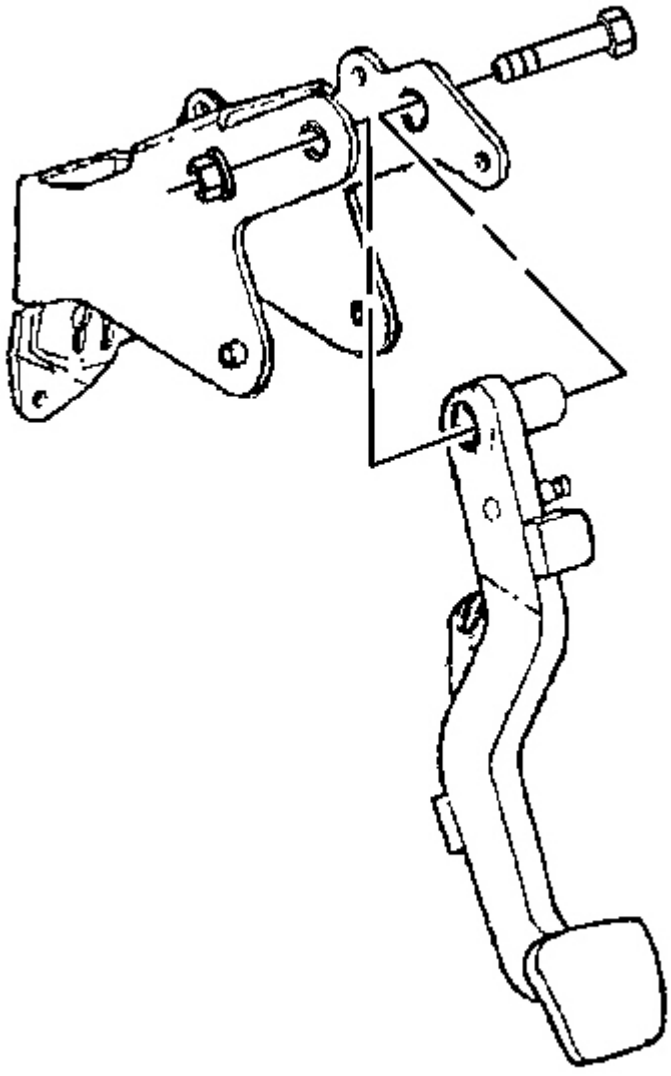


Fig. 9: Clutch Pedal, Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

25. Remove the clutch pedal bolt.
26. Remove the clutch pedal nut.
27. Remove the clutch pedal from the clutch pedal bracket.

Installation Procedure

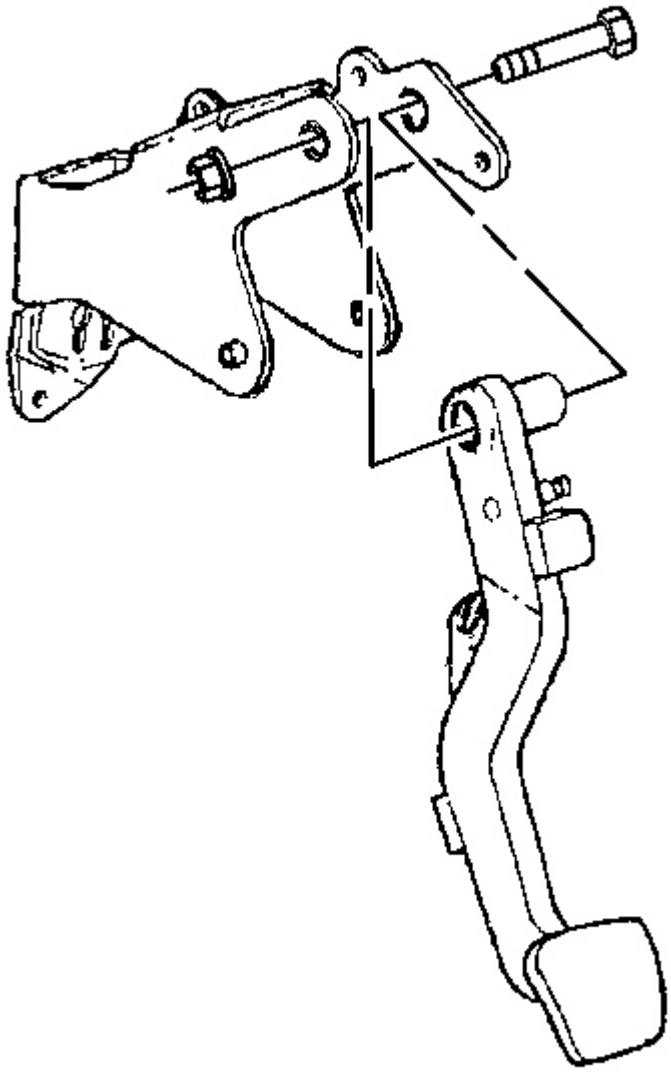


Fig. 10: Clutch Pedal, Bolt & Nut
Courtesy of GENERAL MOTORS CORP.

1. Lubricate the clutch pedal bushings lightly with GM P/N 1052497 or equivalent.
2. Install the clutch pedal to the clutch pedal bracket.
3. Install the clutch pedal bolt.

NOTE: Refer to Fastener Notice in Cautions and Notices.

4. Install the clutch pedal nut.

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

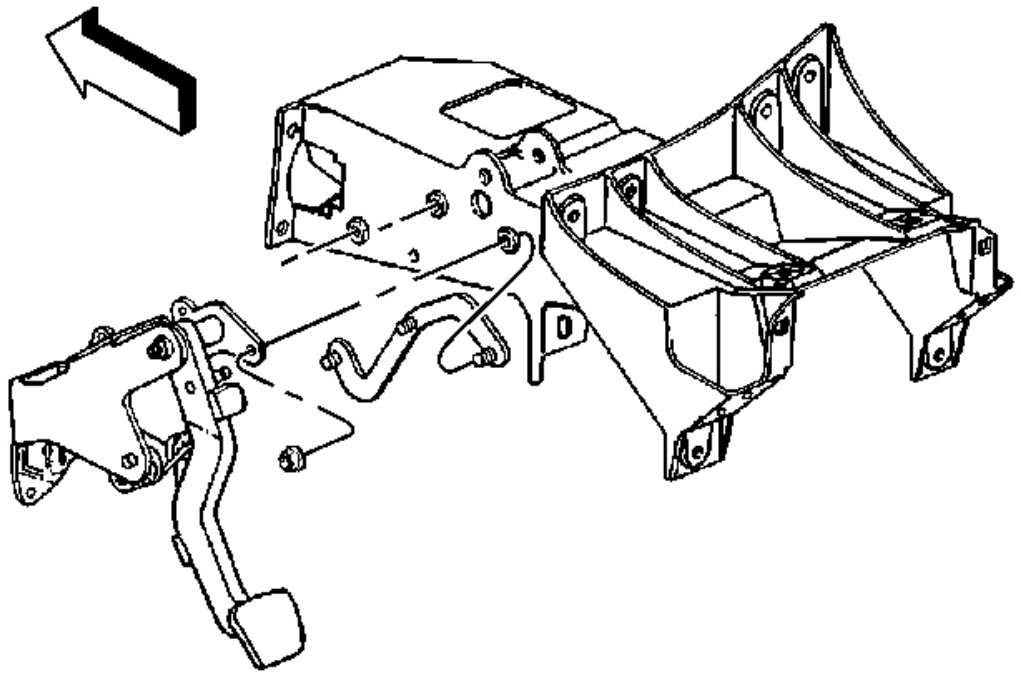


Fig. 11: Clutch Pedal Bracket, Stud & Anchor Plate
Courtesy of GENERAL MOTORS CORP.

5. Install the clutch pedal and bracket assembly into position in the vehicle.
6. Install the clutch pedal bracket stud anchor plate into position on the steering column bracket.
7. Install the clutch pedal bracket mounting nuts.

   Tighten: Tighten the clutch pedal bracket mounting nuts to 27 N.m (20 lb ft).

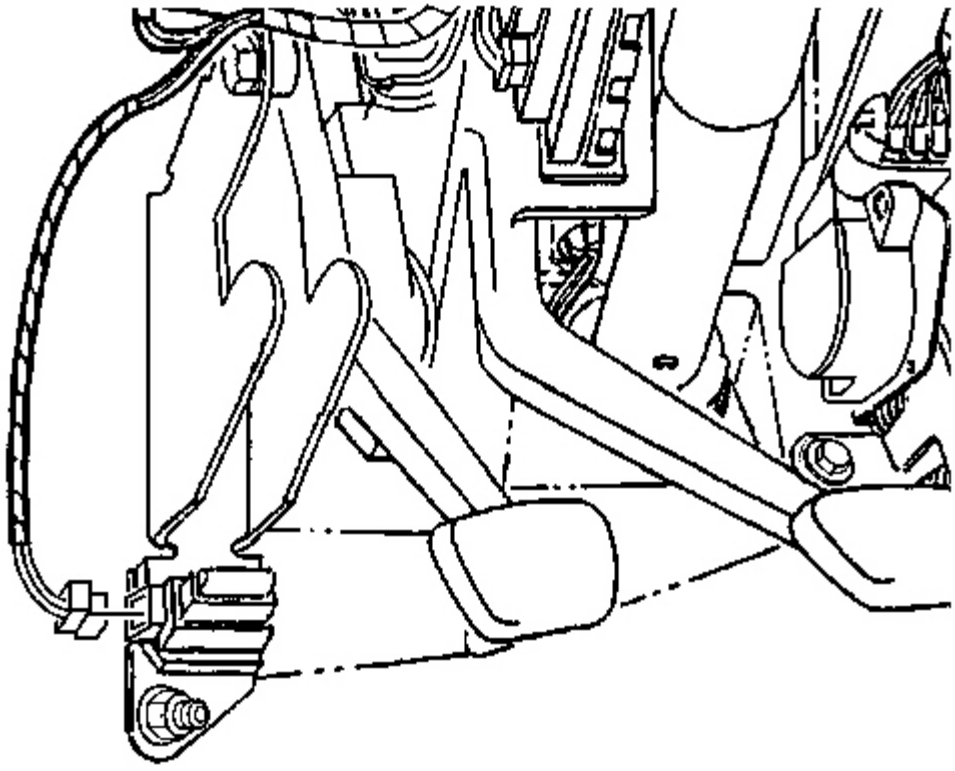


Fig. 12: Clutch Pedal Position Switch & Clutch Start Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

8. Connect the clutch pedal position switch, clutch start switch, electrical connector.

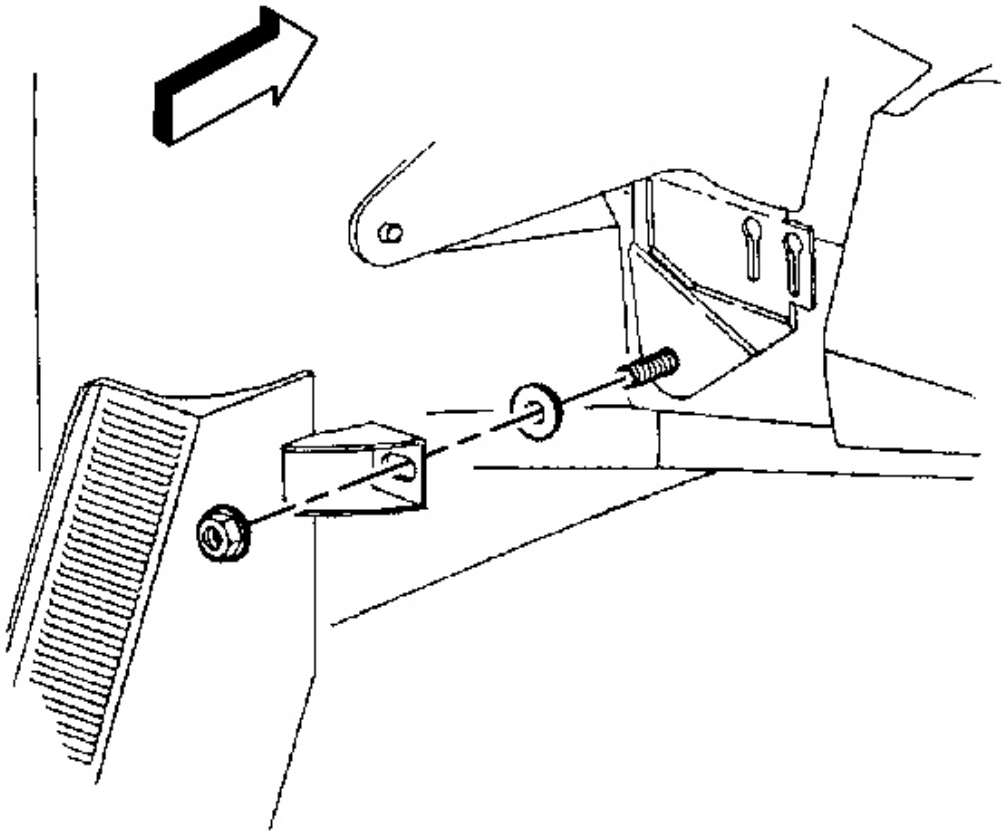


Fig. 13: Driver Foot Rest Bracket, Retaining Bolt & Dash Panel Stud
Courtesy of GENERAL MOTORS CORP.

9. Install the driver foot rest spacer onto the dash panel stud.
10. Install the driver foot rest bracket to the vehicle.
11. Install the driver foot rest bracket retaining nut and the retaining bolt.

Tighten:

- Tighten the driver foot rest bracket retaining nut to 10 N.m (89 lb in).
- Tighten the driver foot rest bracket retaining bolt to 8 N.m (71 lb in).

12. Lubricate the clutch pedal assist spring bushings lightly with GM P/N 1052497 or equivalent.
13. Install the clutch pedal assist spring to the clutch pedal bracket (in the direction noted during removal).
14. Align the clutch pedal to the pedal assist spring and engage.

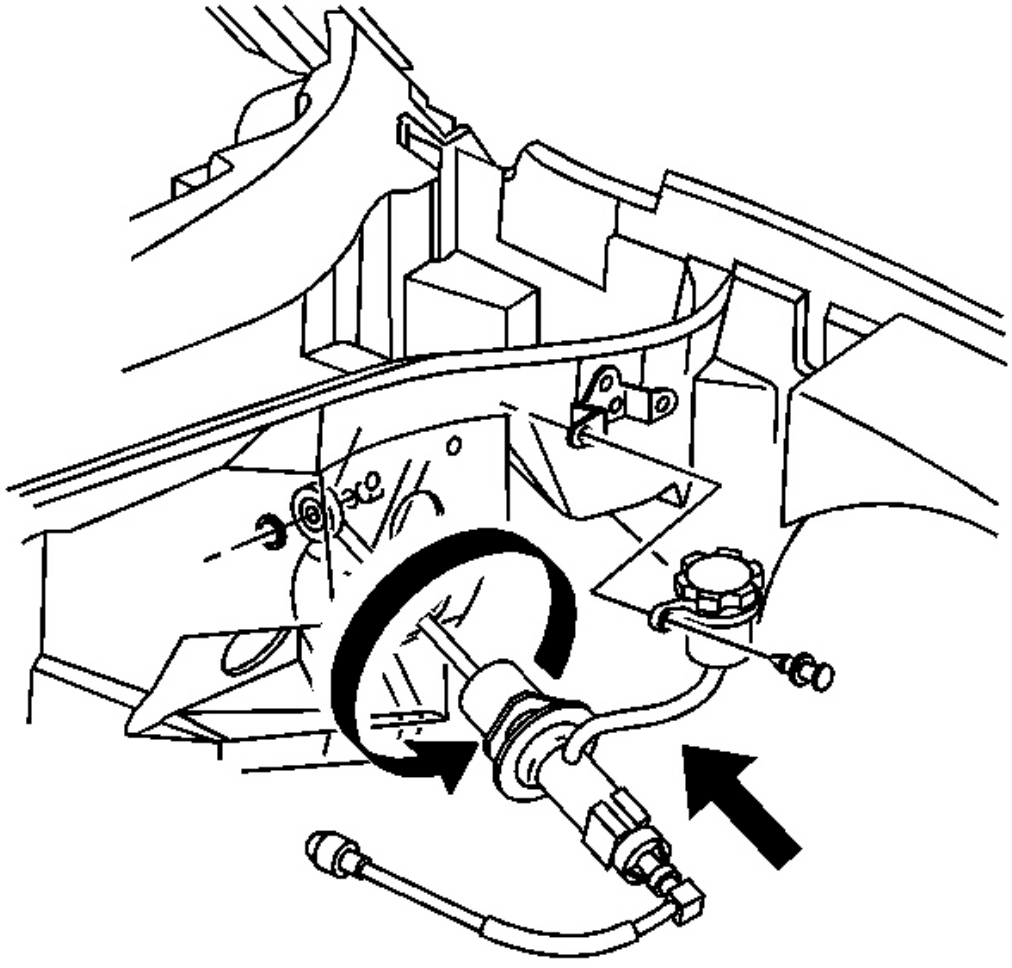


Fig. 14: Clutch Master Cylinder & Dash Panel
Courtesy of GENERAL MOTORS CORP.

15. Install the clutch master cylinder to the dash panel.
    1. Orientate the clutch master cylinder at a 45 degree angle.
    2. Insert the clutch master cylinder into the dash panel.
    3. Rotate the master cylinder clockwise.
    4. Attach the master cylinder to the dash panel.
    5. DO NOT over rotate the master cylinder or damage may occur.
16. Install the windshield washer solvent container. Refer to **Washer Solvent Container Replacement** in Wipers/Washer Systems.

