

## TRANSMISSION

### Clutch - Corvette

## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATIONS

#### Fastener Tightening Specifications

| Application                                           | Specification |           |
|-------------------------------------------------------|---------------|-----------|
|                                                       | Metric        | English   |
| Clutch Actuator Cylinder Mounting Bolts               | 12            | 106 lb in |
| Clutch Pedal Bracket Mounting Nuts                    | 27            | 20 lb ft  |
| Clutch Pedal Nut                                      | 50            | 37 lb ft  |
| Clutch Pressure Plate Bolts <sup>1</sup>              | 70            | 52 lb ft  |
| Cruise Control Release Switch Bracket Retaining Bolts | 12            | 106 lb in |
| Driver Foot Rest Bracket Retaining Bolt               | 8             | 71 lb in  |
| Driver Foot Rest Bracket Retaining Nut                | 10            | 89 lb in  |
| Engine Flywheel Inspection Cover Retaining Bolts      | 25            | 18 lb ft  |
| Negative Battery Cable Bolt                           | 15            | 11 lb ft  |

<sup>1</sup> 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.

### ADHESIVES, FLUIDS, LUBRICANTS AND SEALERS

#### Adhesives, Fluids, Lubricants and Sealers

| Application                   | Type of Material            | GM Part Number                             |
|-------------------------------|-----------------------------|--------------------------------------------|
| Clutch Hydraulic System Fluid | DOT 4 Hydraulic Brake Fluid | GM P/N 88958860<br>(Canadian P/N 88901244) |
| Clutch Pedal Bushing          | Lubricant                   | GM P/N 12377985<br>(Canadian P/N 88901242) |
| Clutch Pressure Plate Bolts   | Sealant                     | Red LOCTITE™ 242                           |

## DIAGNOSTIC INFORMATION AND PROCEDURES

### 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**.

- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Visually inspect the clutch master cylinder reservoir for the correct fluid level. Do not open.
- 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.
- Inspect the clutch pedal for binding, over-center spring in use or operation.

#### Intermittent

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

#### Symptom List

**NOTE:** 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, Hesitates on Return
- Clutch Pedal Hard to Push
- Clutch Frequent Adjustments
- Clutch Vibration
- Clutch - No Load

#### 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.<br>Review the <b><u>Symptoms - Clutch</u></b> and perform the necessary inspections. |        |

|                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pedal blocked from full travel                           | <ol style="list-style-type: none"> <li>1. Inspect for obstacles that will prevent the pedal from going to the floor.</li> <li>2. Clear any obstacles from under the pedal area, such as floor mats or interior panels.</li> </ol>                                                                                                                                                                                                  |
| Too much travel between pedal and clutch master cylinder | <ol style="list-style-type: none"> <li>1. Inspect the pedal for worn bushings.</li> <li>2. Replace the pedal bushings if worn. Refer to <b><u>Clutch Pedal Replacement</u></b>.</li> </ol>                                                                                                                                                                                                                                         |
| Clutch pedal mounting loose                              | <ol style="list-style-type: none"> <li>1. Inspect the clutch pedal mounting bracket for loose or missing fasteners.</li> <li>2. Replace or repair the fasteners. Refer to <b><u>Clutch Pedal Replacement</u></b>.</li> </ol>                                                                                                                                                                                                       |
| Linkage at pedal worn or damaged                         | <ol style="list-style-type: none"> <li>1. Inspect the linkage at the pedal for excessive wear.</li> <li>2. Repair or replace the linkage as required. Refer to <b><u>Clutch Pedal Replacement</u></b>.</li> </ol>                                                                                                                                                                                                                  |
| Clutch master cylinder seized or binding                 | <ol style="list-style-type: none"> <li>1. Inspect the master cylinder for the piston being able to move freely and full range of travel.</li> <li>2. Repair or replace the clutch master cylinder as required. Refer to <b><u>Clutch Master Cylinder Replacement</u></b>.</li> </ol>                                                                                                                                               |
| Air in the clutch hydraulic system                       | Bleed the clutch hydraulic system. Refer to <b><u>Hydraulic Clutch System Bleeding</u></b> .                                                                                                                                                                                                                                                                                                                                       |
| Clutch actuator cylinder seized or binding               | <ol style="list-style-type: none"> <li>1. Inspect the clutch actuator piston for moving freely.</li> <li>2. Replace the clutch actuator cylinder if the piston is binding. Refer to <b><u>Clutch Actuator Cylinder Replacement</u></b>.</li> </ol>                                                                                                                                                                                 |
| Clutch master cylinder leaking internally                | <ol style="list-style-type: none"> <li>1. Inspect for proper pedal reserve. <ol style="list-style-type: none"> <li>1. Let up halfway on pedal.</li> <li>2. Apply the pedal a few times.</li> <li>3. Inspect to ensure there is still the proper pedal reserve.</li> </ol> </li> <li>2. Replace the clutch master cylinder if it will not hold pedal reserve. Refer to <b><u>Clutch Master Cylinder Replacement</u></b>.</li> </ol> |
| Damaged clutch assembly components                       | <ol style="list-style-type: none"> <li>1. Remove the clutch assembly.</li> <li>2. Inspect the following clutch assembly components for damage: <ul style="list-style-type: none"> <li>• Damaged clutch disc hub splines</li> </ul> </li> </ol>                                                                                                                                                                                     |

|                                                                                                    |                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                    | <ul style="list-style-type: none"> <li>• Bent clutch disc</li> <li>• Bent drive straps</li> <li>• Broken or warped pressure plate</li> </ul> <p>3. Replace the clutch assembly if any of the above damage is found. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                       |
| Excessive side loading on the release bearing                                                      | <p>1. Inspect the following clutch system components:</p> <ul style="list-style-type: none"> <li>• Worn or damaged pilot bearing</li> <li>• Excessive flywheel runout</li> <li>• Excessive engine to transmission misalignment</li> </ul> <p>2. Repair or replace any faulty components.</p>      |
| Faulty pilot bearing                                                                               | Replace the pilot bearing. Refer to <b><u>Clutch Pilot Bearing Replacement</u></b> .                                                                                                                                                                                                              |
| Transmission input shaft splines worn or damaged                                                   | Replace the transmission input shaft. Refer to <b><u>Transmission Disassemble</u></b> .                                                                                                                                                                                                           |
| Tight or contaminated clutch disc splines                                                          | <p>1. Clean the clutch disc and input shaft splines.</p> <p>2. If the clutch disc will not clean, replace the clutch assembly. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                                                                                                            |
| Flywheel housing, engine block to clutch housing or transmission front case excessively misaligned | <p>1. Inspect the clutch housing or the transmission front case for being faulty.</p> <p>2. Replace the clutch housing if it is faulty. Refer to <b><u>Transmission Replacement</u></b>.</p> <p>3. Replace the transmission front case half. Refer to <b><u>Transmission Disassemble</u></b>.</p> |
| Grease or oil contamination on the clutch discs facing                                             | <p>1. Repair the oil leak.</p> <p>2. Repair the grease leak.</p> <p>3. Clean the clutch disc facing and the other clutch assembly components.</p> <p>4. Replace the clutch assembly if it will not clean. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                                 |

## 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 pedal position switch. Refer to <b>Clutch Pedal Position Sensor Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| The clutch pedal return spring is broken or missing                              | Replace the clutch pedal return spring, if equipped. Refer to <b>Clutch Pedal Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| The clutch pedal is binding or sticking                                          | <ol style="list-style-type: none"><li>1. Clear away any items that may be contacting the pedal.</li><li>2. Inspect the pedal bushings for ease of movement.</li><li>3. Replace the clutch pedal if it is faulty. Refer to <b>Clutch Pedal Replacement</b>.</li></ol>                                                                                                                                                                                                                                                                                            |
| Clutch master cylinder binding or seized                                         | Replace the clutch master cylinder. Refer to <b>Clutch Master Cylinder Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Clutch actuator cylinder binding or seized                                       | Replace the clutch actuator cylinder. Refer to <b>Clutch Actuator Cylinder Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Kinked or damaged clutch hydraulic hose                                          | <ol style="list-style-type: none"><li>1. Inspect for the correct routing of the clutch hydraulic hose.</li><li>2. Route the hose properly.</li><li>3. Inspect for loose or faulty engine mounts that may allow the hydraulic hose to be kinked or pinched.</li><li>4. Repair or replace faulty engine mounts. Refer to <b>Engine Mount Replacement - Left Side</b> and <b>Engine Mount Replacement - Right Side</b>.</li><li>5. Repair or replace the clutch hydraulic hose if it is damaged. Refer to <b>Hydraulic Clutch Hose/Pipe Replacement</b>.</li></ol> |
| Grease or oil contamination of the clutch disc                                   | <ol style="list-style-type: none"><li>1. Repair the source of the oil leak.</li><li>2. Repair the source of the grease leak.</li><li>3. Clean the contamination from the clutch components.</li><li>4. If contaminants cannot be removed, replace the clutch assembly. Refer to <b>Clutch Assembly Replacement</b>.</li></ol>                                                                                                                                                                                                                                   |
| Worn or damaged flywheel                                                         | Replace the engine flywheel. Refer to <b>Engine Flywheel Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Worn clutch disc facing                                                          | Replace the clutch assembly. Refer to <b>Clutch Assembly Replacement</b> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Burnt or glazed clutch discs                                                     | Replace the clutch assembly. Refer to <b>Clutch</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                      |                                                                                                                                                                                                              |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | <b><u>Assembly Replacement.</u></b>                                                                                                                                                                          |
| Input shaft splines worn             | Replace the input shaft. Refer to <b><u>Transmission Disassemble</u></b> .                                                                                                                                   |
| 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 <b><u>Engine Flywheel Replacement</u></b> . |