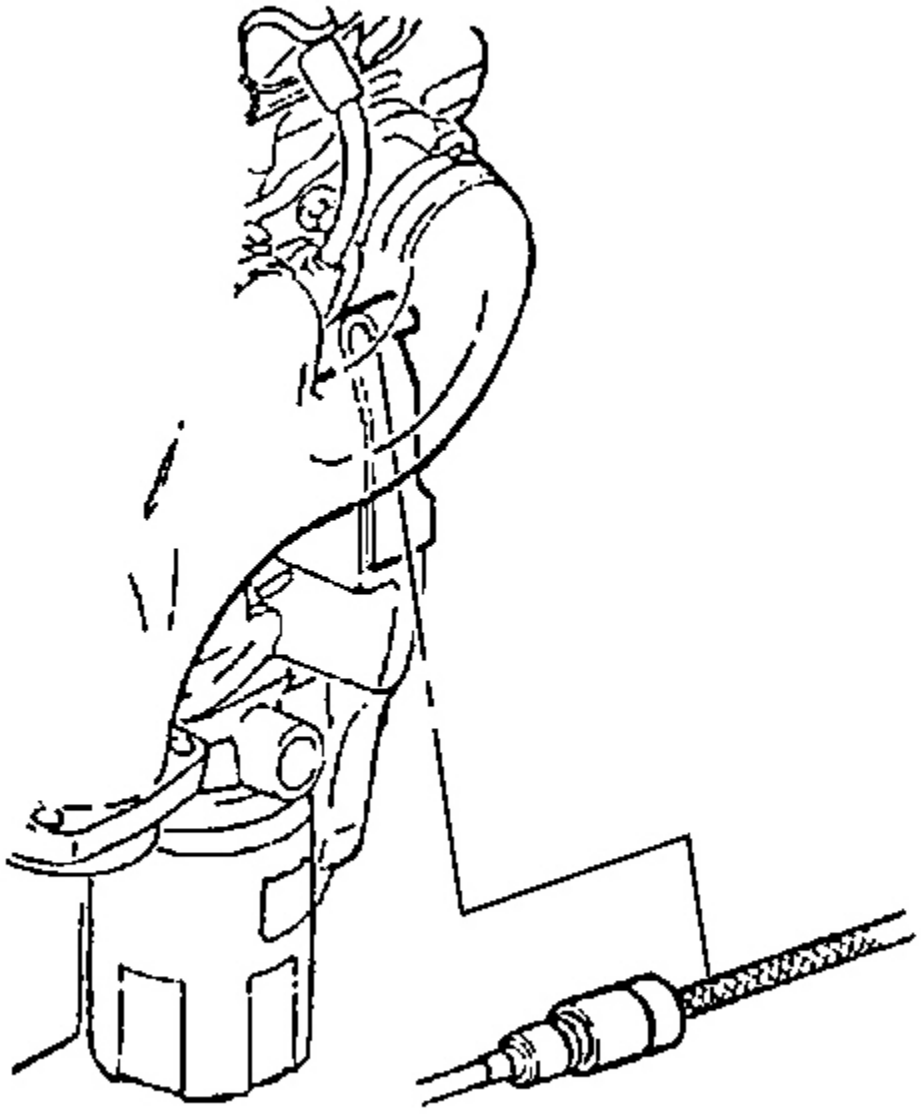


Fig. 15: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

17. Raise the vehicle.
18. Install the clutch actuator cylinder hose to the hose retaining clip.

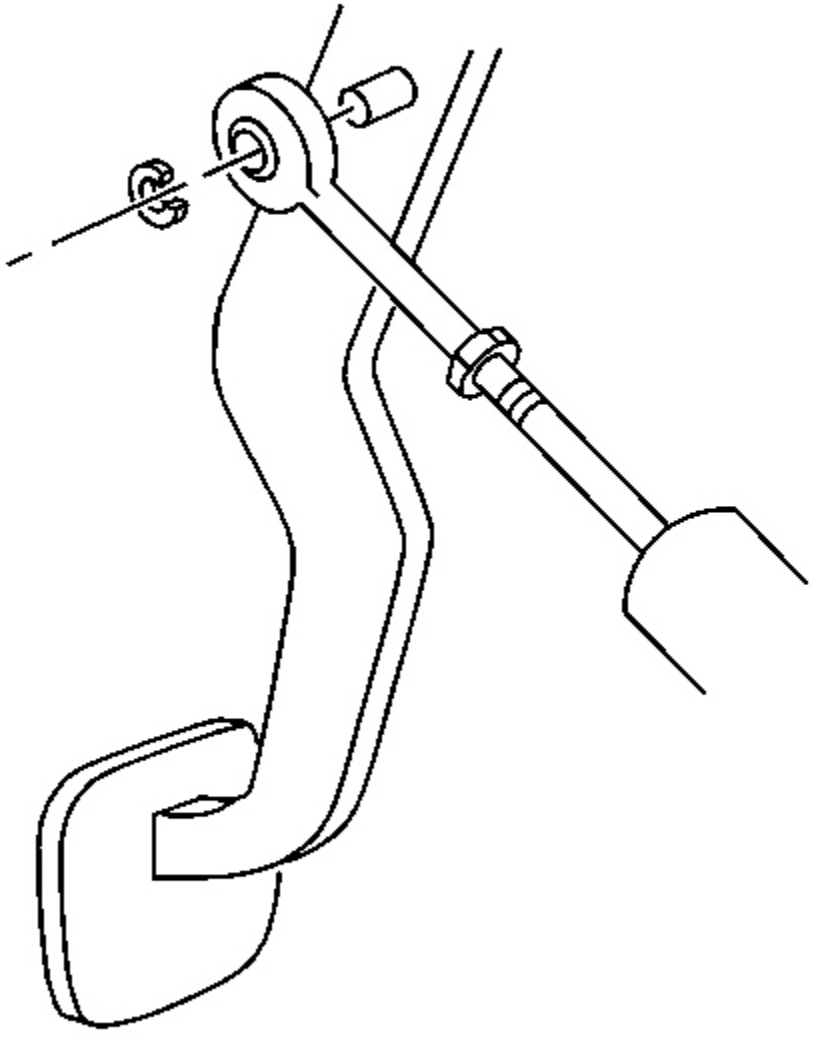


Fig. 16: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

19. Lower the vehicle.
20. Install the clutch master cylinder rod to the clutch pedal.
21. Install the clutch master cylinder rod retainer.

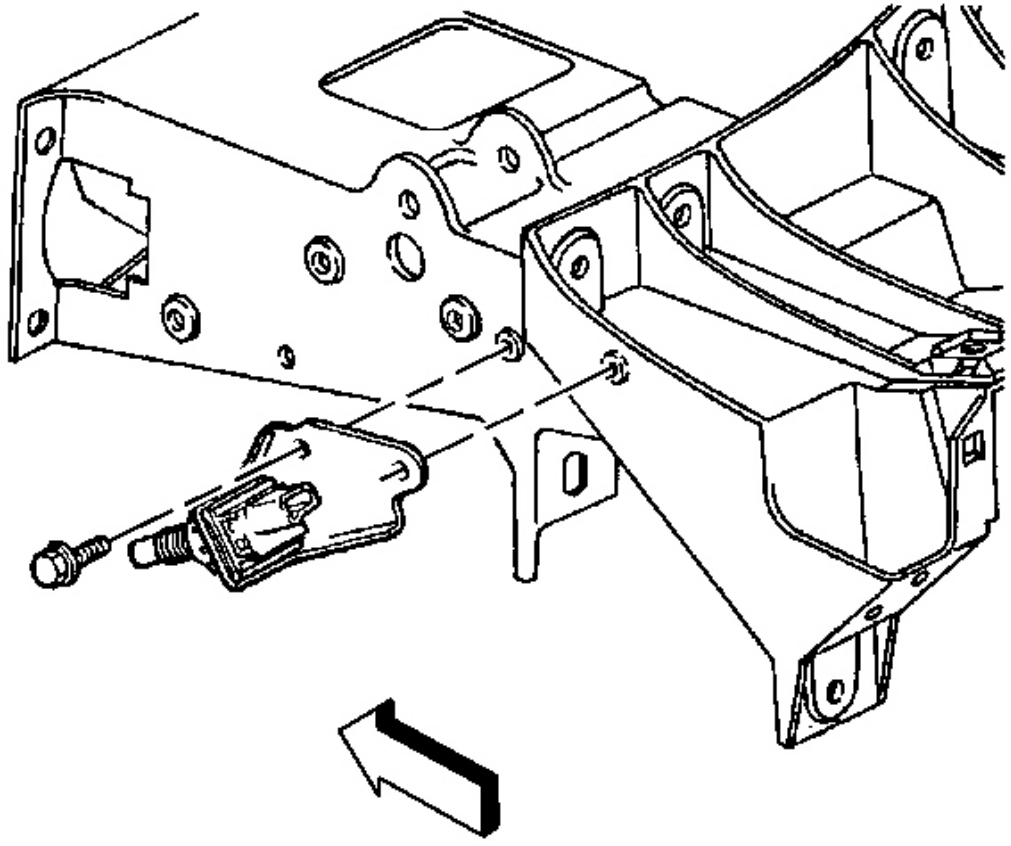


Fig. 17: Cruise Control Release Switch Bracket & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

22. Install the cruise control release switch, with bracket into position.
23. Install the cruise control release switch bracket retaining bolts.

Tighten: Tighten the cruise control release switch bracket retaining bolts to 12 N.m (106 lb in).

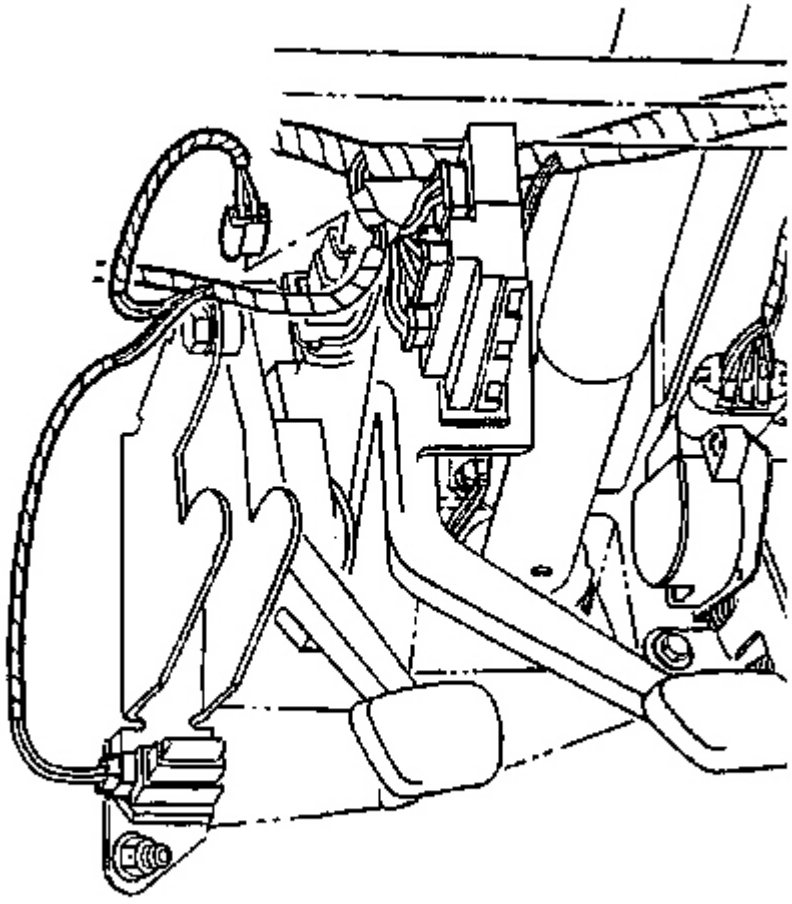


Fig. 18: Cruise Control Release Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

24. Connect the cruise control release switch electrical connector.
25. Install the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.
26. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

27. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.

CLUTCH MASTER CYLINDER REPLACEMENT

Tools Required

J 36221 Hydraulic Clutch Line Separator

Removal Procedure

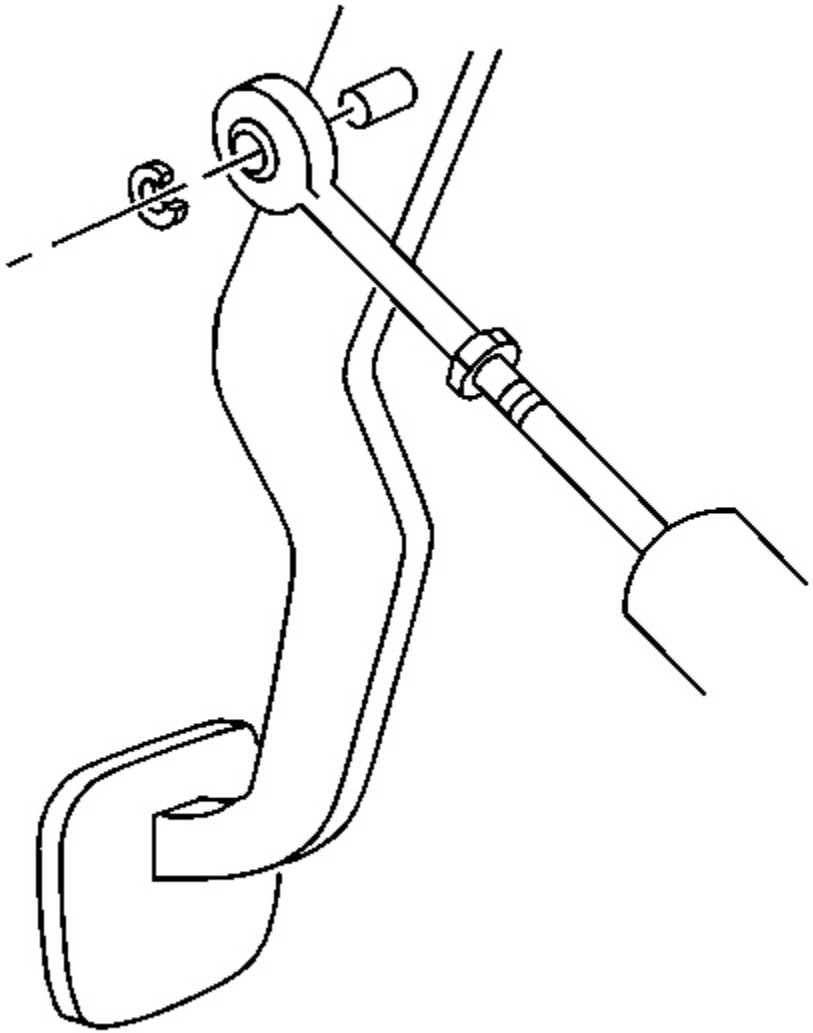


Fig. 19: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Remove the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.
3. Remove the clutch master cylinder rod retainer.
4. Remove the clutch master cylinder rod from the clutch pedal.
5. Remove the windshield washer solvent container. Refer to **Washer Solvent Container Replacement** in Wipers/Washer Systems.

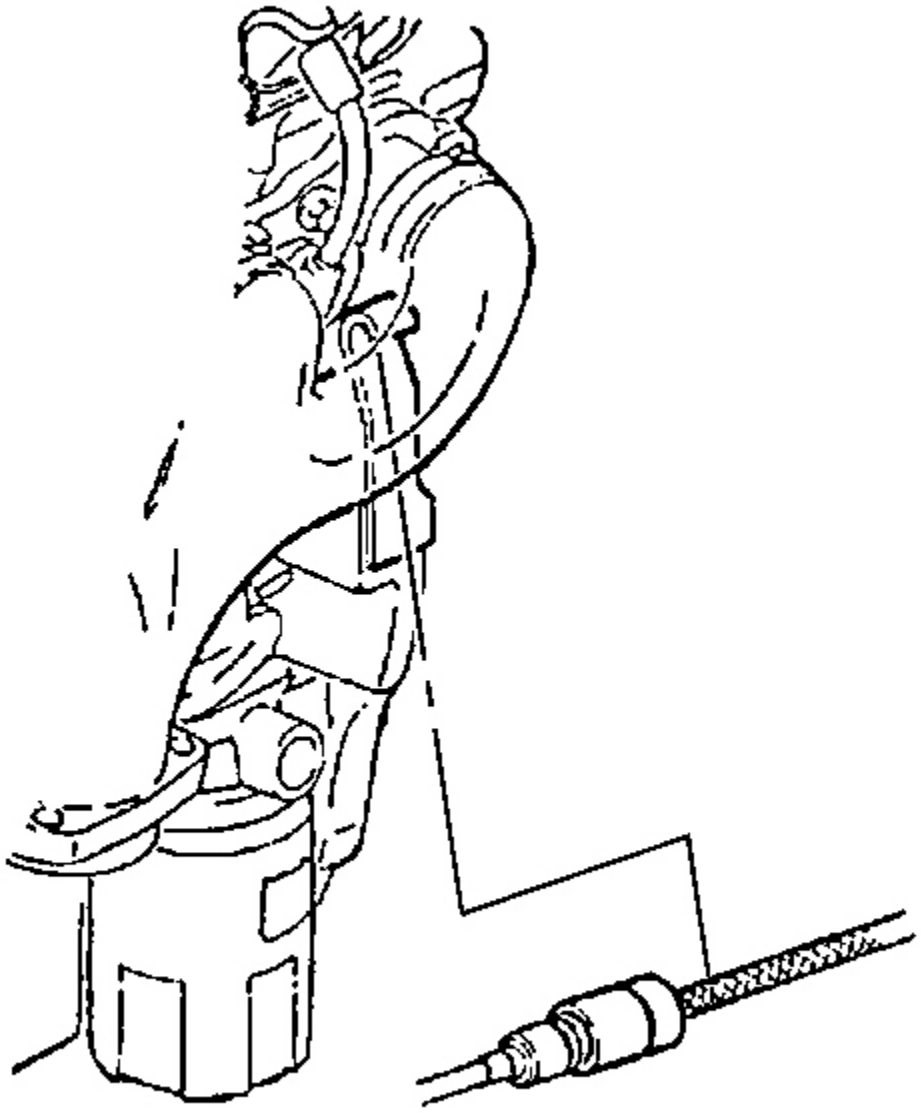


Fig. 20: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

6. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
7. Remove the clutch actuator cylinder hose from the hose retaining clip, at the rear of the engine.

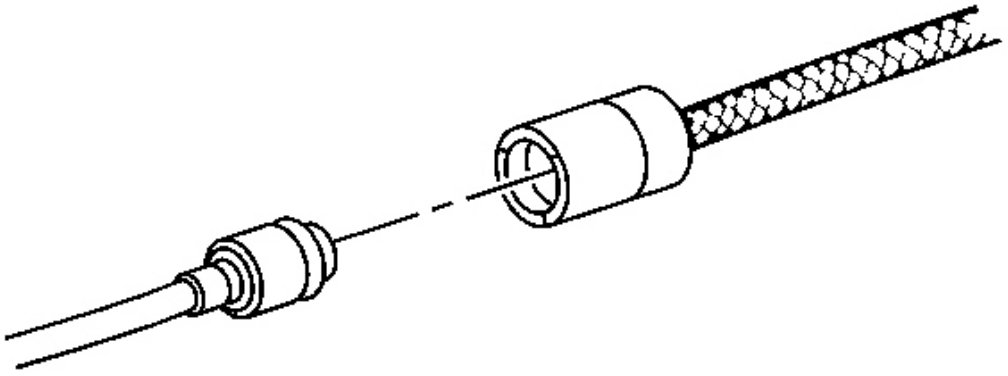


Fig. 21: Identifying White Circular Release Ring On The Actuator Hose
Courtesy of GENERAL MOTORS CORP.

8. Using the **J 36221** , depress the white circular release ring on the actuator hose and simultaneously pull lightly on the master cylinder hose to disconnect.
9. Protect both hose coupling ends from dirt and damage.

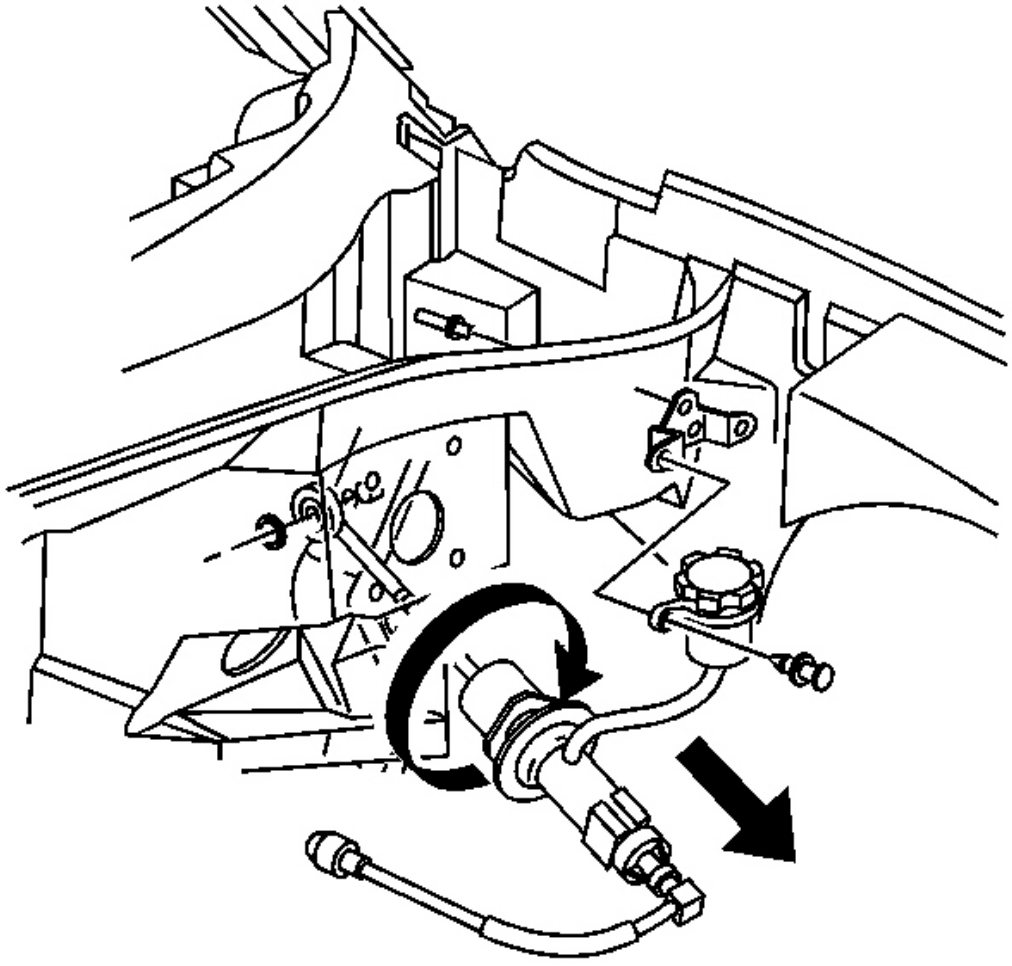


Fig. 22: Clutch Master Cylinder & Dash Panel
Courtesy of GENERAL MOTORS CORP.