## CLUTCH GRABBING

### Clutch Grabbing

| Cause                                                                                                                                                                                                                                        | Action                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>DEFINITION: The clutch grabs or chatters or the clutch is unable to release without the vehicle jerking. An abrupt engagement of the clutch.</p> <p>Review the <b><u>Symptoms - Clutch</u></b> and perform the necessary inspections.</p> |                                                                                                                                                                                                                                                                                              |
| Grease or oil contamination on the clutch facings                                                                                                                                                                                            | <ol style="list-style-type: none"> <li>1. Repair the cause of the oil leak or grease contamination.</li> <li>2. Clean the clutch facings.</li> <li>3. Replace the clutch components if they will not clean. Refer to <b><u>Clutch Assembly Replacement</u></b>.</li> </ol>                   |
| Loose or faulty engine mounts                                                                                                                                                                                                                | <ol style="list-style-type: none"> <li>1. Inspect the engine mounts for being loose or faulty.</li> <li>2. Repair or replace the engine mounts as required. Refer to <b><u>Engine Mount Replacement - Left Side</u></b> and <b><u>Engine Mount Replacement - Right Side</u></b> .</li> </ol> |
| Clutch pedal sticking                                                                                                                                                                                                                        | <ol style="list-style-type: none"> <li>1. Inspect the clutch pedal for correct operation.</li> <li>2. Replace the clutch pedal if it is faulty. Refer to <b><u>Clutch Pedal Replacement</u></b>.</li> </ol>                                                                                  |
| Clutch actuator binding                                                                                                                                                                                                                      | <ol style="list-style-type: none"> <li>1. Inspect the clutch actuator for the piston seals binding or sticking on the hub.</li> <li>2. Replace the clutch actuator if it is binding. Refer to <b><u>Clutch Actuator Cylinder Replacement</u></b>.</li> </ol>                                 |
| Clutch master cylinder binding                                                                                                                                                                                                               | <ol style="list-style-type: none"> <li>1. Inspect the clutch master cylinder for the piston binding or sticking in the cylinder.</li> <li>2. Replace the master cylinder if it is faulty. Refer to <b><u>Clutch Master Cylinder Replacement</u></b>.</li> </ol>                              |
| Warped Clutch Cover                                                                                                                                                                                                                          | <ol style="list-style-type: none"> <li>1. Inspect the clutch cover for distortion</li> </ol>                                                                                                                                                                                                 |

|                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                        | <p>caused by improperly tightening the clutch cover bolts.</p> <p>2. Replace the clutch cover if it is distorted. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                                                                                                                                                                                                                                                                                                                                |
| Improper clutch installation           | <p>1. Inspect the pressure plate for distortion caused by improperly tightening the pressure plate bolts.</p> <p>2. Inspect the clutch disc for a bent hub caused by forcing the installation of the transmission.</p> <p>3. Inspect for the correct clutch disc.</p> <p>4. Inspect the clutch disc for being installed backwards.</p> <p>5. Replace the clutch assembly if it is damaged or the wrong components were installed. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                |
| Clutch disc binding on the input shaft | <p>1. Inspect the input shaft for rust dirt or debris.</p> <p>2. Clean and lubricate the input shaft.</p> <p>3. Inspect the clutch disc for a bent hub.</p> <p>4. Replace the clutch assembly if the clutch disc is faulty. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p> <p>5. Inspect the input shaft for excessive wear on the splines, causing the clutch disc to bind.</p> <p>6. Replace the transmission input shaft if it is worn. Refer to <b><u>Transmission Disassemble</u></b>.</p> |
| Clutch pressure plate damaged          | <p>1. Inspect the pressure plate for bent drive straps caused by improper vehicle use.</p> <p>2. Replace the clutch assembly if the clutch pressure plate is damaged. Inform the customer. Refer to <b><u>Clutch Assembly Replacement</u></b>.</p>                                                                                                                                                                                                                                                       |
| Flywheel improperly machined           | <p>1. Inspect the flywheel for being machined and causing interference with the clutch disc.</p> <p>2. Replace the flywheel if it has been machined. Refer to <b><u>Engine Flywheel Replacement</u></b>.</p>                                                                                                                                                                                                                                                                                             |
| Flywheel uneven                        | <p>1. Inspect the flywheel surface for being</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

warped or uneven.