10. Lower the vehicle. Leave the vehicle on the hoist.
11. Remove the clutch master cylinder reservoir push-in fasteners.
12. Rotate the clutch master cylinder clockwise 45 degrees.
13. Release the clutch master cylinder from the dash panel.
14. Remove the clutch master cylinder and reservoir from the vehicle.

Installation Procedure

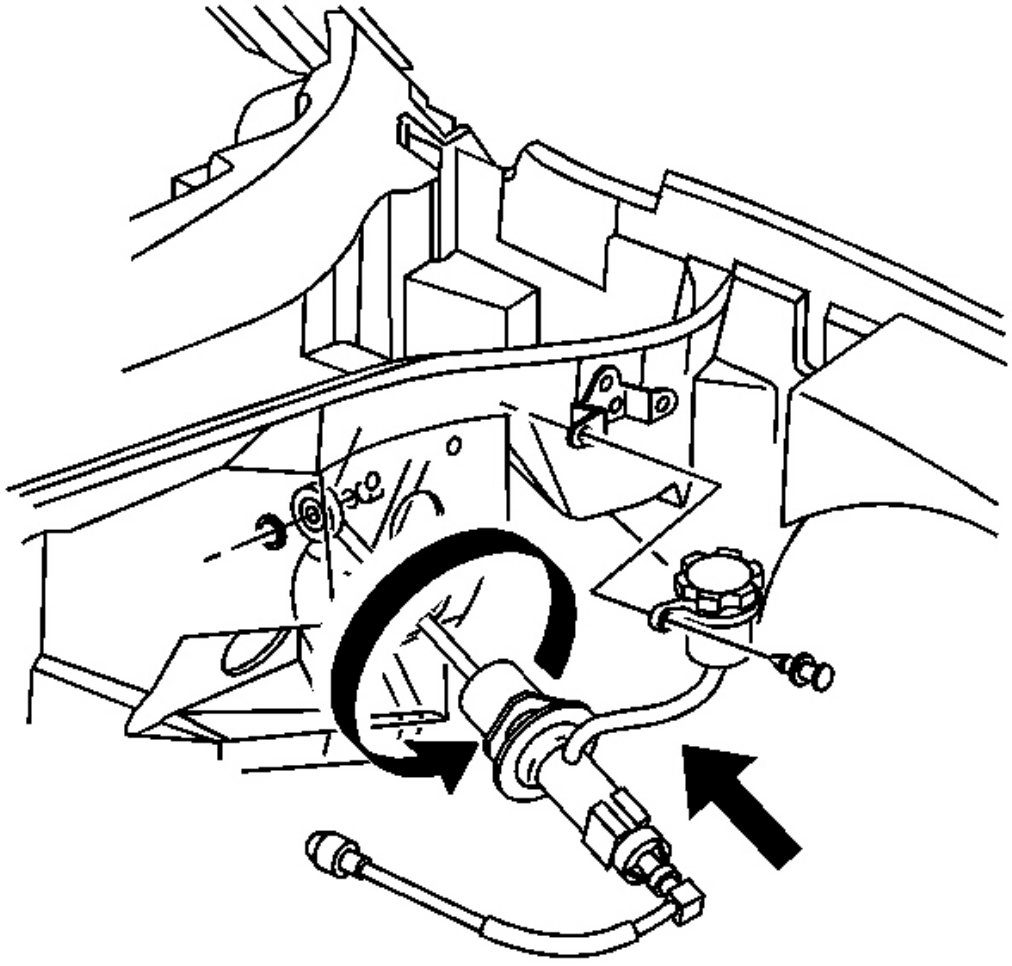


Fig. 23: Clutch Master Cylinder & Dash Panel
Courtesy of GENERAL MOTORS CORP.

1. Install the clutch master cylinder and the reservoir into position.
2. Install the clutch master cylinder to the dash panel.
    1. Orientate the clutch master cylinder at a 45 degree angle.
    2. Insert the clutch master cylinder into the dash panel.
    3. Rotate the master cylinder counterclockwise to secure.

    DO NOT over-rotate the master cylinder.

3. Install the clutch master cylinder reservoir into position.

4. Install the clutch master cylinder reservoir push-in fasteners.
5. Install the windshield washer solvent container. Refer to **Washer Solvent Container Replacement** in Wipers/Washer Systems.

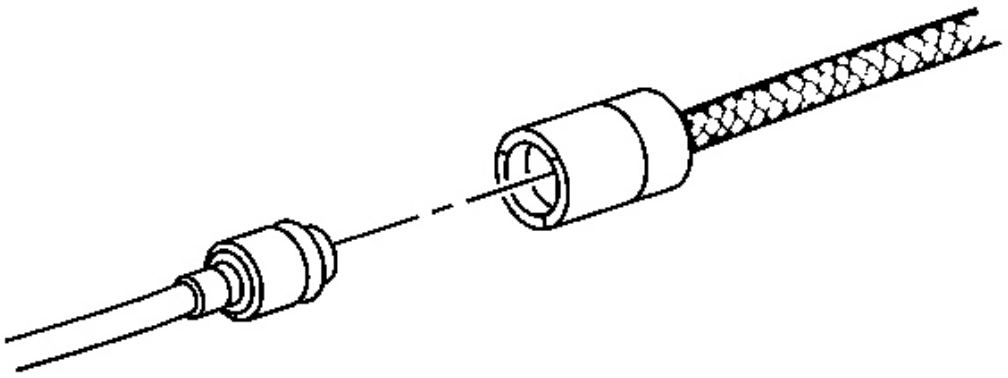


Fig. 24: Identifying White Circular Release Ring On The Actuator Hose
Courtesy of GENERAL MOTORS CORP.

6. Raise the vehicle.

IMPORTANT: DO NOT rely on an audible click or a visual verification of the clutch hydraulic hose quick connect fitting connection.

7. Connect the clutch actuator cylinder hose to the clutch master cylinder hose.

   Push together the clutch hydraulic hose quick connect fittings, then pull back on the fittings to verify engagement.

8. Check the clutch hydraulic hoses for twists or kinks.

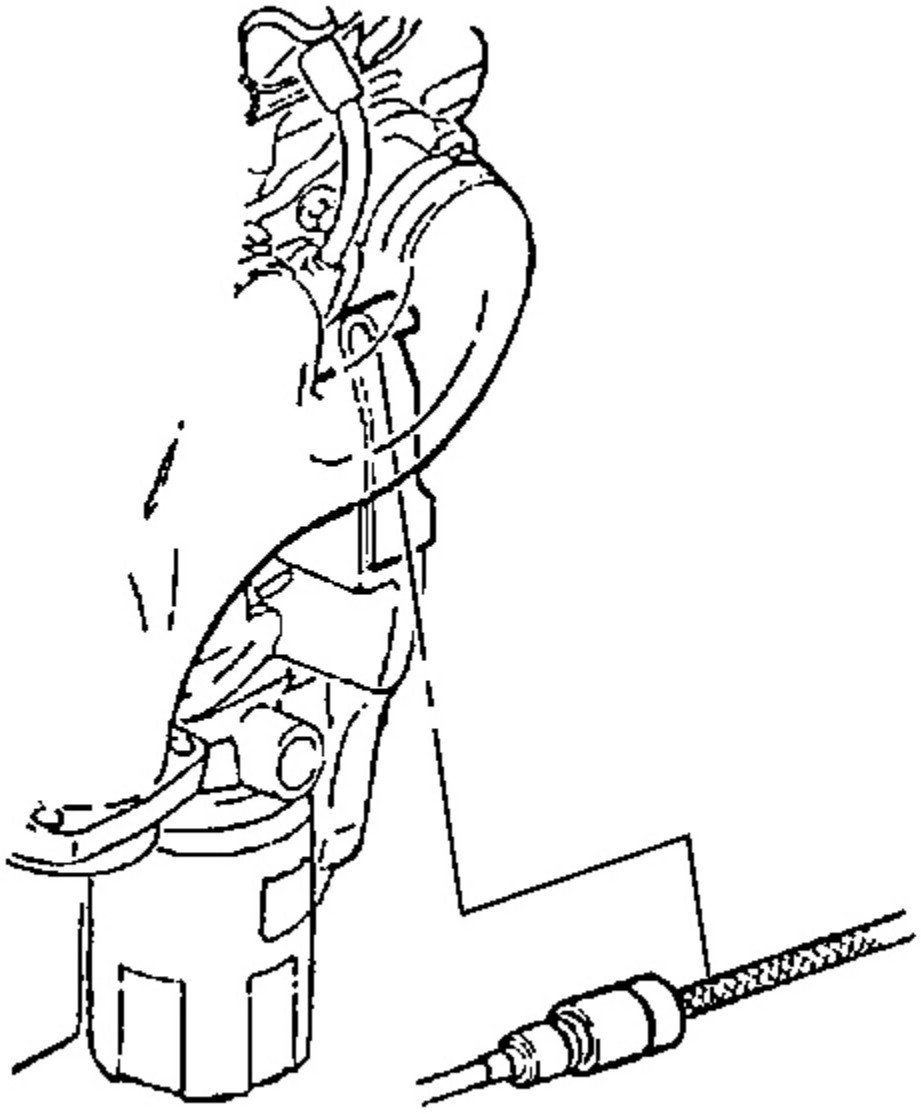


Fig. 25: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

9. Install the clutch actuator cylinder hose to the hose retaining clip, at the rear of the engine.
10. Lower the vehicle.

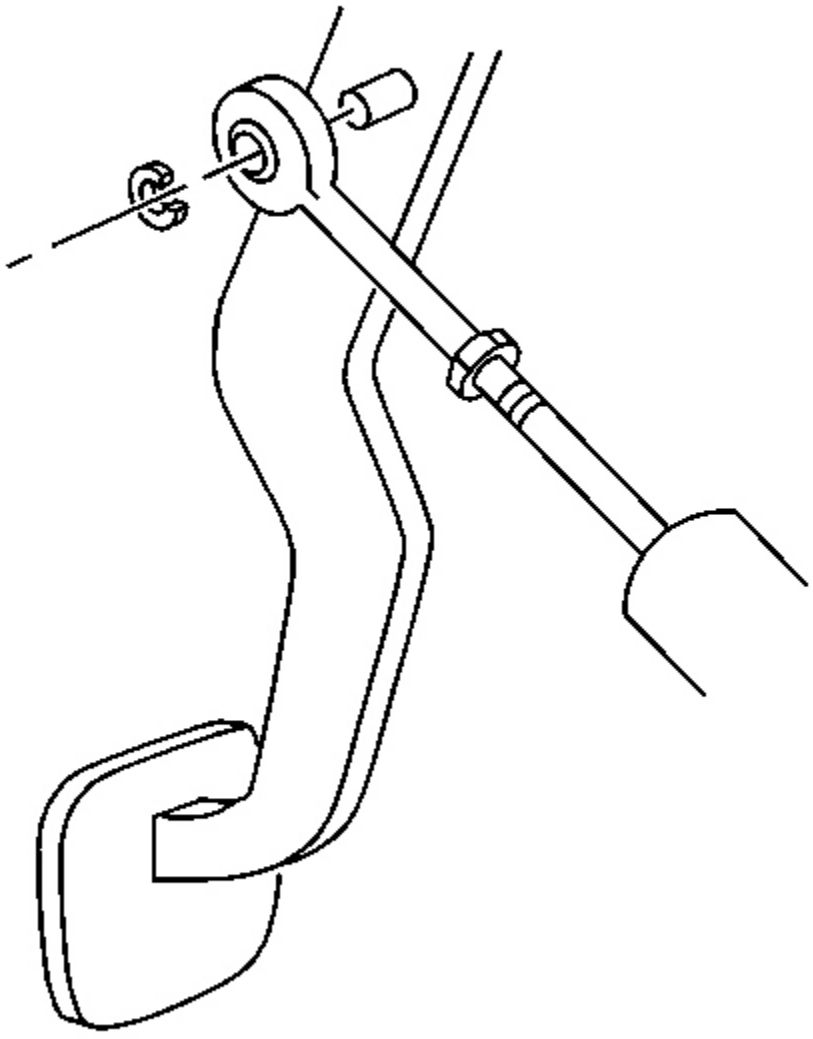


Fig. 26: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

11. Install the clutch master cylinder rod to the clutch pedal.
12. Install the clutch master cylinder rod retainer.
13. Install the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.

NOTE: Refer to Fastener Notice in Cautions and Notices.

14. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

15. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.
16. Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch Bleeding** .

HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT

Removal Procedure

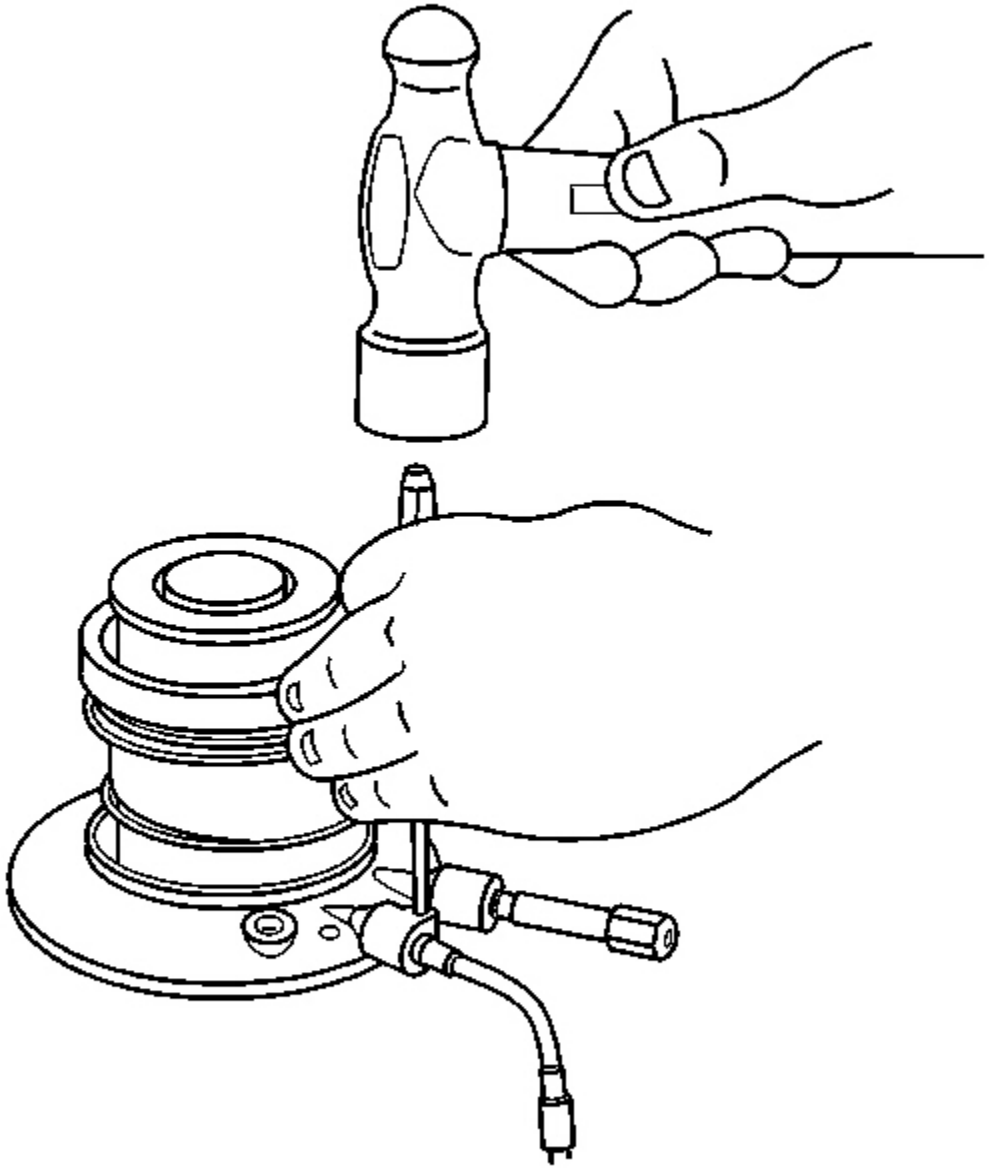


Fig. 27: Removing/Installing The Clutch Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

1. Remove the clutch actuator cylinder. Refer to **Clutch Actuator Cylinder Replacement** .
2. Use a small drift or punch to remove the roll-pin retaining the hydraulic hose to the actuator cylinder.

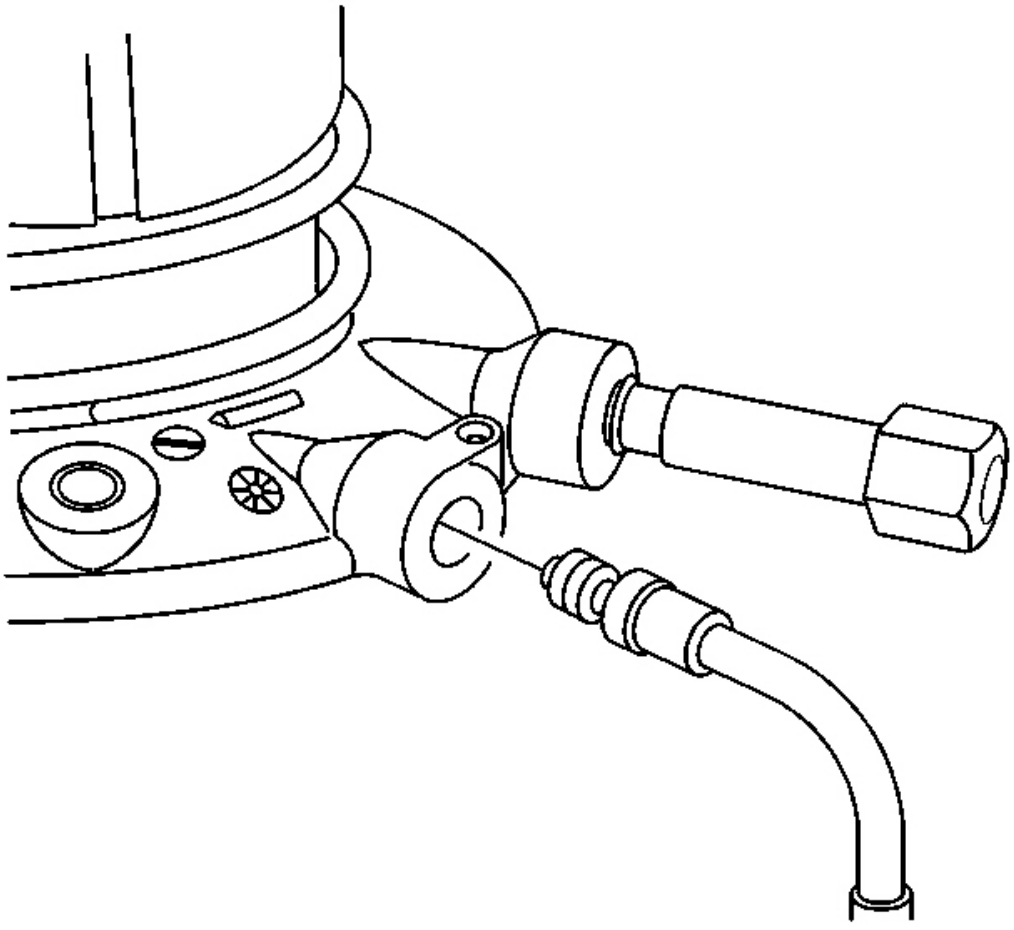


Fig. 28: Hydraulic Hose & Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

3. Remove the hydraulic hose from the actuator cylinder.
4. Drain off the excess fluid from the actuator cylinder into a container.