2. Replace the flywheel if it is faulty. Refer to **Engine Flywheel Replacement** .

## CLUTCH RATTLE

### Clutch Rattle

| Cause                                                                                                                                                                                    | Action                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEFINITION: A rattle noise coming from the clutch components with the clutch disengaged or engaged.<br>Review the <b><u>Symptoms - Clutch</u></b> and perform the necessary inspections. |                                                                                                                                                                                                                                                                                                                                                 |
| Idle rattle clutch engaged                                                                                                                                                               | Replace the clutch disc, due to faulty damper springs. Refer to <b><u>Clutch Assembly Replacement</u></b> .                                                                                                                                                                                                                                     |
| Clutch is improperly installed                                                                                                                                                           | Remove the clutch and install it correctly. Refer to <b><u>Clutch Assembly Replacement</u></b> .                                                                                                                                                                                                                                                |
| Clutch disc damper worn or damaged                                                                                                                                                       | <ol style="list-style-type: none"><li>1. Inspect the clutch disc for a broken or worn damper.</li><li>2. Replace the clutch assembly. Refer to <b><u>Clutch Assembly Replacement</u></b>.</li></ol>                                                                                                                                             |
| Clutch disc splines and input shaft splines worn                                                                                                                                         | <ol style="list-style-type: none"><li>1. Inspect the clutch disc hub to input shaft splines for excessive clearance.</li><li>2. Replace the clutch assembly if the clutch splines are worn. Refer to <b><u>Clutch Assembly Replacement</u></b>.</li><li>3. Replace the input shaft. Refer to <b><u>Transmission Disassemble</u></b> .</li></ol> |

## CLUTCH NOISY

### Clutch Noisy

| Cause                                                                                                                                                                         | Action                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| DEFINITION: A growl or whine noise is coming from the clutch when engaged or disengaged.<br>Review the <b><u>Symptoms - Clutch</u></b> and perform the necessary inspections. |                                                                                            |
| Pilot bearing is worn or damaged                                                                                                                                              | Replace the pilot bearing. Refer to <b><u>Clutch Pilot Bearing Replacement</u></b> .       |
| Release bearing damaged or worn                                                                                                                                               | Replace the release bearing. Refer to <b><u>Clutch Actuator Cylinder Replacement</u></b> . |

## CLUTCH PEDAL SPONGY, LOW PEDAL EFFORT, HESITATES ON RETURN

### Clutch Pedal Spongy, Low Pedal Effort, Hesitates on Return

| Cause | Action |
|-------|--------|
|-------|--------|

DEFINITION: The clutch pedal may feel spongy or it requires very little effort to operate. The clutch pedal may temporarily hang up at the bottom of travel.

Review **Symptoms - Clutch** and perform the necessary inspections.

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air in the hydraulic system              | Bleed the clutch hydraulic system. Refer to <b><u>Hydraulic Clutch System Bleeding</u></b> .                                                                                                                                                                                                                                                                                                                           |
| Contaminated hydraulic fluid             | <ol style="list-style-type: none"> <li>1. Inspect the clutch hydraulic fluid for contamination of water.</li> <li>2. Inspect the reservoir cap for being faulty if water is present.</li> <li>3. Inspect the clutch hydraulic fluid for dirt or debris.</li> <li>4. Flush and bleed the clutch hydraulic system if the above conditions are found. Refer to <b><u>Hydraulic Clutch System Bleeding</u></b>.</li> </ol> |
| Master cylinder fluid level low          | <ol style="list-style-type: none"> <li>1. Inspect for leakage in the clutch master cylinder, hose connections and the clutch actuator.</li> <li>2. Repair or replace any faulty components.</li> </ol>                                                                                                                                                                                                                 |
| Incomplete pedal return                  | <ol style="list-style-type: none"> <li>1. Inspect the pedal for full return.</li> <li>2. Clear any obstacles that may interfere with the pedal operation.</li> <li>3. Replace the clutch pedal return spring, if equipped. Refer to <b><u>Clutch Pedal Replacement</u></b>.</li> <li>4. Adjust the clutch pedal position switch. Refer to <b><u>Clutch Pedal Position Sensor Replacement</u></b>.</li> </ol>           |
| Clutch incorrectly installed             | Remove the clutch and install it correctly. Refer to <b><u>Clutch Assembly Replacement</u></b> .                                                                                                                                                                                                                                                                                                                       |
| Clutch mounting bolts loose or broken    | <ol style="list-style-type: none"> <li>1. Remove the broken bolts.</li> <li>2. Replace the broken or loose bolts and tighten. Refer to <b><u>Clutch Assembly Replacement</u></b>.</li> </ol>                                                                                                                                                                                                                           |
| Clutch pressure plate not adjusted       | Adjust the clutch pressure plate. Refer to <b><u>Clutch Pressure Plate Adjustment (Tremec 6-Speed)</u></b> .                                                                                                                                                                                                                                                                                                           |
| Clutch actuator cylinder worn or damaged | Replace the clutch actuator cylinder. Refer to <b><u>Clutch Actuator Cylinder Replacement</u></b> .                                                                                                                                                                                                                                                                                                                    |

## CLUTCH PEDAL HARD TO PUSH

### Clutch Pedal Hard to Push

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

## CLUTCH FREQUENT ADJUSTMENTS

### Clutch Frequent Adjustments

| Cause                                                                                                                                               | Action                                                                                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| DEFINITION: The self-adjusting clutch is constantly adjusting.<br>Review the <b><u>Symptoms - Clutch</u></b> and perform the necessary inspections. |                                                                                                                         |
| Excessive clutch slippage                                                                                                                           | Refer to <b><u>Clutch Slipping</u></b> .                                                                                |
| Clutch wearing excessively                                                                                                                          | <ul style="list-style-type: none"> <li>Review the vehicle application.</li> <li>Review the driver practices.</li> </ul> |

## 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 <b>Vibration Analysis - Driveline</b> .                                                                                                                                                                                                                                                                       |
| Clutch incorrectly installed                              | Remove the clutch and install it correctly. Refer to <b>Clutch Assembly Replacement</b> .                                                                                                                                                                                                                                |
| Pilot bearing worn or damaged                             | <ol style="list-style-type: none"> <li>1. Replace the pilot bearing. Refer to <b>Clutch Pilot Bearing Replacement</b>.</li> <li>2. Inspect the input shaft pilot bearing journal for wear or damage.</li> <li>3. Replace the input shaft if it is damaged or worn. Refer to <b>Transmission Disassemble</b> .</li> </ol> |
| Transmission input splines worn or damaged                | <ol style="list-style-type: none"> <li>1. Inspect the clutch disc to input splines for wear or damage.</li> <li>2. Replace the input shaft if the splines are excessively worn. Refer to <b>Transmission Disassemble</b> .</li> </ol>                                                                                    |
| Clutch disc facings damaged                               | Replace the clutch assembly. Refer to <b>Clutch Assembly Replacement</b> .                                                                                                                                                                                                                                               |
| Flywheel housing to clutch housing excessively misaligned | Replace the faulty clutch housing or transmission front case. Refer to <b>Transmission Disassemble</b> .                                                                                                                                                                                                                 |
| Clutch out of balance                                     | Replace the clutch assembly. Refer to <b>Clutch Assembly Replacement</b> .                                                                                                                                                                                                                                               |

## CLUTCH - NO LOAD

### Clutch - No Load

| Cause                                                                                                                                                                                                                                                                     | Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEFINITION: Regardless of ambient temperature and vehicle on/off operational status, the clutch pedal effort is zero/light in both up-stroke and down-stroke and the clutch will not disengage.<br>Review <b>Symptoms - Clutch</b> and perform the necessary inspections. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Internal damage to the clutch master cylinder and the hydraulic system                                                                                                                                                                                                    | <ol style="list-style-type: none"> <li>1. Inspect for fluid leaks.</li> <li>2. Replace the clutch hydraulic system. Refer to <b>Clutch Master Cylinder Replacement</b> and <b>Hydraulic Clutch Hose/Pipe Replacement</b>.</li> <li>3. Replace the clutch master cylinder and the clutch actuator cylinder (CSC). Refer to <b>Clutch Master Cylinder Replacement</b> and <b>Clutch Actuator Cylinder Replacement</b>.</li> <li>4. Re-bleed the clutch hydraulic system. Refer</li> </ol> |

## REPAIR INSTRUCTIONS

### CLUTCH PEDAL REPLACEMENT

#### Removal Procedure

1. Remove the clutch master cylinder from the vehicle. Refer to Clutch Master Cylinder Replacement.
2. Disconnect the clutch pedal position sensor electrical connector.
3. Remove the steering column bracket. Refer to Steering Column Bracket Replacement .

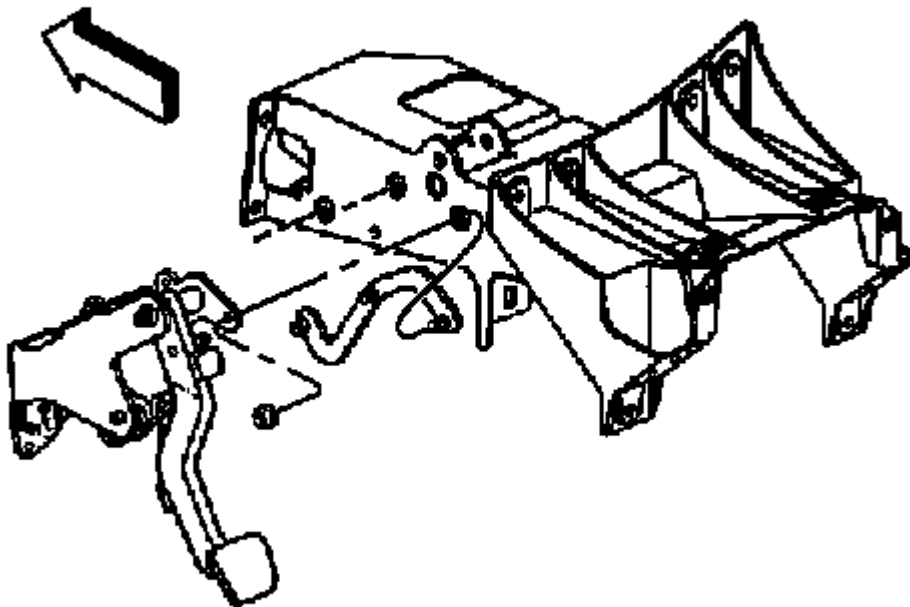


**Fig. 1: Clutch Pedal Bracket & Steering Column Bracket**  
**Courtesy of GENERAL MOTORS COMPANY**

4. Remove the clutch pedal bracket mounting nuts.
5. Remove the clutch pedal bracket stud anchor plate.
6. Remove the clutch pedal assembly from the steering column bracket.