Installation Procedure

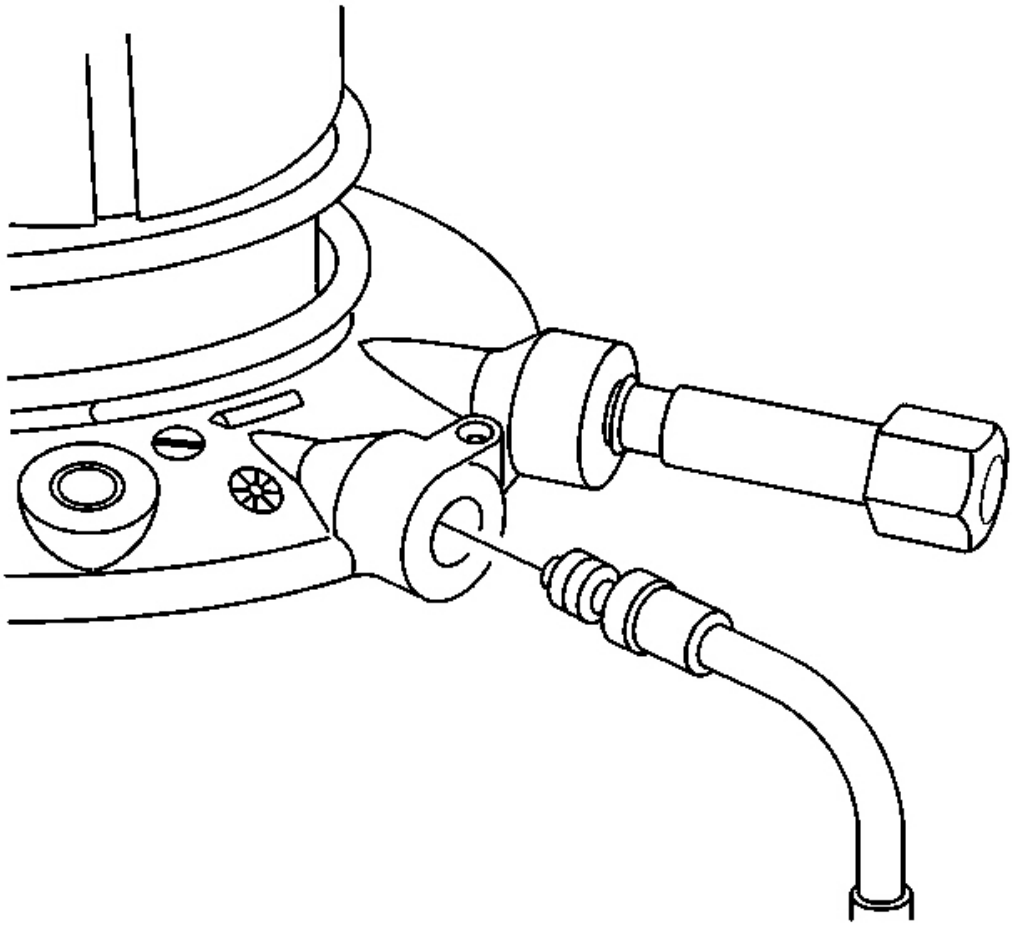


Fig. 29: Hydraulic Hose & Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

1. Install the new clutch actuator cylinder hose to the clutch actuator cylinder.

   Check the new O-ring seal for proper placement on the actuator cylinder hose.

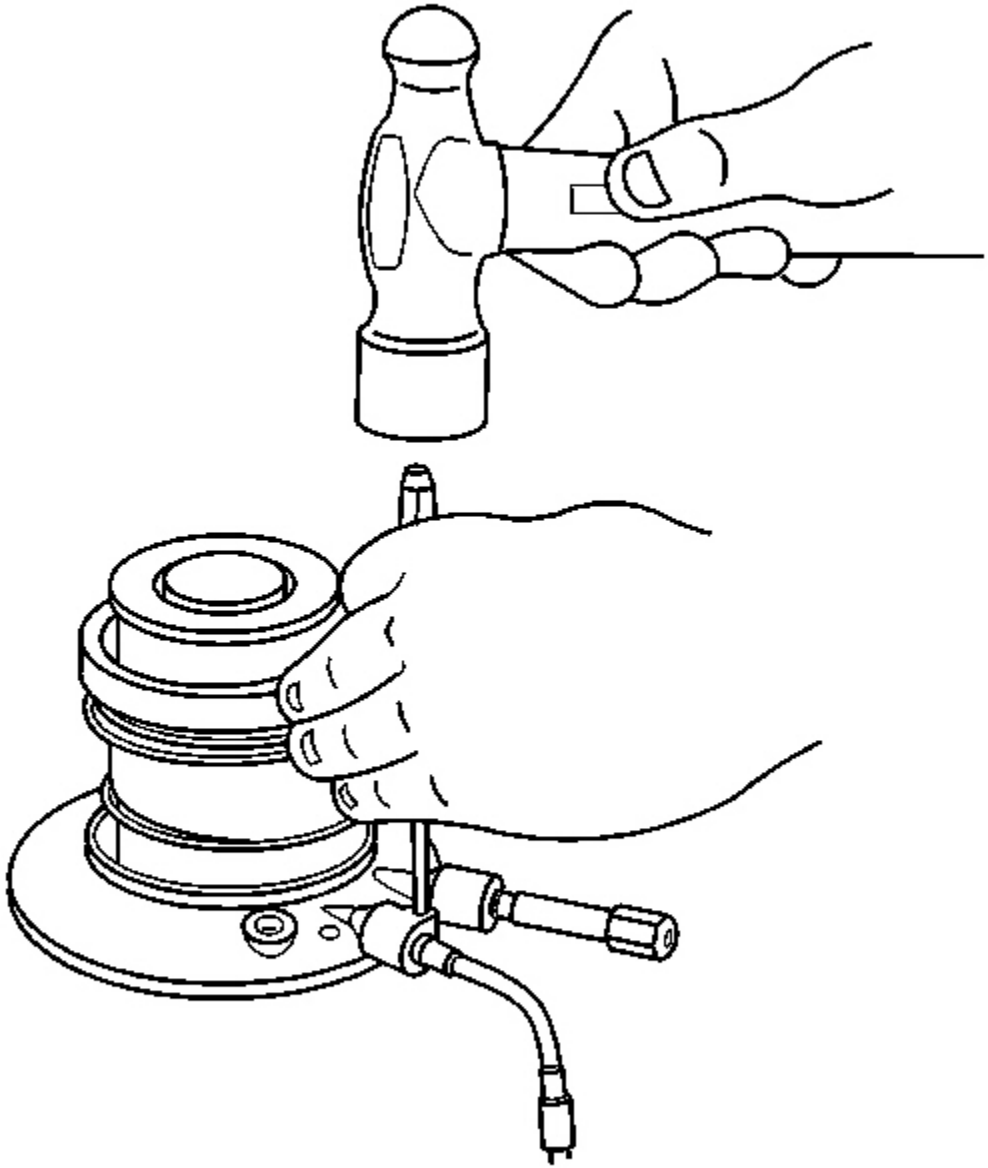


Fig. 30: Removing/Installing The Clutch Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

2. Install the actuator cylinder hose roll-pin retainer using a small drift or punch.
3. Rotate the actuator cylinder hose to ensure freedom of movement.
4. Install the clutch actuator cylinder. Refer to **Clutch Actuator Cylinder Replacement** .

HYDRAULIC CLUTCH BLEEDING

NOTE: DO NOT use fluid which has been bled from a hydraulic clutch system, in order to fill the clutch master cylinder reservoir, due to the possibility that the fluid may be aerated, have too much moisture content, or be contaminated and may cause system or vehicle damage.

Bleeding the hydraulic clutch system is necessary whenever the level of fluid in the clutch master cylinder reservoir has been allowed to fall so low that air has been drawn into the master cylinder.

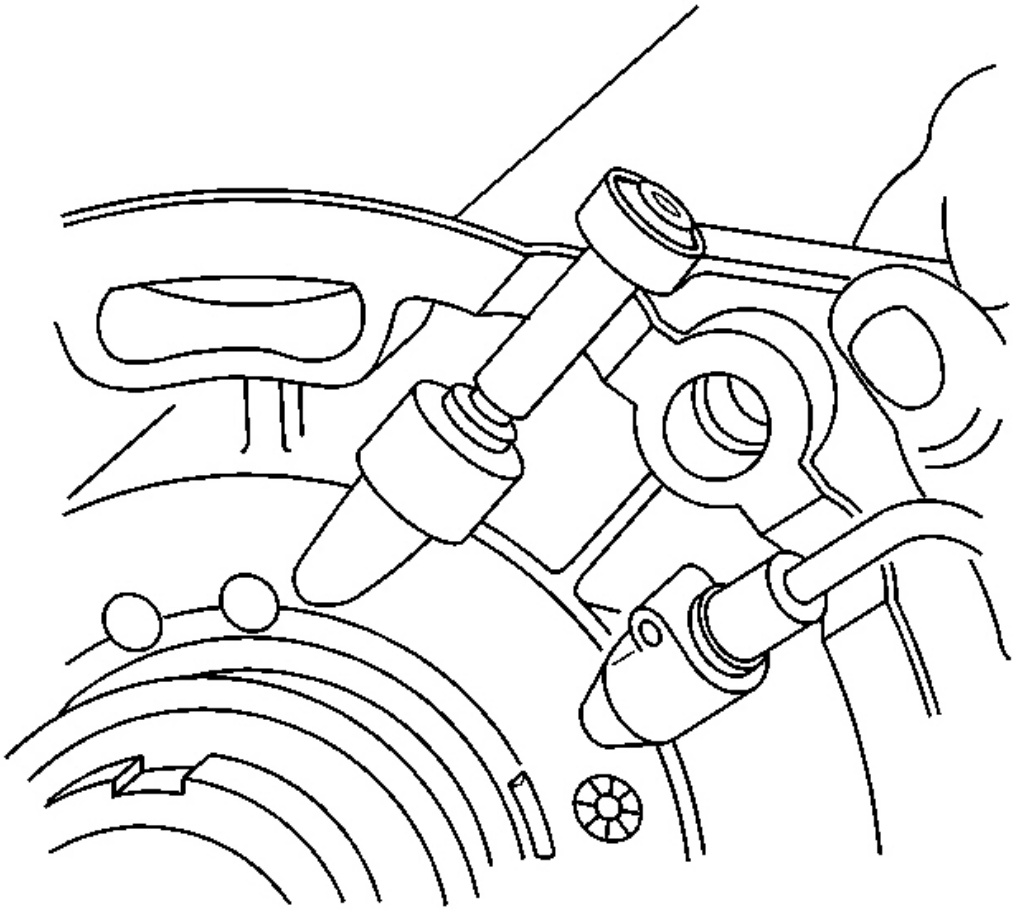


Fig. 31: Removing The Clutch Master Cylinder Reservoir Cap With Diaphragm
Courtesy of GENERAL MOTORS CORP.

1. Clean all dirt and debris from the clutch master cylinder cap to ensure that no foreign substances will

enter the system.

2. Remove the clutch master cylinder reservoir cap with diaphragm.
3. Fill the clutch master cylinder reservoir with clutch hydraulic fluid GM P/N 12345347, (Canadian P/N 10953517), or equivalent, if necessary.
4. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
5. Remove the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
6. Remove the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.
7. Have an assistant depress the clutch pedal fully and hold.
8. Loosen the bleeder screw on the clutch actuator cylinder to purge air.
9. Tighten the bleeder screw.
10. Release the clutch pedal.
11. Repeat steps 7 through 10 until all air is completely evacuated.

    Check and refill the clutch master cylinder reservoir with clutch hydraulic fluid GM P/N 12345347, (Canadian P/N 10953517), or equivalent, as necessary in order to prevent air from being drawn through the clutch master cylinder.

12. Fill the clutch master cylinder reservoir with clutch hydraulic fluid GM P/N 12345347, (Canadian P/N 10953517), or equivalent, if necessary.
13. Install the driveline tunnel closeout panel. Refer to **Driveline Tunnel Closeout Panel Replacement** in Propeller Shaft.
14. Install the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
15. Lower the vehicle.

CLUTCH PEDAL POSITION SWITCH REPLACEMENT

Removal Procedure

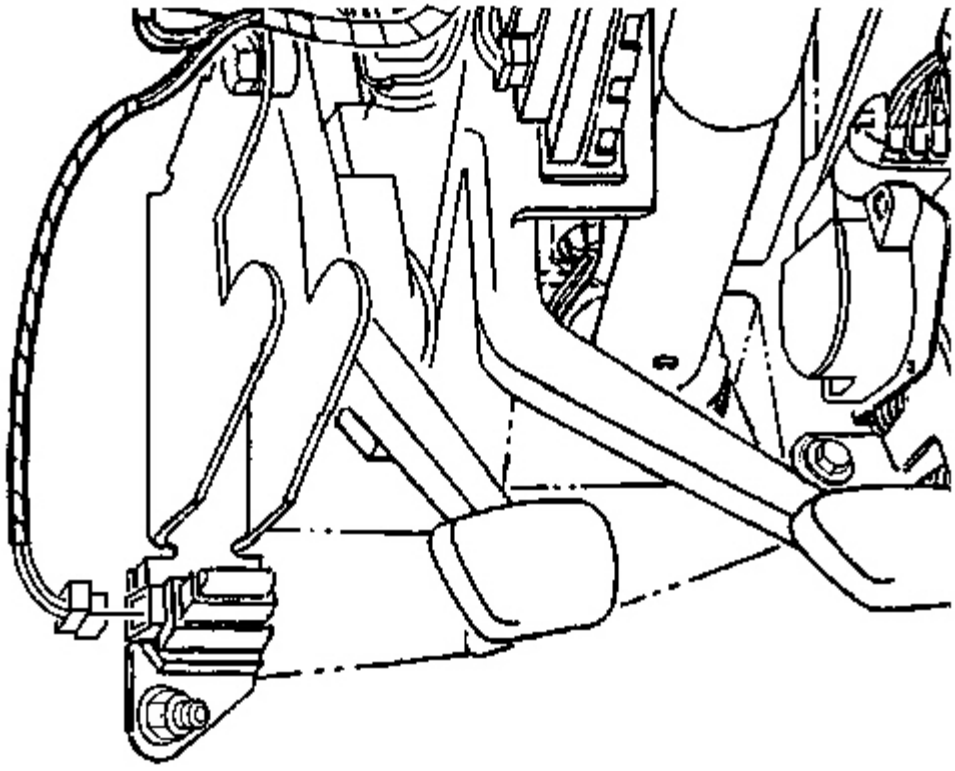


Fig. 32: Clutch Pedal Position Switch & Clutch Start Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Remove the clutch pedal position switch (clutch start switch) electrical connector.

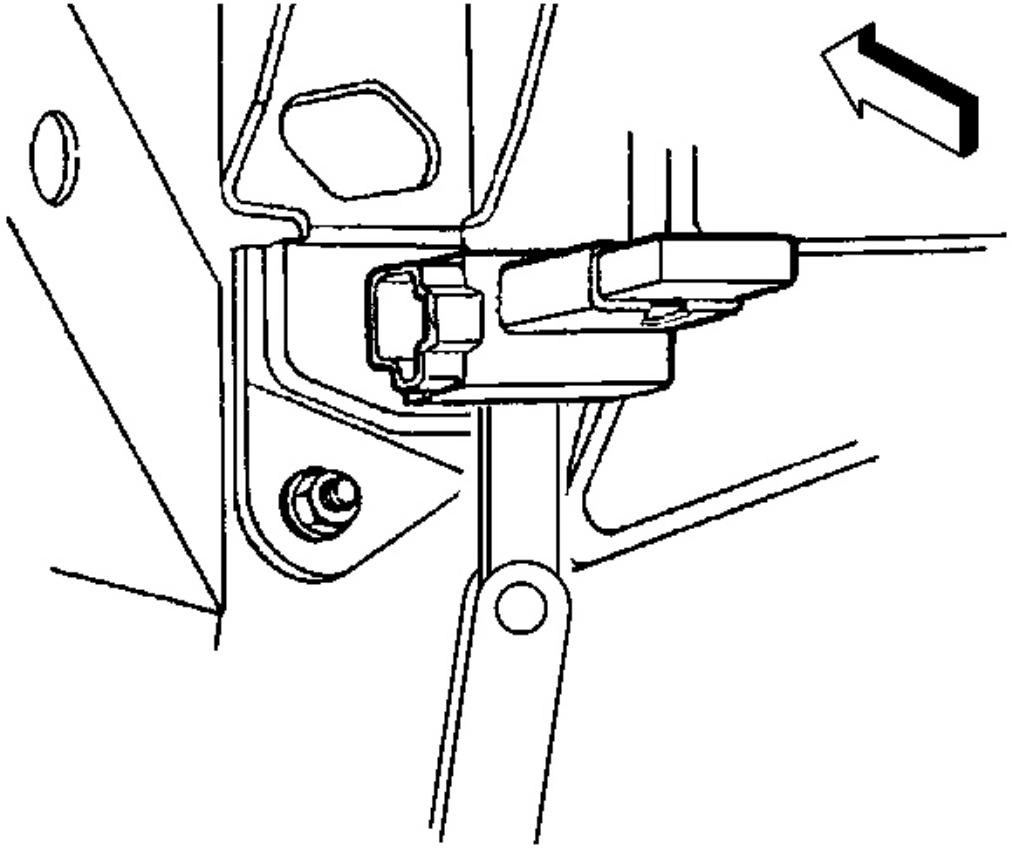


Fig. 33: Inserting A Feeler Gage Between The Switch & Clutch Pedal Bracket
Courtesy of GENERAL MOTORS CORP.

3. Insert a feeler gage between the switch and the clutch pedal bracket to release the switch tab.
4. Remove the switch.

   Lift the switch slightly then pull to remove.