## Installation Procedure

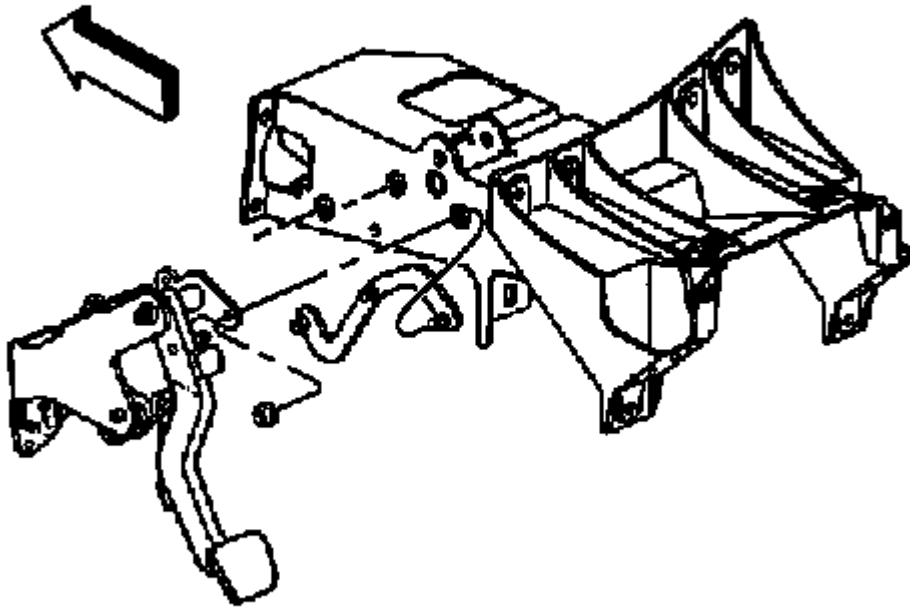


**Fig. 2: Clutch Pedal Bracket & Steering Column Bracket**  
Courtesy of GENERAL MOTORS COMPANY

1. Install the clutch pedal assembly to the steering column bracket.
2. Install the clutch pedal bracket mounting nuts and tighten to 27 (20 lb ft).
3. Install the steering column bracket. Refer to **Steering Column Bracket Replacement** .
4. Install the clutch master cylinder. Refer to **Clutch Master Cylinder Replacement**.
5. Connect the clutch pedal position sensor electrical connector.
6. Perform the clutch pedal position sensor learn procedure. Refer to **Control Module References** .

## CLUTCH MASTER CYLINDER REPLACEMENT

### Removal Procedure

1. Remove the left instrument panel (I/P) lower insulator panel. Refer to **Instrument Panel Insulator Panel Replacement - Left Side** .

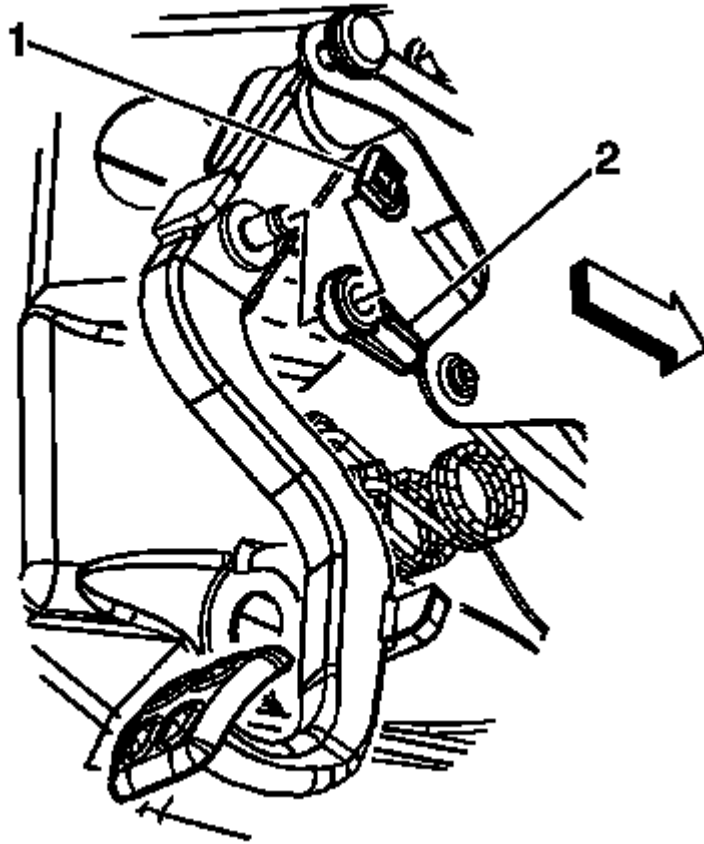


**Fig. 3: Clutch Master Cylinder Rod & Retainer**  
Courtesy of GENERAL MOTORS COMPANY

2. Remove the clutch master cylinder rod retainer (1).
3. Remove the clutch master cylinder rod (2) from the clutch pedal.
4. Remove the windshield washer solvent container. Refer to **Windshield Washer Solvent Container Replacement** .

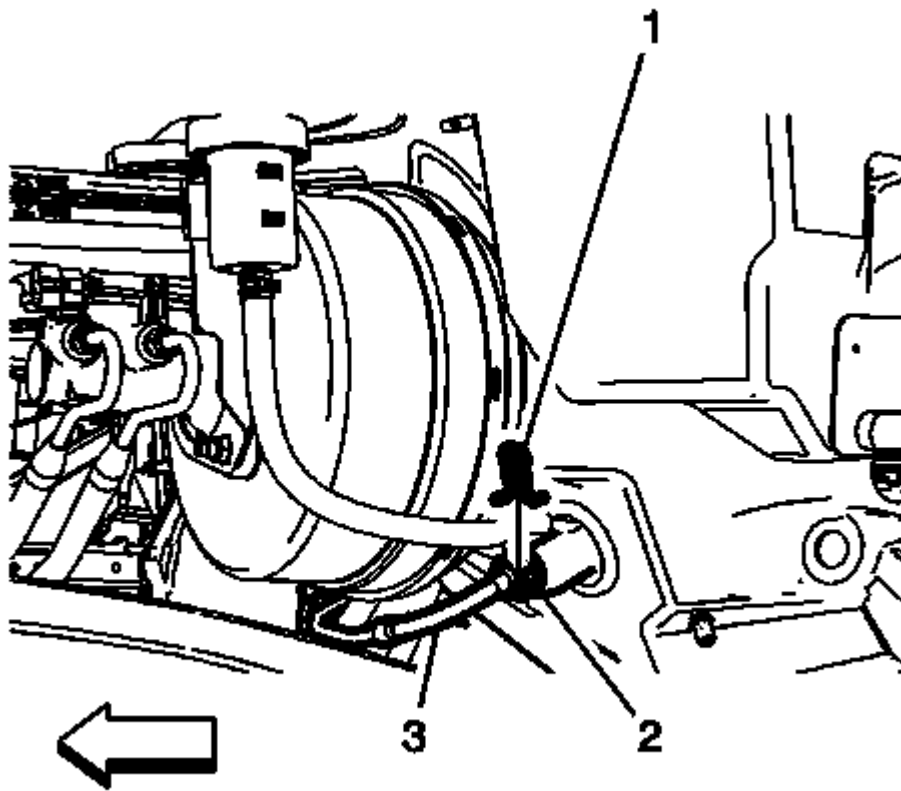


**Fig. 4: Clutch Pipe Connection Retaining Clip**  
**Courtesy of GENERAL MOTORS COMPANY**

- 5.
6. Remove the clutch pipe connection retaining clip (1).
7. Separate the clutch hose (3) from the clutch master cylinder (2).
8. Protect both pipe end from dirt and damage.