Installation Procedure

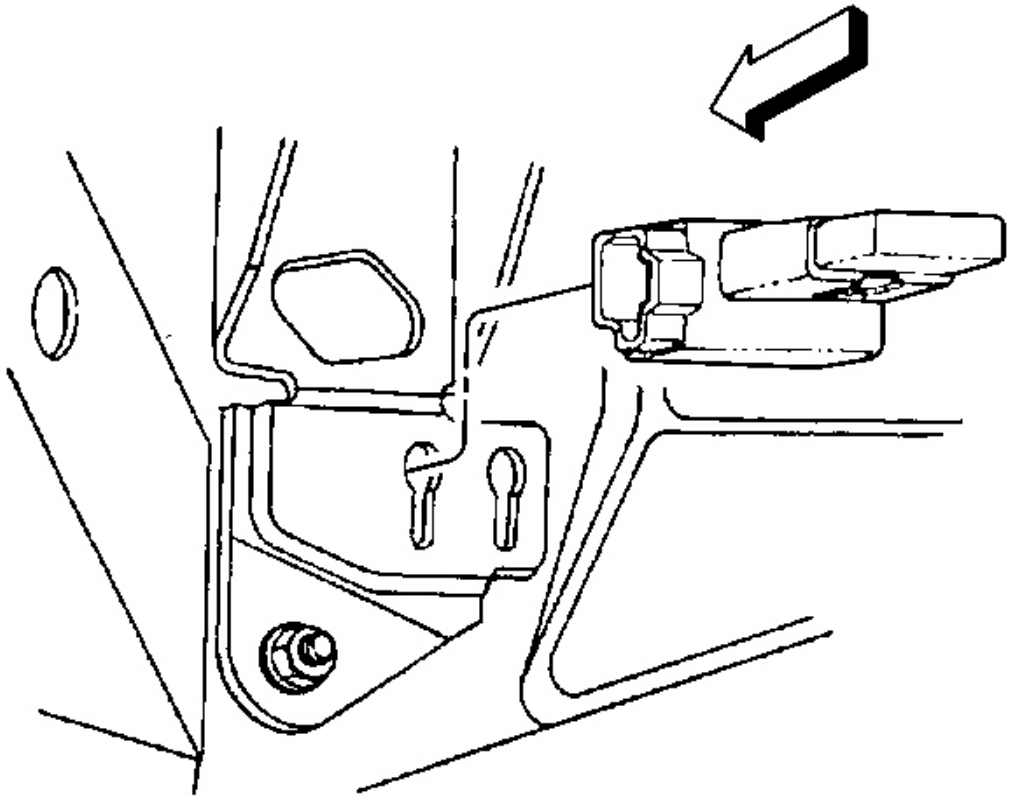


Fig. 34: Clutch Pedal Position Switch & Clutch Pedal Bracket
Courtesy of GENERAL MOTORS CORP.

1. Install the clutch pedal position switch (clutch start switch) to the clutch pedal bracket.

   Insert the switch locators into the top of the slots, then slide down to lock.

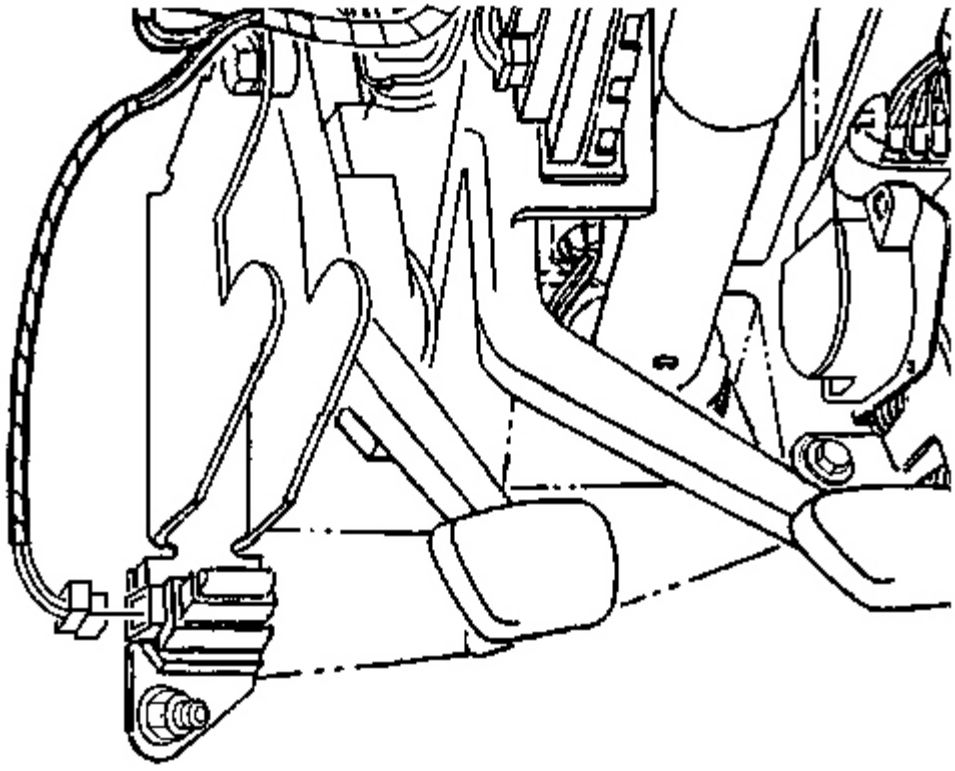


Fig. 35: Clutch Pedal Position Switch & Clutch Start Switch Electrical Connector
Courtesy of GENERAL MOTORS CORP.

2. Connect the switch electrical connector.

NOTE: Refer to Fastener Notice in Cautions and Notices.

3. Connect the negative battery cable.

Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

4. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.

PILOT BEARING REPLACEMENT

Tools Required

J 23907 Clutch Pilot Bearing Remover. See **Special Tools and Equipment** .

Removal Procedure

NOTE: DO NOT use grease under pressure to force the pilot bearing from the crankshaft or engine damage may result.

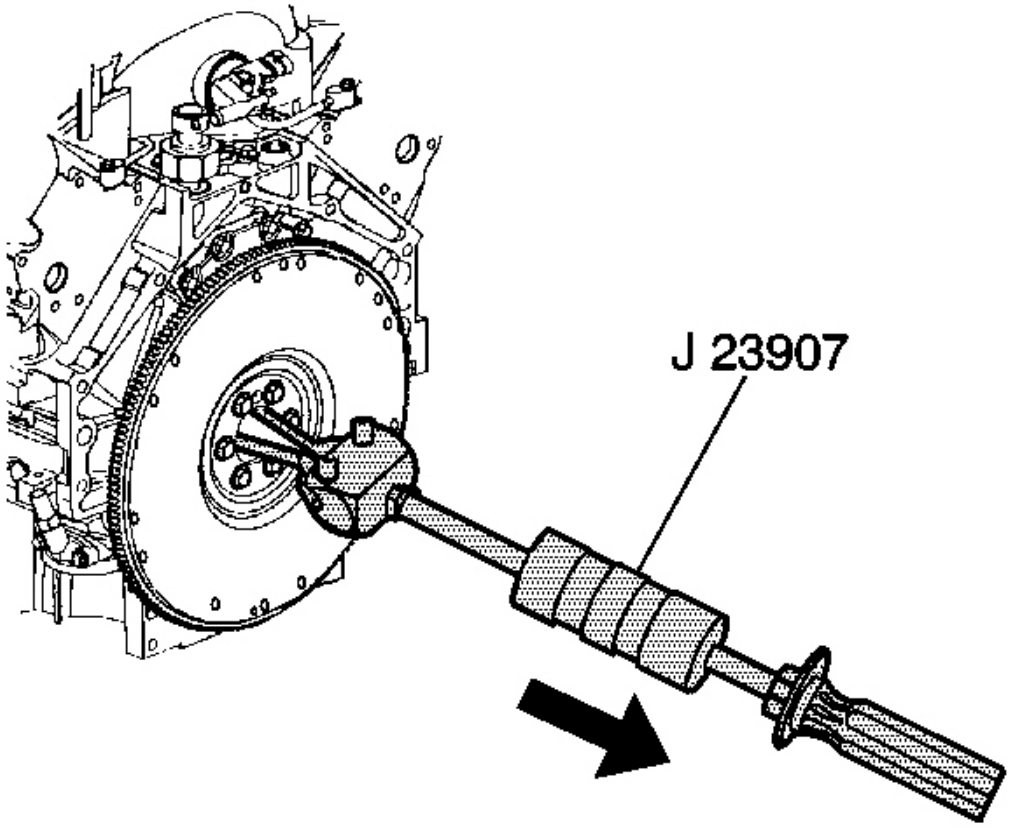


Fig. 36: J 23907 & Clutch Pilot Bearing
Courtesy of GENERAL MOTORS CORP.

1. Remove the clutch assembly. Refer to **Clutch Assembly Replacement** .
2. Using the **J 23907** , remove the clutch pilot bearing. See **Special Tools and Equipment** .

Installation Procedure

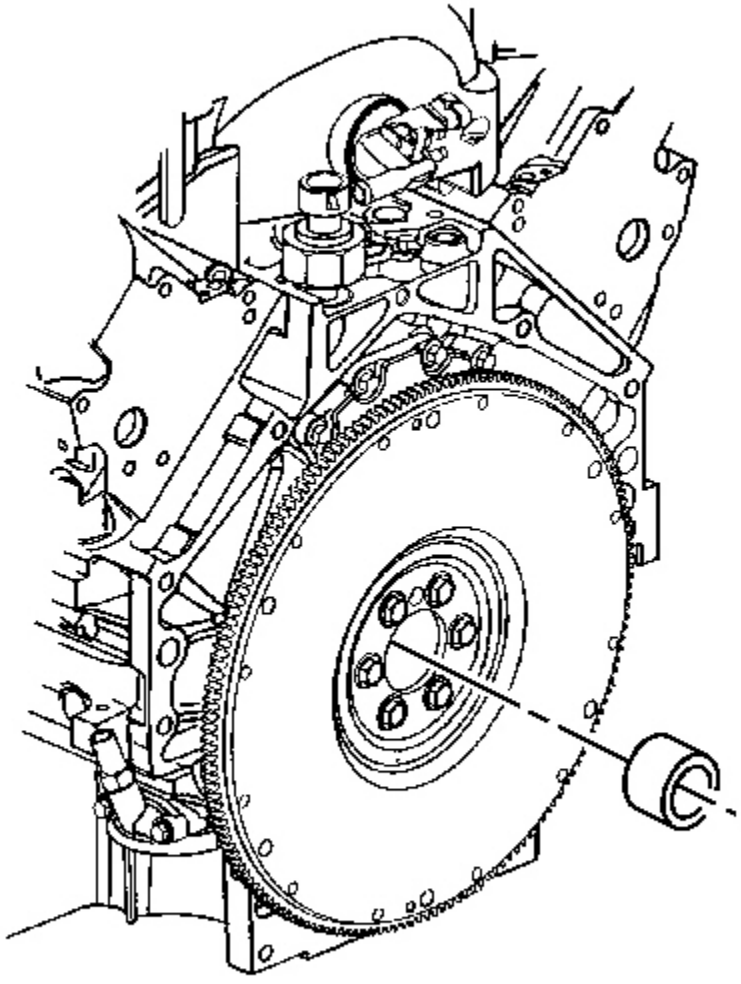


Fig. 37: Installing Clutch Pilot Bearing Using A Suitable Size Socket
Courtesy of GENERAL MOTORS CORP.

1. Using a suitable size socket, install the clutch pilot bearing.
2. Install the clutch assembly. Refer to **Clutch Assembly Replacement** .

CLUTCH ASSEMBLY REPLACEMENT

Tools Required

J 38836 Pilot Bushing Installer/Clutch Alignment Arbor

Removal Procedure

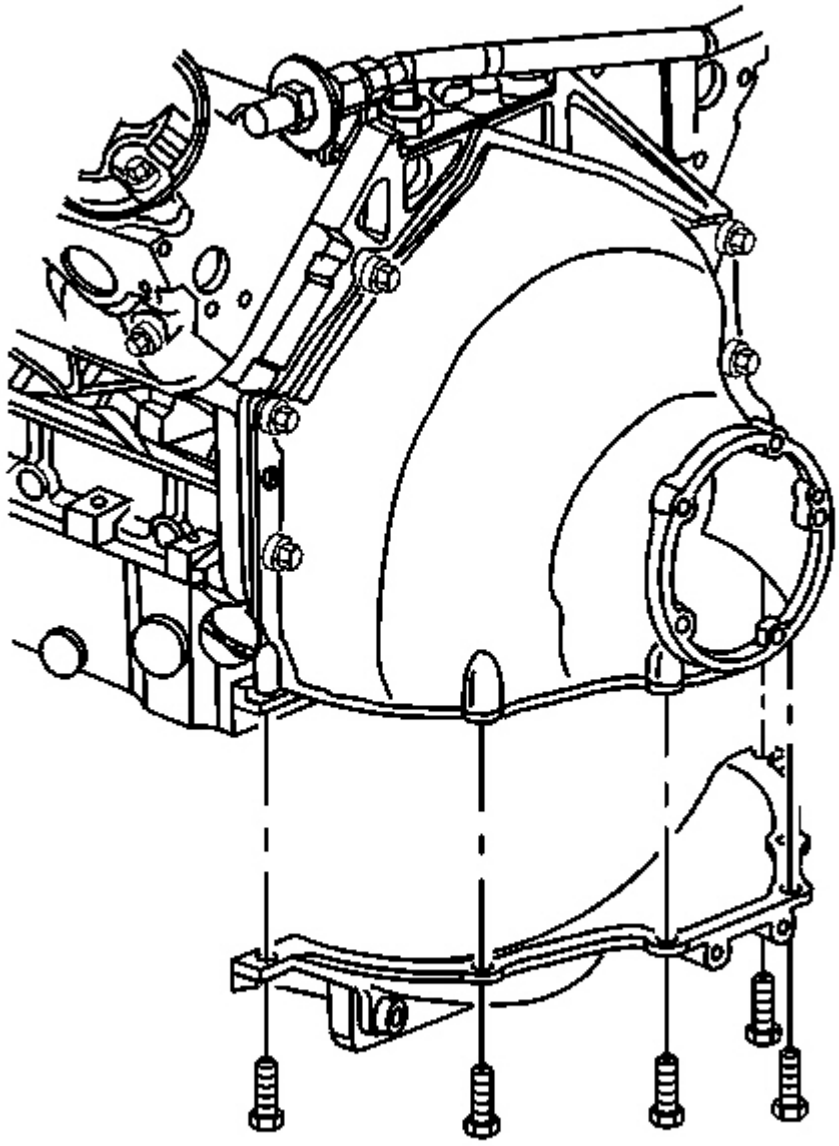


Fig. 38: Engine Flywheel Inspection Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Raise and suitably support the vehicle. Refer to **Lifting and Jacking the Vehicle** in General Information.
3. Remove the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
4. Remove the driveline support assembly with the transaxle. Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.
5. Remove the engine flywheel inspection cover retaining bolts.
6. Remove the engine flywheel inspection cover from the engine flywheel housing.

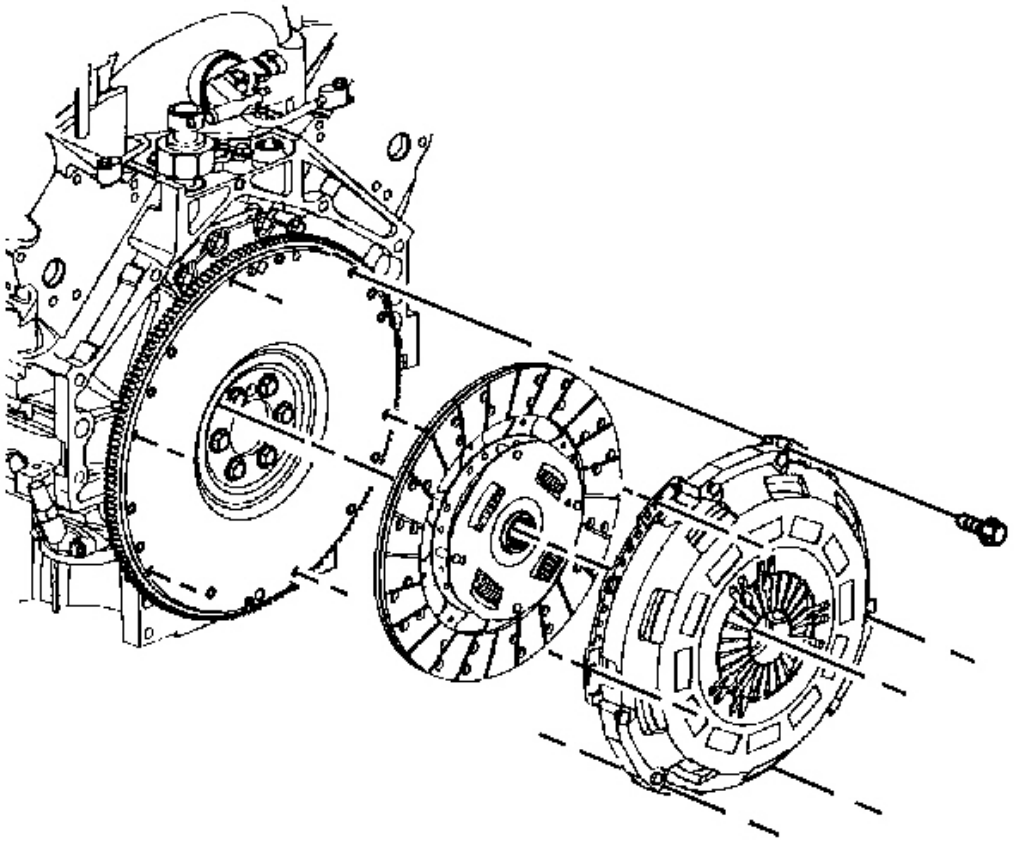


Fig. 39: Visible Clutch Pressure Plate & Bolts
Courtesy of GENERAL MOTORS CORP.

7. Loosen the visible clutch pressure plate bolts.

8. Rotate the engine flywheel.
9. Repeat steps 7 and 8 until all the bolts have been loosened.
10. Remove the visible clutch pressure plate bolts.
11. Rotate the engine flywheel.
12. Repeat steps 10 and 11 until all the bolts have been removed.
13. Remove the clutch pressure plate bolts from the flywheel.
14. Remove the clutch pressure plate and the clutch driven plate.

Installation Procedure

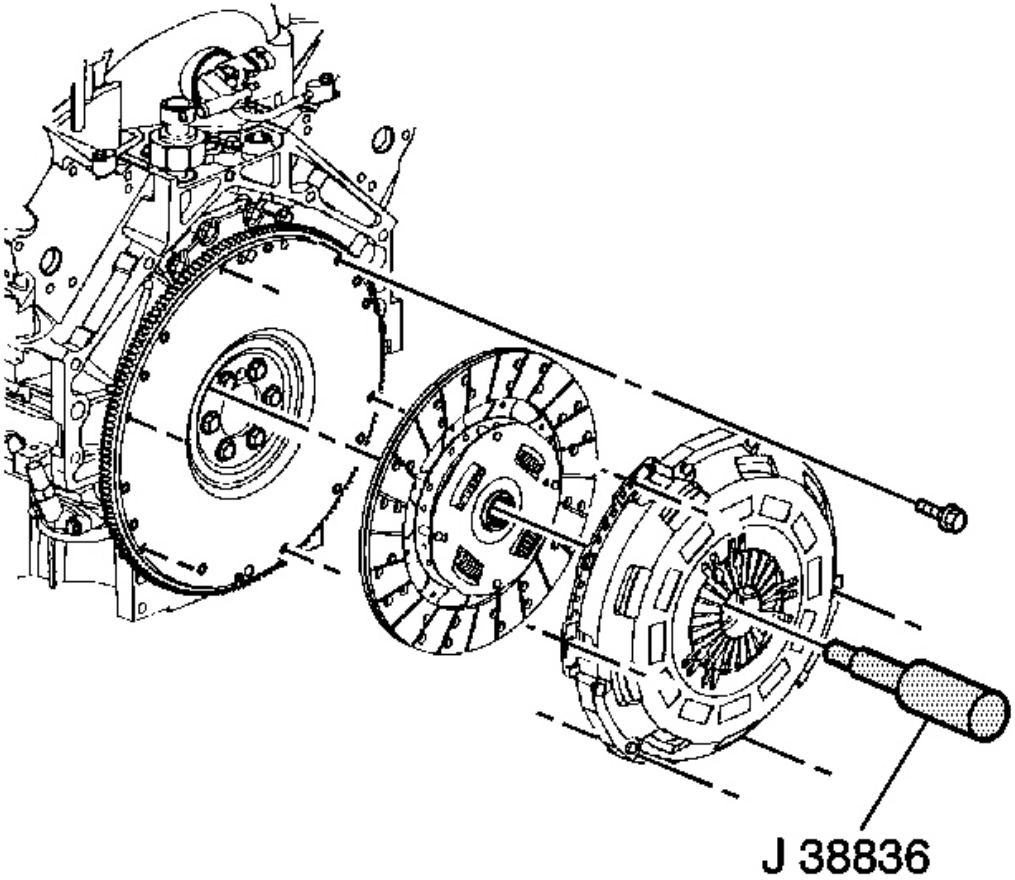


Fig. 40: J 38836, Clutch Driven Plate & Pilot Bearing
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: When the clutch pressure plate requires replacement; the engine flywheel

must also be replaced along with the clutch pressure plate as an assembly.

1. Inspect the clutch pressure plate and the clutch driven plate for wear or damage. Repair or replace as necessary.
2. Inspect the engine flywheel. Refer to **Engine Flywheel Replacement** in Engine Mechanical.
3. Adjust the clutch pressure plate, if necessary. Refer to **Clutch Pressure Plate Adjustment (Off-Vehicle)** or **Clutch Pressure Plate Adjustment (On-Vehicle)** .
4. Install the clutch driven plate and clutch pressure plate to the engine flywheel.
5. Install the visible clutch pressure plate bolts finger-tight.
6. Rotate the engine flywheel.
7. Repeat steps 5 and 6 until all the bolts are installed finger-tight.
8. Using the **J 38836** , align the clutch driven plate to the pilot bearing.

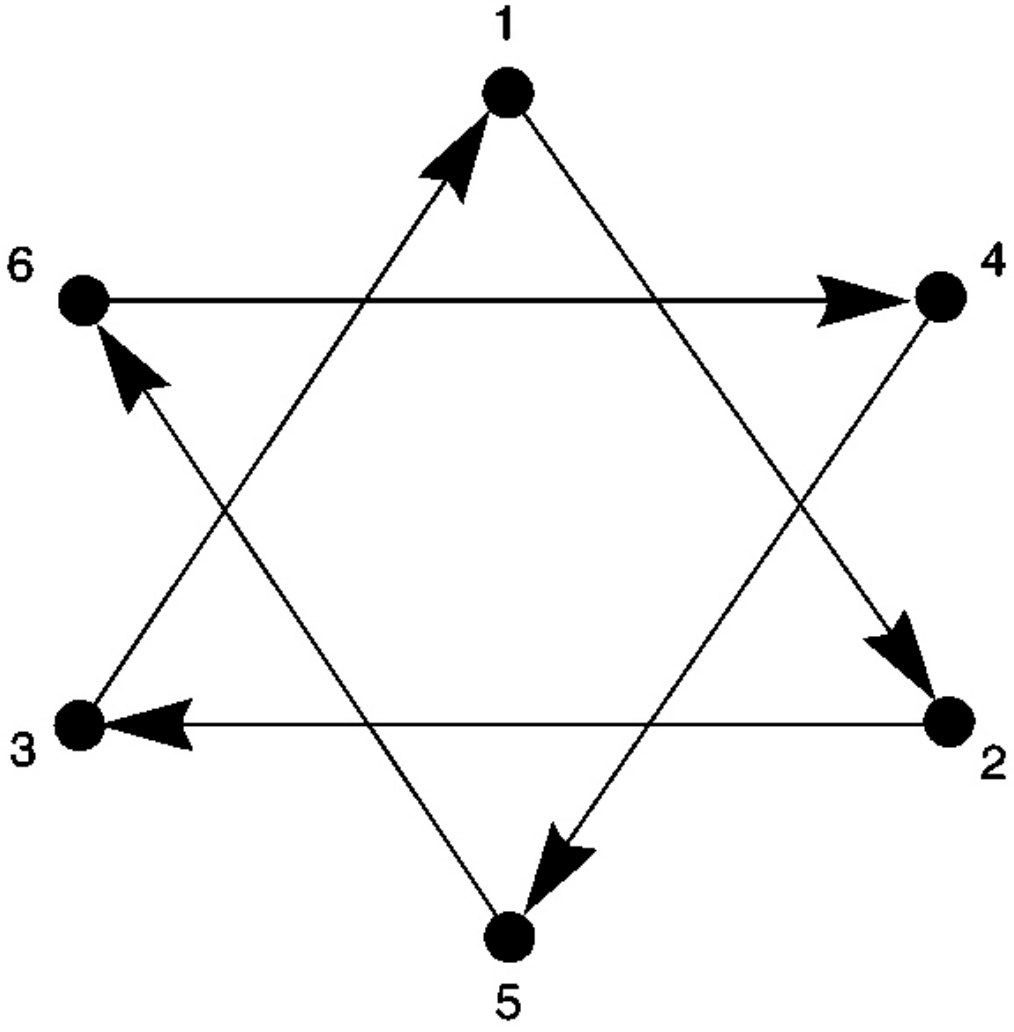


Fig. 41: Tightening The Clutch Pressure Plate Bolts In Numerical Order
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to Fastener Notice in Cautions and Notices.

9. Tighten the clutch pressure plate bolts in the sequence shown, starting with the number one and following in numerical order.

   Tighten: Tighten the clutch pressure plate bolts in sequence and evenly over 3 increments with the fourth increment to 70 N.m (52 lb ft).

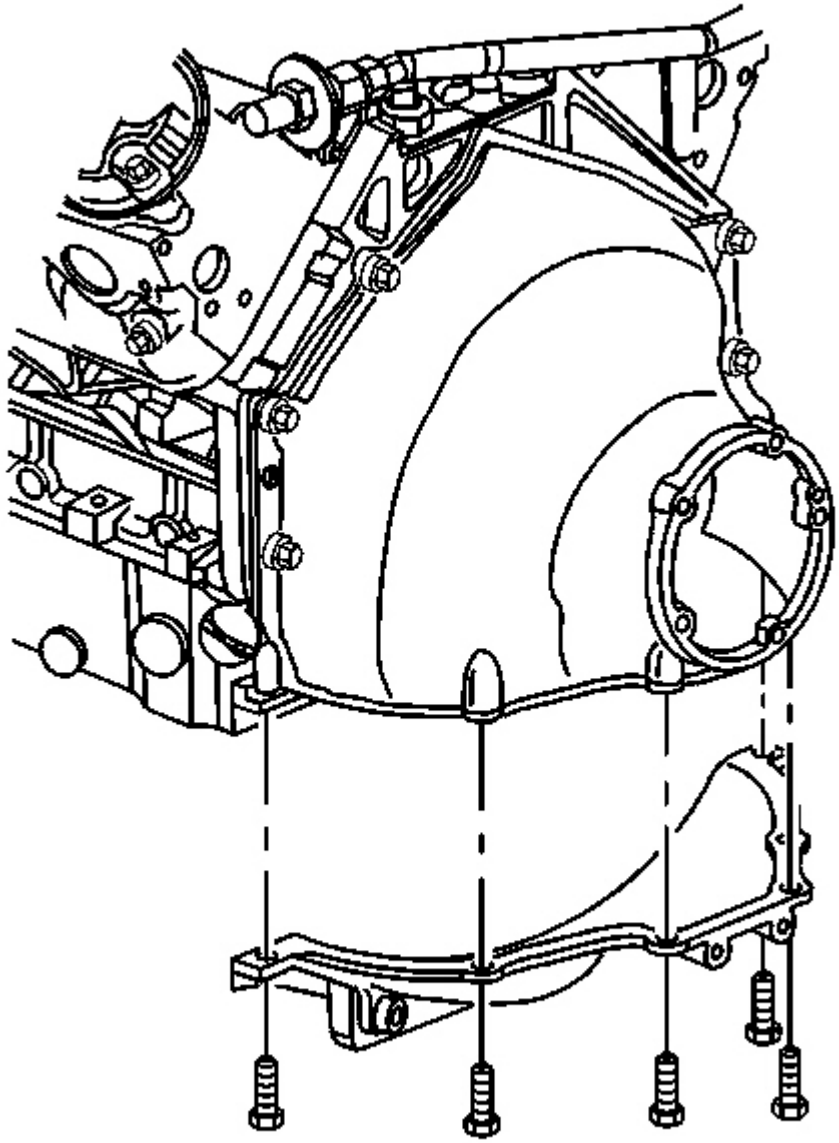


Fig. 42: Engine Flywheel Inspection Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

10. Install the engine flywheel inspection cover.
11. Install the engine flywheel inspection cover retaining bolts.

Tighten: Tighten the engine flywheel inspection cover retaining bolts to 25 N.m (18 lb ft).

12. Install the driveline support assembly and the transaxle. Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.
13. Install the catalytic converter. Refer to **Catalytic Converter Replacement** in Engine Exhaust.
14. Connect the negative battery cable.

    Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

15. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.
16. Lower the vehicle.

RELEASE BEARING REPLACEMENT

Removal Procedure

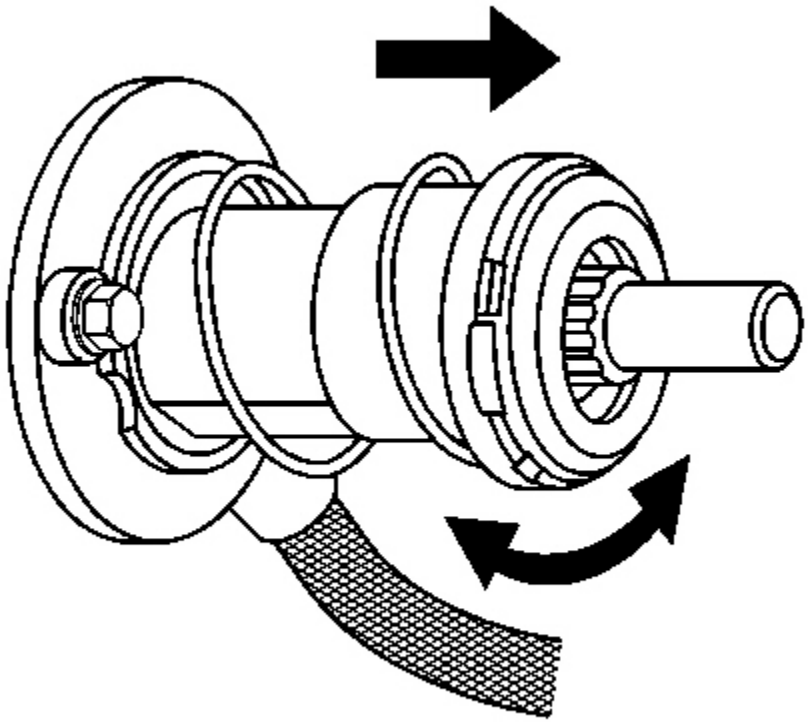


Fig. 43: Removing Clutch Release Bearing
Courtesy of GENERAL MOTORS CORP.

1. Remove the driveline support assembly and the transaxle from the vehicle (with the clutch actuator cylinder). Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.
2. Remove the clutch release bearing.

   Rotate the bearing in either direction.

   The compression spring load will push the release bearing off the end of the clutch actuator cylinder.

Installation Procedure

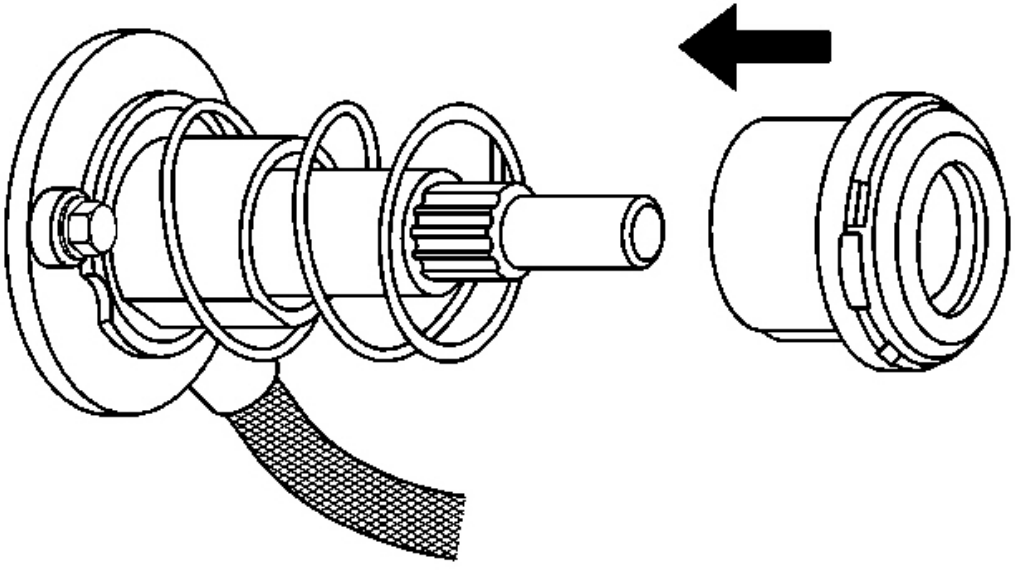


Fig. 44: Installing Clutch Release Bearing To Clutch Actuator Cylinder
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT use cleaners or chemicals to clean the quill and DO NOT grease the quill.

1. Using a clean dry rag, clean the exposed area of the actuator cylinder quill.

IMPORTANT: DO NOT grease the new clutch release bearing. The new clutch release bearing to be installed is pre-greased.

2. Install the new clutch release bearing to the clutch actuator cylinder.

Firmly push the clutch release bearing into place.

The release bearing will snap over the retainer tab and will be self-retained to the actuator cylinder.

3. Install the driveline support assembly and the transaxle to the vehicle (with the clutch actuator cylinder). Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.

CLUTCH ACTUATOR CYLINDER REPLACEMENT

Tools Required

J 36221 Hydraulic Clutch Line Separator

Removal Procedure

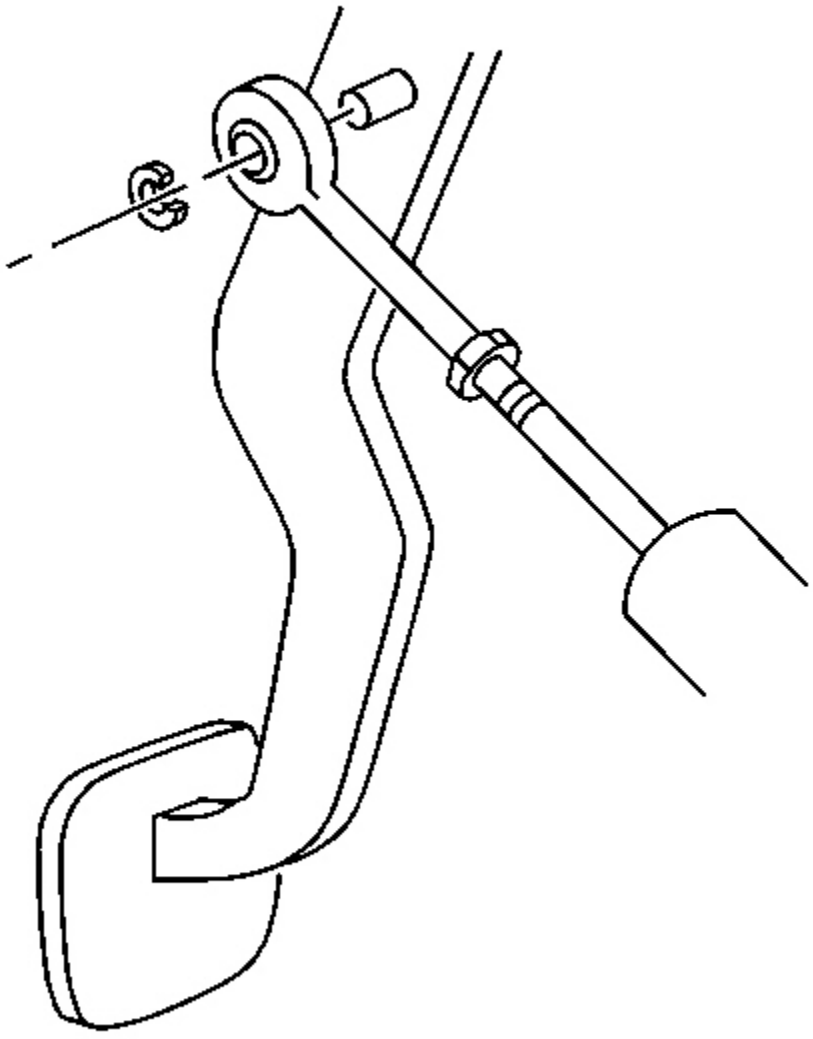


Fig. 45: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

CAUTION: Refer to Battery Disconnect Caution in Cautions and Notices.

1. Disconnect the negative battery cable.
2. Remove the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.

3. Remove the clutch master cylinder rod retainer.
4. Remove the clutch master cylinder rod from the clutch pedal.

Fig. 46: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

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

6. Remove the clutch actuator cylinder hose from the hose retaining clip (at the rear of the engine).

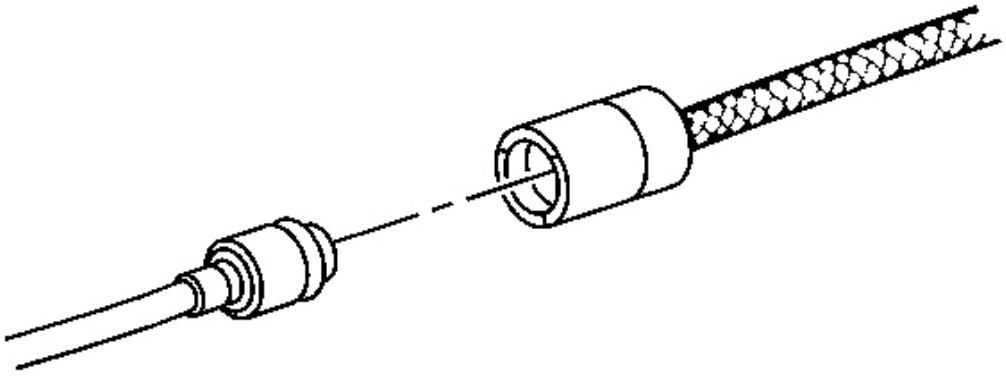


Fig. 47: Identifying White Circular Release Ring On The Actuator Hose
Courtesy of GENERAL MOTORS CORP.

7. Using the **J 36221** , depress the white circular release ring on the actuator hose and simultaneously pull lightly on the master cylinder hose to disconnect.
8. Protect both hose coupling ends from dirt and damage.

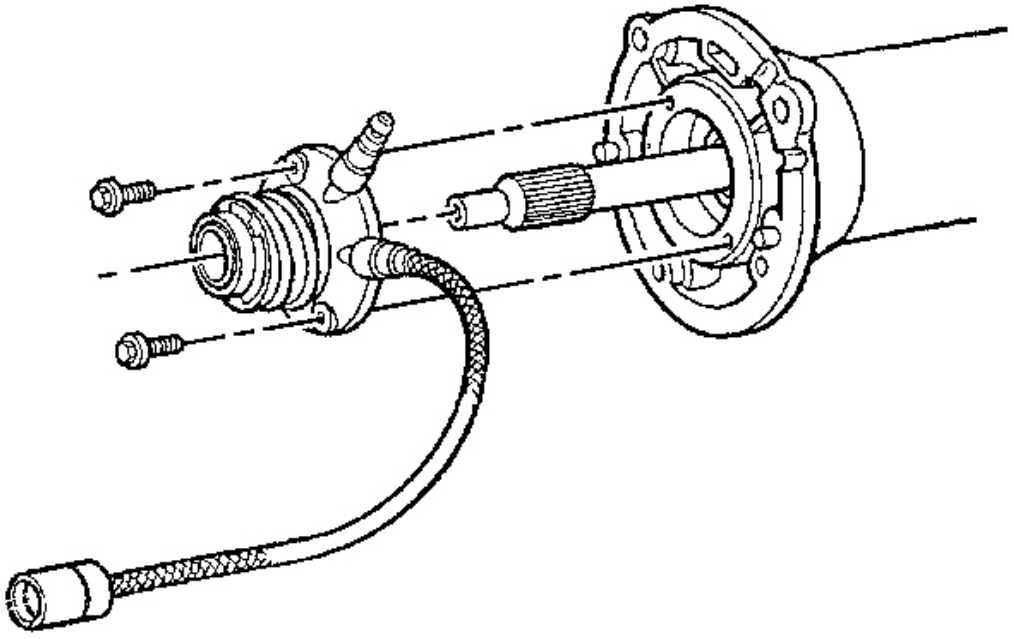


Fig. 48: Clutch Actuator Cylinder & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the driveline support assembly and transaxle from the vehicle. Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.
10. Remove the clutch actuator cylinder mounting bolts.
11. Remove the clutch actuator cylinder from the driveline support assembly.

Installation Procedure

NOTE: Ensure that the clutch hydraulic hoses are positioned away from nearby vehicle components or vehicle damage may result.

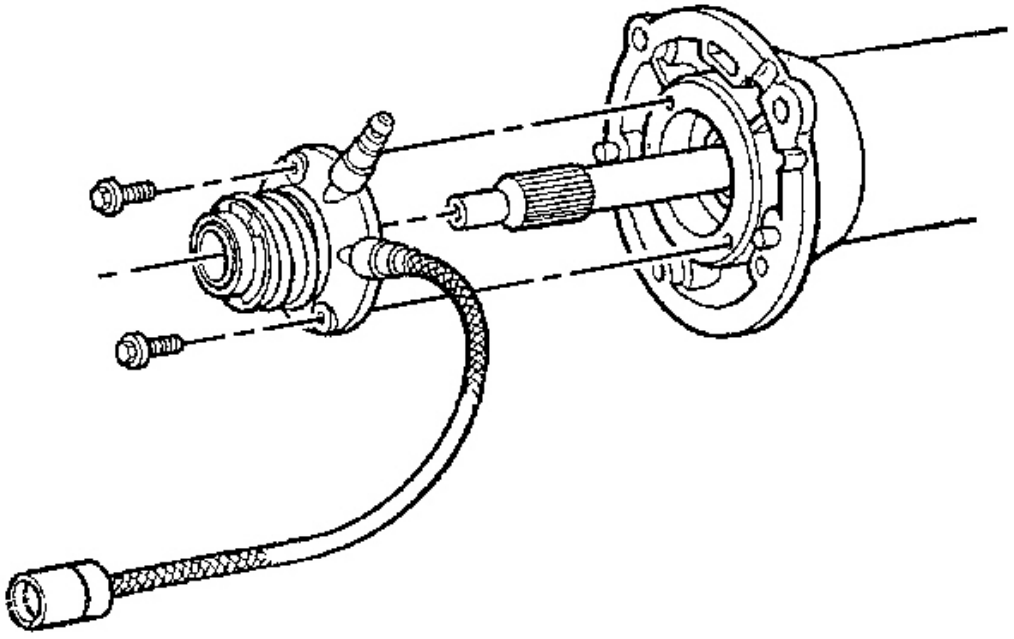


Fig. 49: Clutch Actuator Cylinder & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

1. Install the clutch actuator cylinder into position on the driveline support assembly.

NOTE: Refer to Fastener Notice in Cautions and Notices.

2. Install the actuator cylinder mounting bolts.

   Tighten: Tighten the clutch actuator cylinder mounting bolts to 12 N.m (106 lb in).

3. Install the driveline support assembly and transaxle to the vehicle. Refer to **Driveline Support Assembly Replacement (Automatic Transmission)** or **Driveline Support Assembly Replacement (Manual Transmission)** in Propeller Shaft.

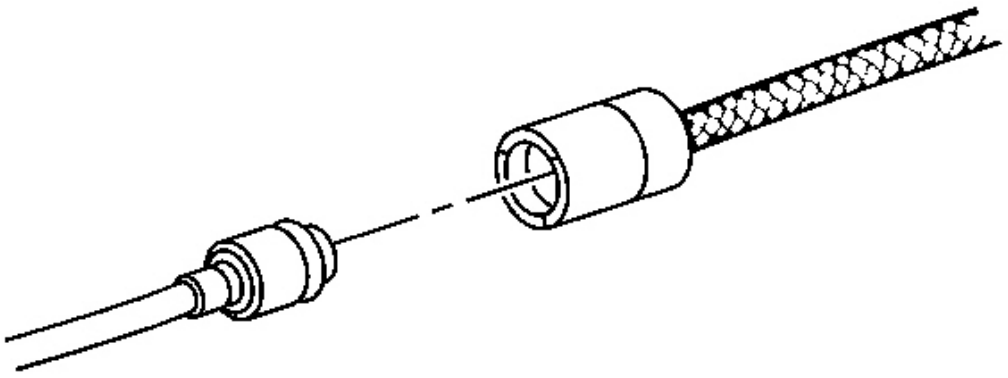


Fig. 50: Identifying White Circular Release Ring On The Actuator Hose
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: DO NOT rely on an audible click or a visual verification of the clutch hydraulic hose quick connect fitting connection.

4. Connect the clutch actuator cylinder hose to the clutch master cylinder hose.

   Push together the clutch hydraulic hose quick connect fittings, then pull back on the fittings to verify engagement.

5. Check the hydraulic hoses for twists of kinks.

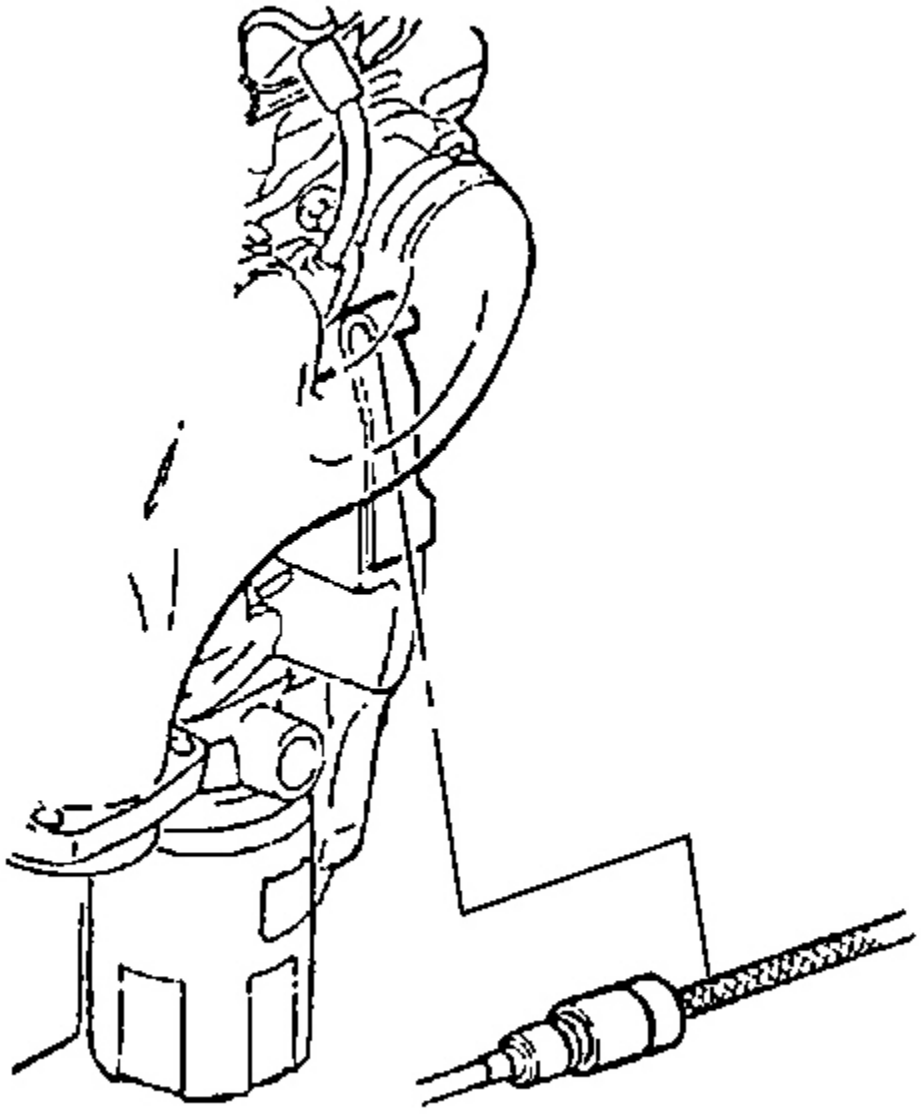


Fig. 51: Clutch Actuator Cylinder Hose
Courtesy of GENERAL MOTORS CORP.

6. Install the clutch actuator cylinder hose to the hose retaining clip (at the rear of the engine).
7. Lower the vehicle.

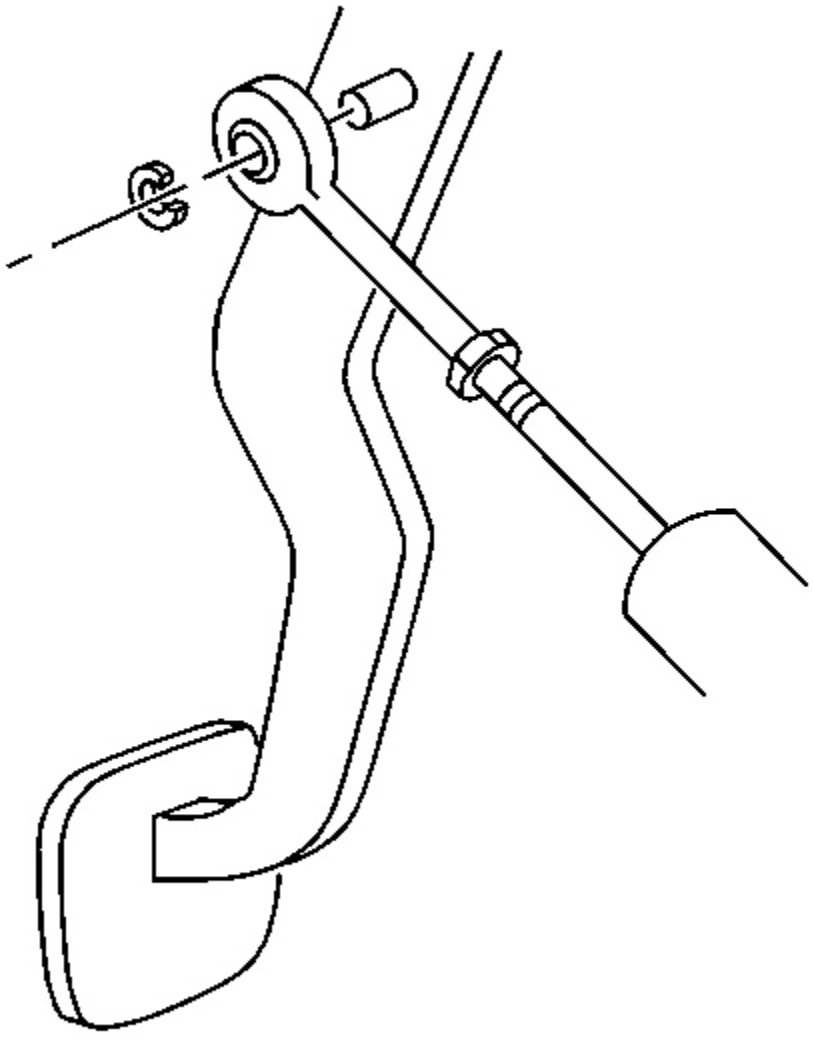


Fig. 52: Master Cylinder Push Rod From The Clutch Pedal
Courtesy of GENERAL MOTORS CORP.

8. Install the clutch master cylinder rod to the clutch pedal.
9. Install the clutch master cylinder rod retainer.
10. Install the left I/P lower insulator panel. Refer to **Closeout/Insulator Panel Replacement - Left** in Instrument Panel, Gages and Console.
11. Connect the negative battery cable.

Tighten: Tighten the negative battery cable bolt to 15 N.m (11 lb ft).

12. Program the transmitters. Refer to **Transmitter Programming** in Keyless Entry.
13. Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch Bleeding** .

CLUTCH PRESSURE PLATE ADJUSTMENT (OFF-VEHICLE)

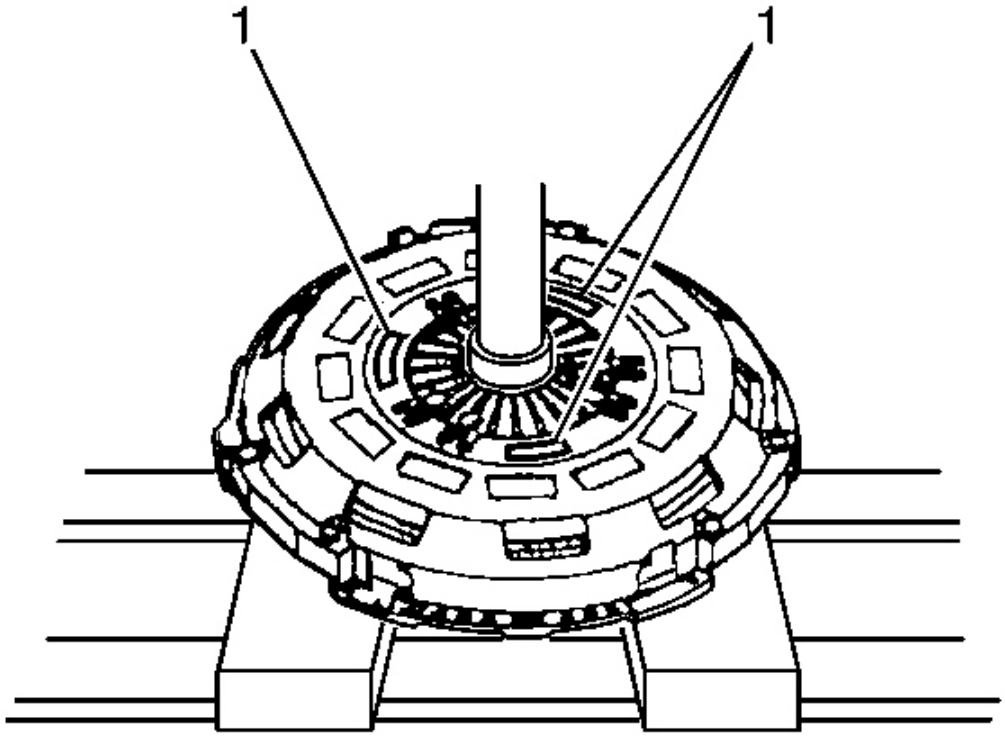


Fig. 53: Clutch Pressure Plate & Ring Tension Spring Stops
Courtesy of GENERAL MOTORS CORP.

1. Place the clutch pressure plate, flat surface down, on a press.
2. Compress the pressure plate diaphragm spring fingers until tension is released from the stepped adjusting ring.
3. Hold 2 screwdrivers or other suitable tools, and place them against 2 of the 3 stepped adjusting ring tension spring stops (1), just ahead of the adjusting ring tension springs.

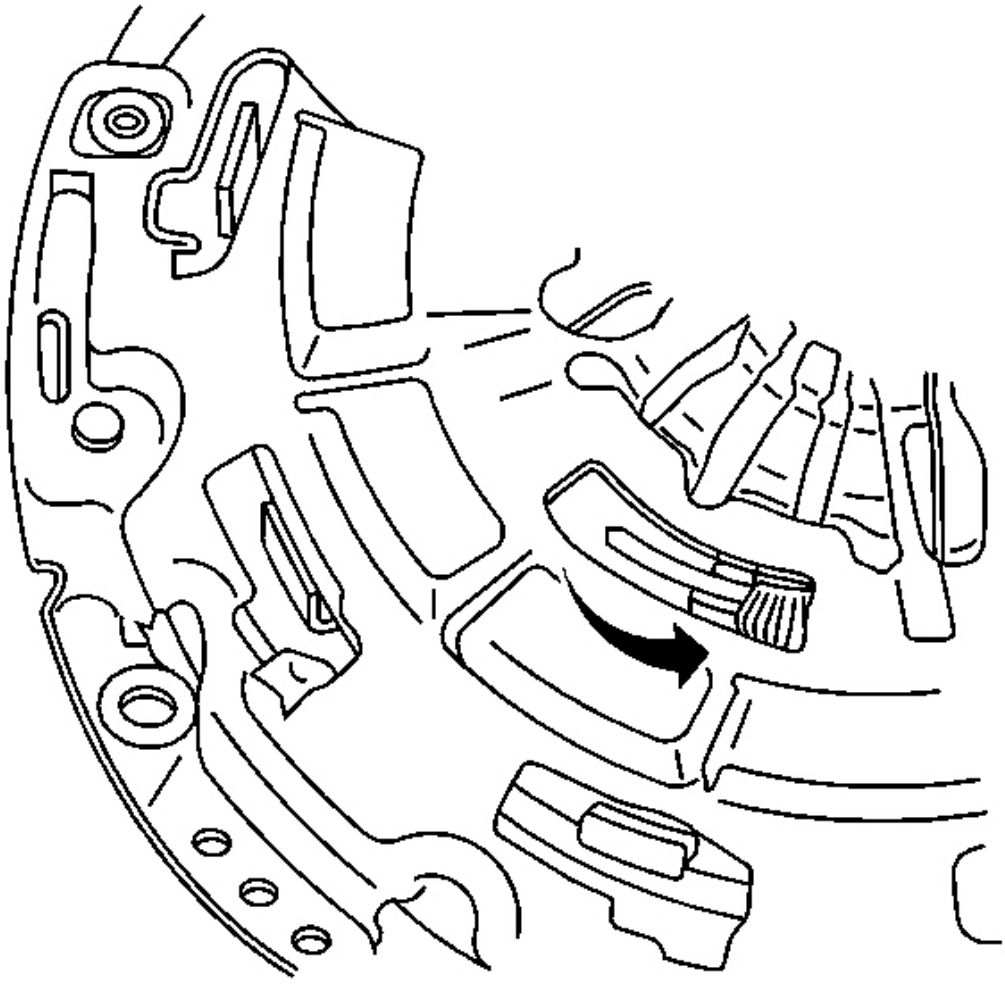


Fig. 54: Rotating The Stepped Adjusting Ring Counterclockwise
Courtesy of GENERAL MOTORS CORP.

4. Using the screwdrivers, rotate the stepped adjusting ring counterclockwise (compressing the tension springs) until the adjusting ring steps are fully adjusted out, then continue to hold in position.
5. Release the press pressure from the pressure plate diaphragm spring fingers.
6. Release the adjusting ring tension spring stops.
7. Remove the pressure plate from the press.

CLUTCH PRESSURE PLATE ADJUSTMENT (ON-VEHICLE)

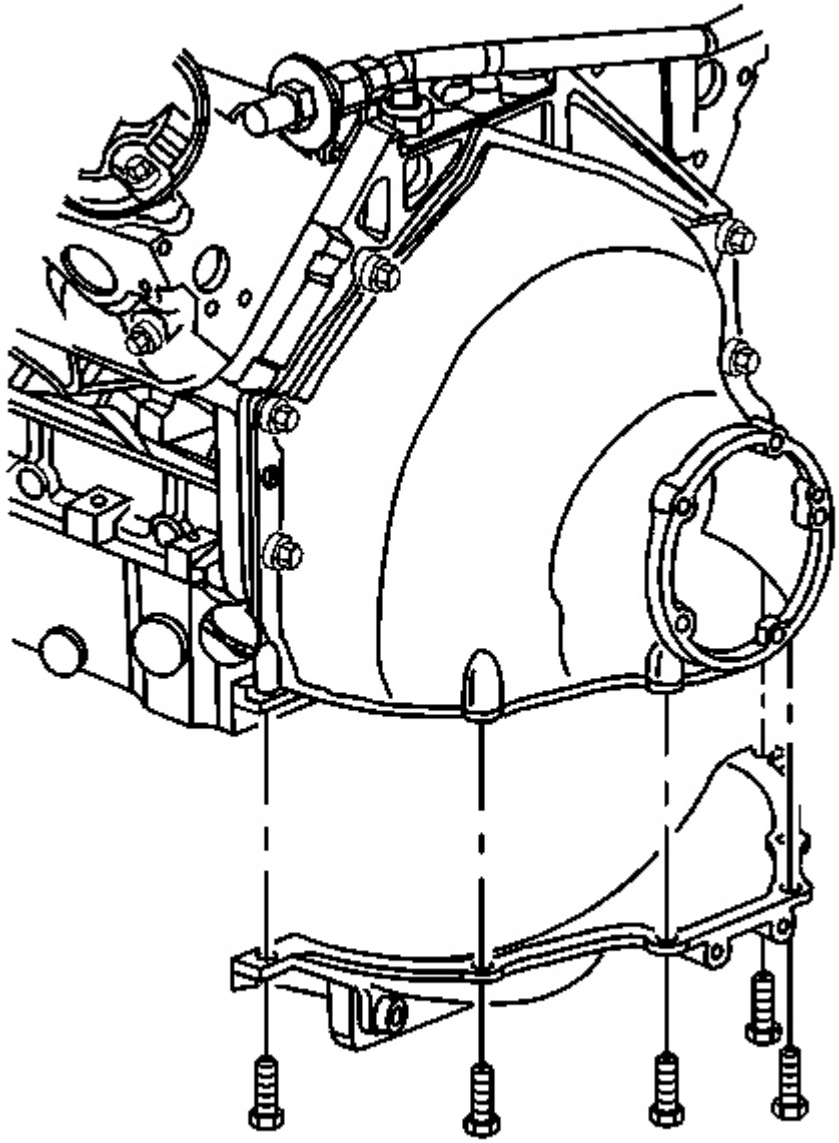


Fig. 55: Engine Flywheel Inspection Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

IMPORTANT: The aid of an assistant will be necessary during this procedure.

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

2. Remove the engine flywheel inspection cover retaining bolts.
3. Remove the engine flywheel inspection cover.

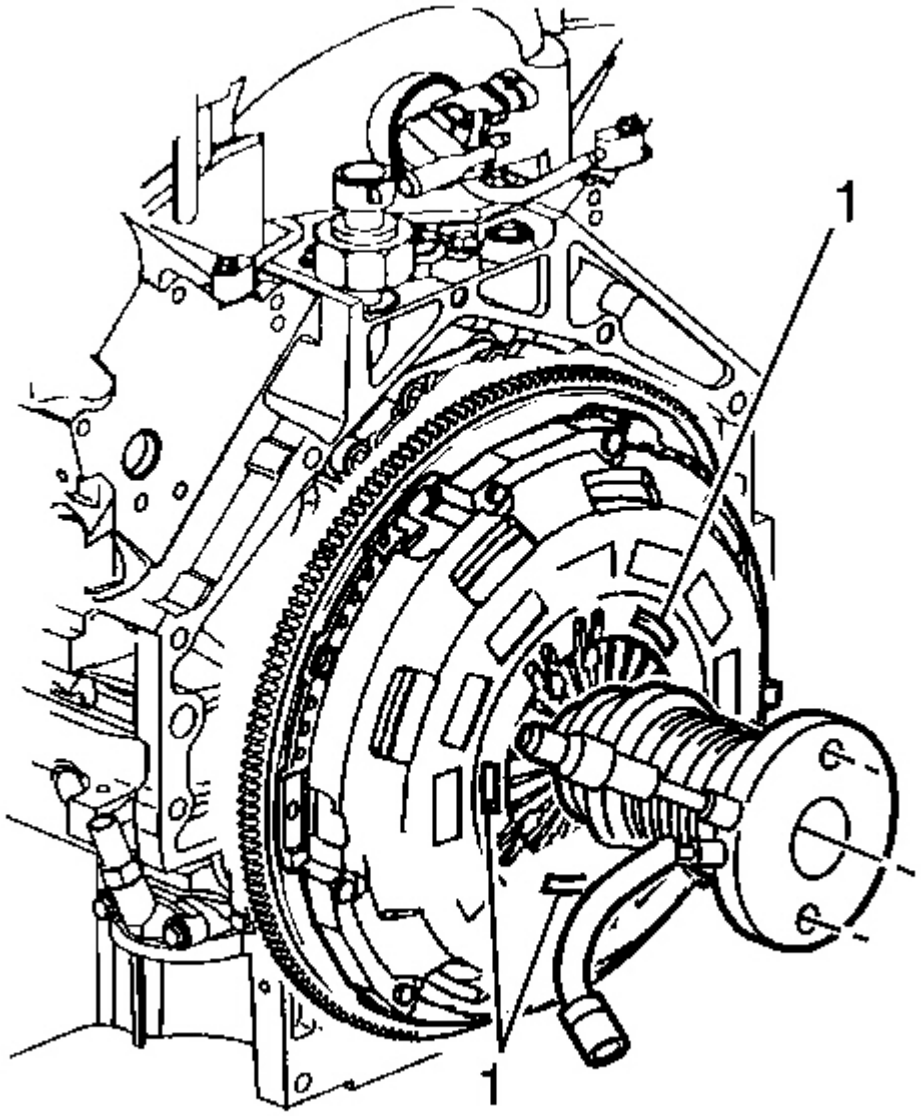


Fig. 56: Adjusting Ring Tension Spring Stops
Courtesy of GENERAL MOTORS CORP.

4. Have an assistant press the clutch pedal until tension is released from the clutch pressure plate stepped

adjusting ring, then continue to hold the pedal.

5. Hold 2 screwdrivers or other suitable tools, and place them against 2 of the 3 stepped adjusting ring tension spring stops (1), just ahead of the adjusting ring tension springs.

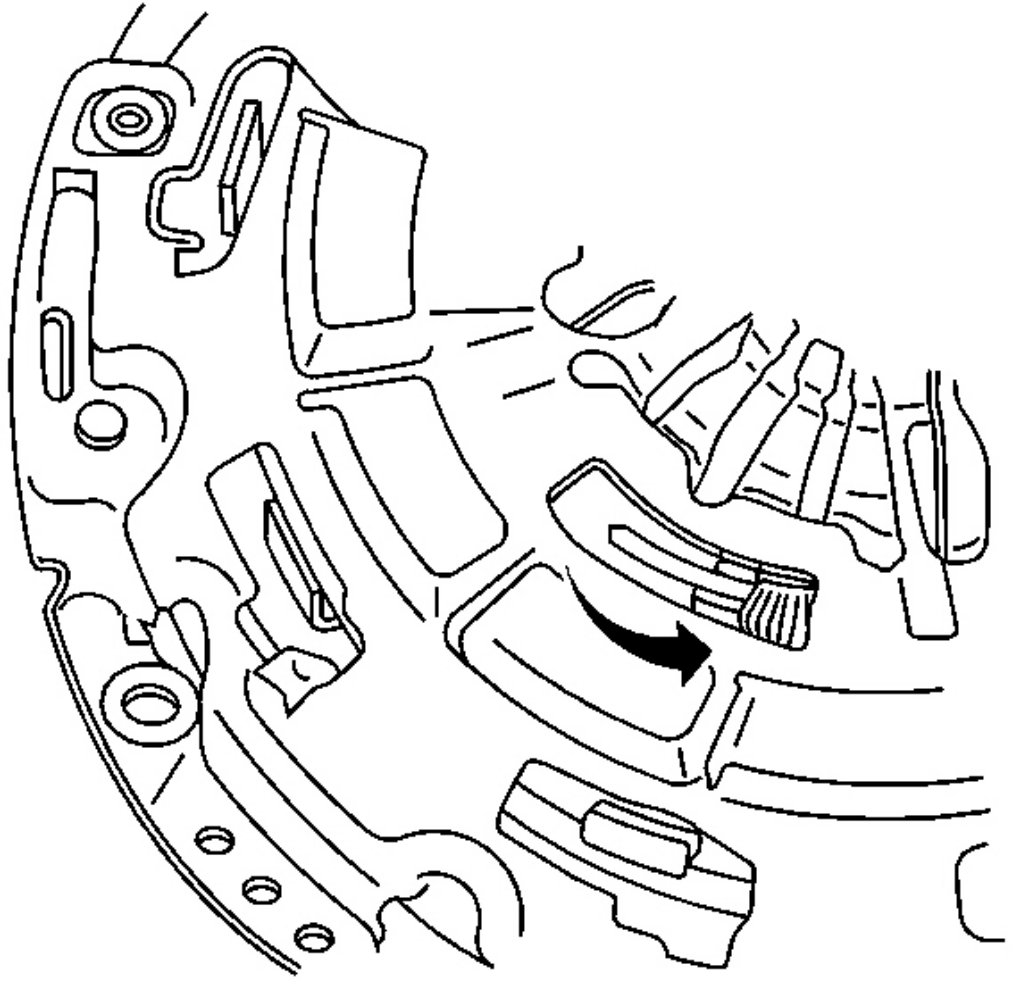


Fig. 57: Rotating The Stepped Adjusting Ring Counterclockwise
Courtesy of GENERAL MOTORS CORP.

6. Use the screwdrivers to rotate the stepped adjusting ring counterclockwise, compressing the tension springs, until the adjusting ring steps are fully adjusted out. Continue to hold in position.
7. Have your assistant release the clutch pedal.
8. Release the adjusting ring tension spring stops.

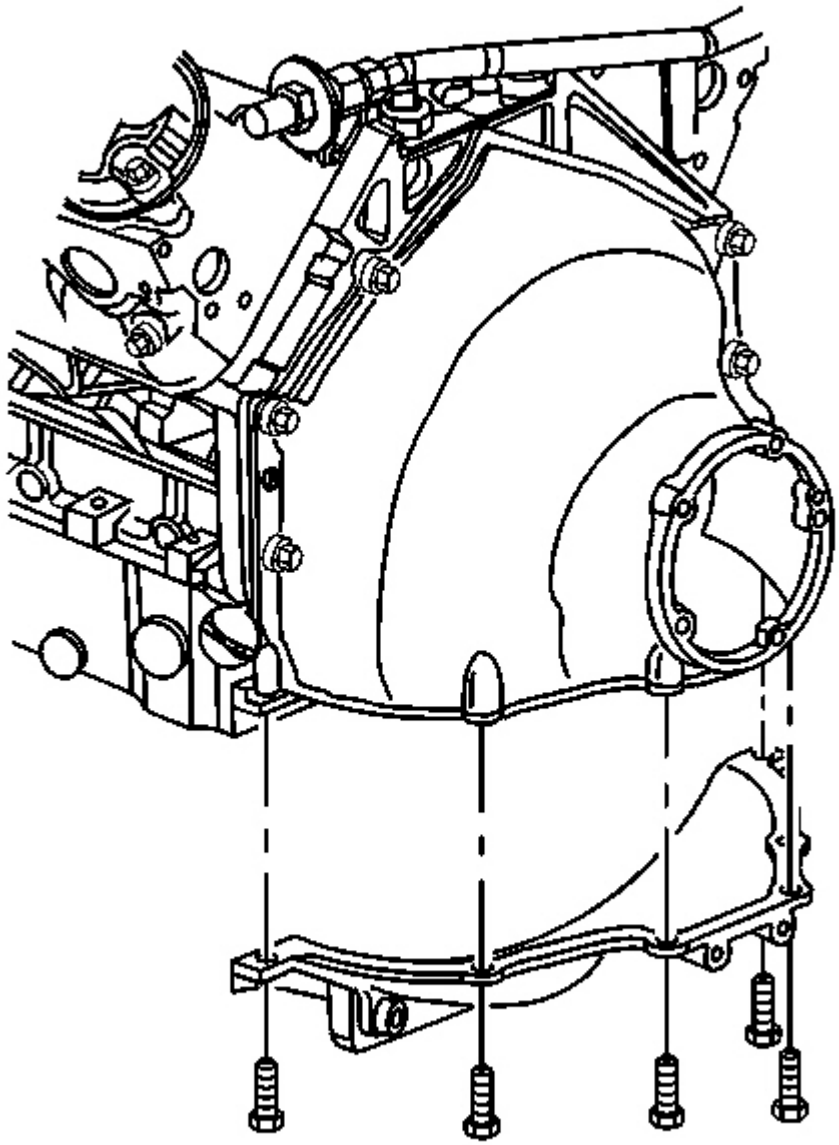


Fig. 58: Engine Flywheel Inspection Cover & Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

9. Install the engine flywheel inspection cover.

NOTE: Refer to Fastener Notice in Cautions and Notices.

10. Install the engine flywheel inspection cover retaining bolts.

    Tighten: Tighten the engine flywheel inspection cover retaining bolts to 25 N.m (18 lb ft).

11. Lower the vehicle.

DESCRIPTION AND OPERATION

CLUTCH SYSTEM DESCRIPTION AND OPERATION

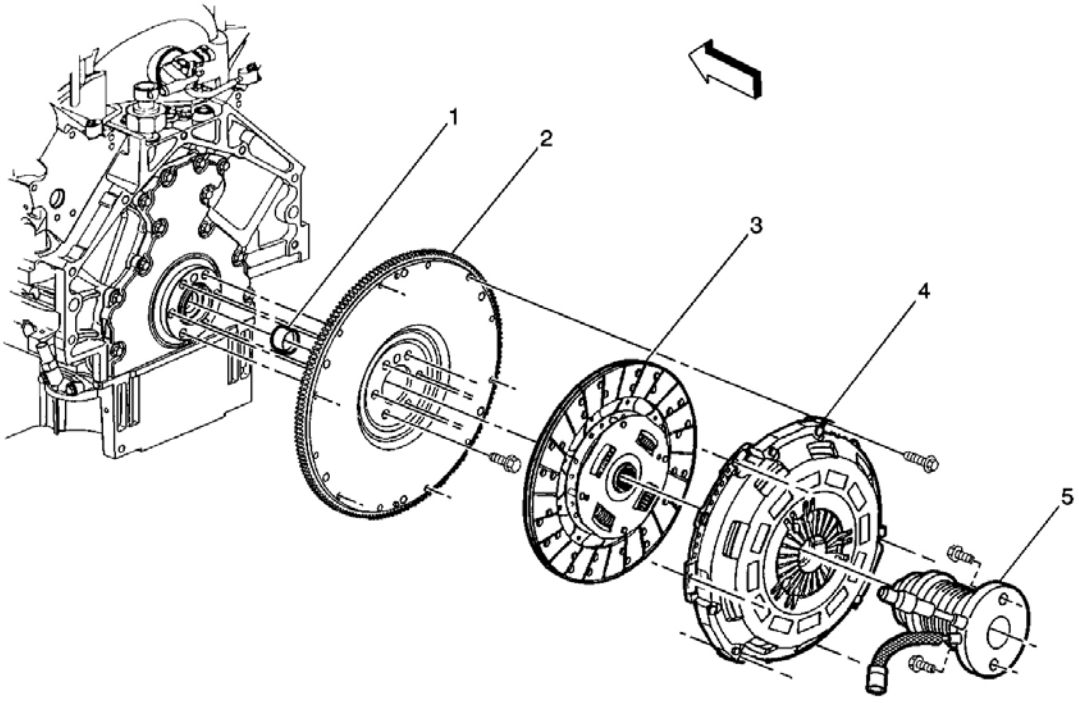


Fig. 59: Clutch System Description
Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 59

Callout	Component Name
1	Clutch Pilot Bearing
2	Engine Flywheel
3	Clutch Driven Plate
4	Clutch Pressure Plate
5	Clutch Actuator Cylinder

The following are the principal components of the clutch system:

- The driving members; attached to the engine and turning with the engine.
- The driven member; attached to the driveline and transmission and turning with the driveline and transmission.
- The operating members; including the spring, the clutch hydraulic system, and the clutch pedal linkages, required to apply and release the pressure, which holds the driving and driven members in contact with each other.

Clutch Driving Members

The clutch driving members consist of two, flat surfaced, iron plates, machined to a smooth finish. One of these surfaces is the rear face of the engine flywheel and the other is a comparatively heavy flat ring, with one side machined, known as the clutch pressure plate.

Clutch Driven Members

The driven member (clutch disc) has a splined hub that freely slides lengthwise along the splines of the input shaft, which also drives the shaft through these same splines. Suitable friction facings are attached to each side of the plate by rivets.

In order to make the clutch engagement as smooth as possible and eliminate chatter; the steel segments driving the splined hub are slightly waved, which causes the contact pressure on the facings to rise gradually as the waved springs flatten out.

Clutch Operating Members

The driving member and the driven member are held in contact by spring pressure. This pressure is exerted by a one-piece conical or diaphragm spring.

A diaphragm spring is a conical piece of spring steel that has been specially stamped to give it greater flexibility. The diaphragm is positioned between the cover and the pressure plate so that the diaphragm spring is nearly flat when the clutch is in the engaged position. The action of this type of spring is similar to that of an ordinary oil can.

The pressure of the inner rim of the spring on the pressure plate decreases as the flat position is passed. The inner rim of the diaphragm bears on the pressure plate and is pivoted on a ring on the outer edge of the pressure plate. The application of a pulling load on the inner section of the pressure plate will cause the inner rim to move away from the flywheel and allow the pressure plate to move away from the clutch disc, thereby releasing or disengaging the clutch. When the pressure is released from the inner section, the OIL CAN action of the diaphragm causes the inner section to move in, and the movement of the inner rim forces the pressure plate against the clutch disc, thus engaging the clutch.

The clutch release bearing is moved by the actuator assembly to move the release levers which move the pressure plate to the rear, thus separating the clutch disc from the flywheel when the clutch pedal is depressed by the driver. A piston return spring in the actuator cylinder preloads the clutch linkage and assures a small load on the release bearing with the actuator assembly at all times. As the clutch disc wears, the diaphragm spring fingers move forward forcing the release bearing, actuator assembly, and pushrod to move. This movement

forces the actuator cylinder piston to move forward in its bore, consuming hydraulic fluid from the master cylinder reservoir, thereby providing the SELF-ADJUSTING feature of the hydraulic clutch linkage system.

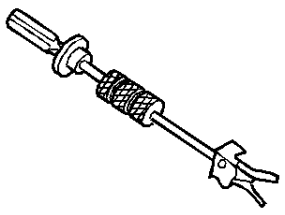
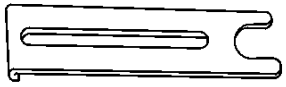
Hydraulic Clutch Description

The clutch hydraulic system consists of a master cylinder and an actuator cylinder. When pressure is applied to the clutch pedal (pedal depressed), the pushrod contacts the plunger and pushes it down the bore of the master cylinder. In the first 0.8 mm (0.031 in) of movement, the recuperation seal closes the port to the fluid reservoir tank, and as the plunger continues to move down the bore of the cylinder, the fluid is forced through the outlet line to the actuator cylinder mounted to the driveline support assembly. As fluid is pushed down the pipe from the master cylinder, this in turn forces the piston in the actuator cylinder outward. As the actuator cylinder piston moves forward, it forces the release bearing to disengage the clutch pressure plate from the clutch disc. On the return stroke (pedal released), the plunger moves back as a result of the return pressure of the clutch. Fluid returns to the master cylinder and the final movement of the plunger opens the port to the fluid reservoir, allowing an unrestricted flow of fluid between system and reservoir. Some systems may have a clutch pedal hold down assist spring. Its purpose is to keep the clutch pedal depressed. This reduces driver fatigue during stop and go traffic.

SPECIAL TOOLS AND EQUIPMENT

SPECIAL TOOLS

Special Tools

Illustration	Tool Number/ Description
	J 23907 Clutch Pilot Bearing Remover
	J 36221 Hydraulic Clutch Line Separator
	J 38836 Pilot Bushing Installer/Clutch Alignment Arbor