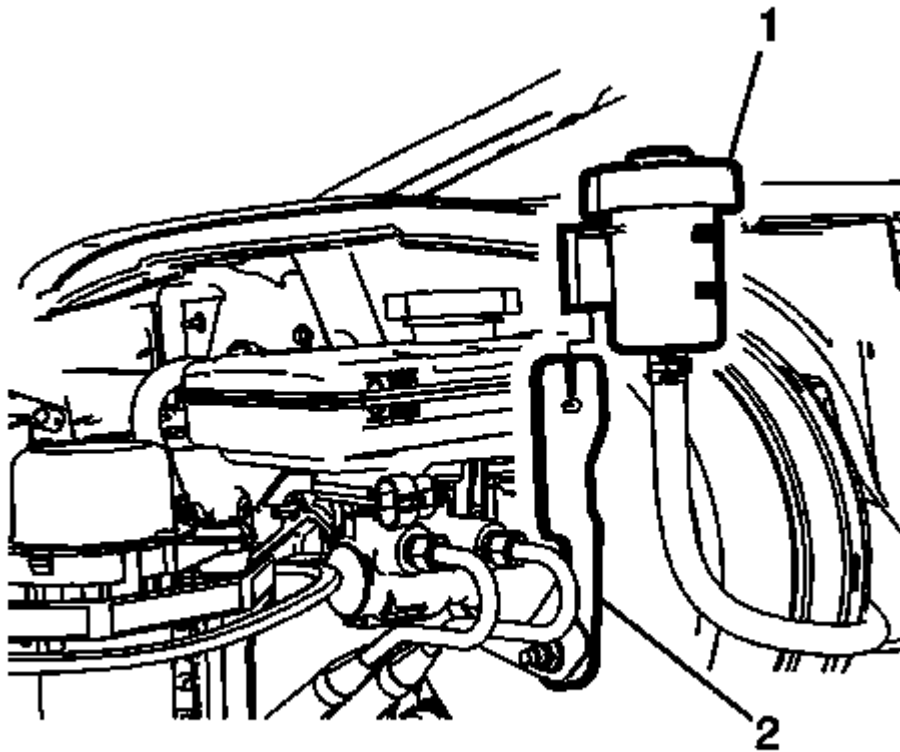


**Fig. 5: Clutch Master Cylinder Reservoir**  
**Courtesy of GENERAL MOTORS COMPANY**

9. Remove the clutch master cylinder reservoir (1) from the reservoir bracket (2).

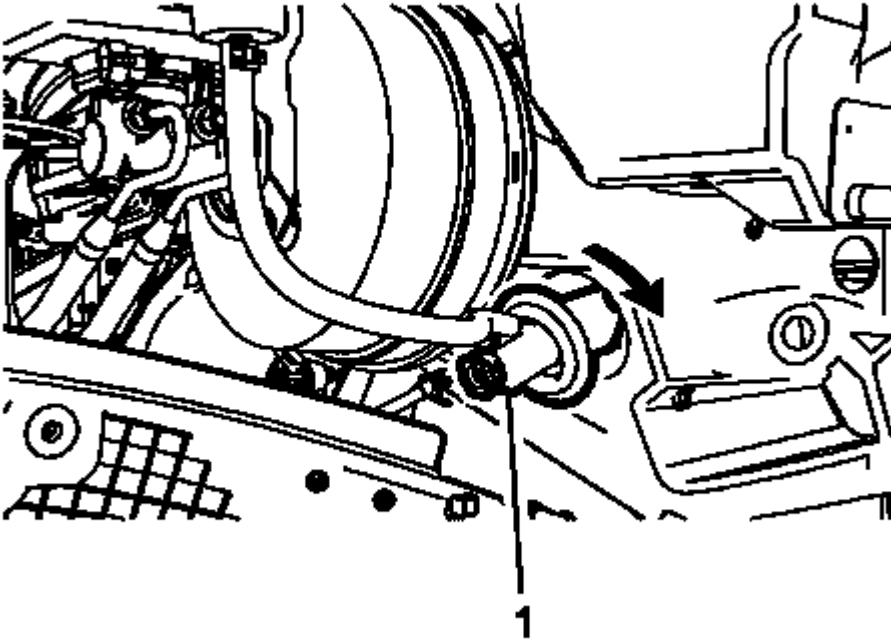


**Fig. 6: Clutch Master Cylinder**  
**Courtesy of GENERAL MOTORS COMPANY**

10. Rotate the clutch master cylinder (1) clockwise 45 degrees.
11. Release the clutch master cylinder (1) from the dash panel.
12. Remove the clutch master cylinder (1) and reservoir from the vehicle.

**Installation Procedure**

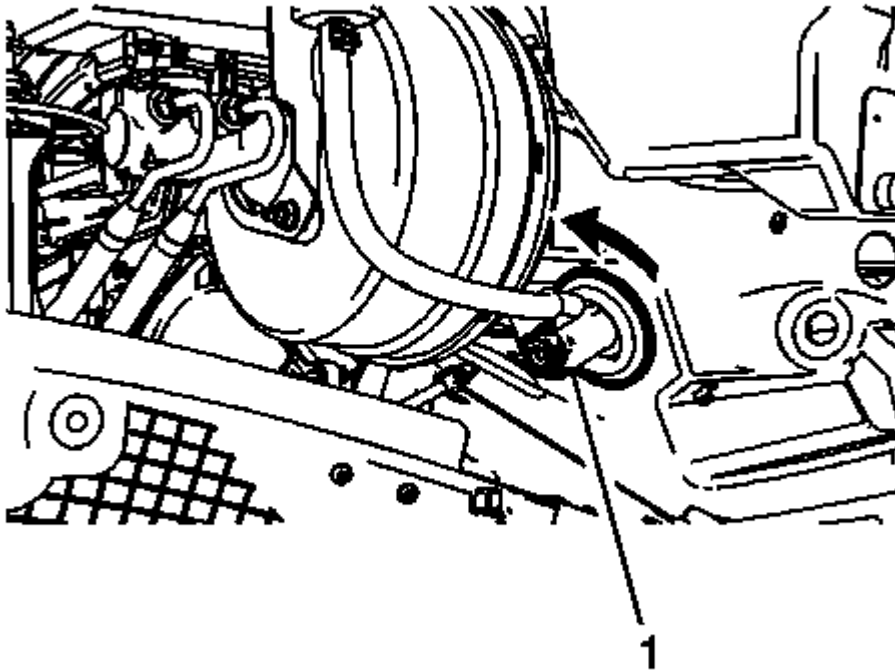


**Fig. 7: Clutch Master Cylinder**

**Courtesy of GENERAL MOTORS COMPANY**

1. Install the clutch master cylinder (1) and the reservoir into position.
2. Install the clutch master cylinder (1) 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.

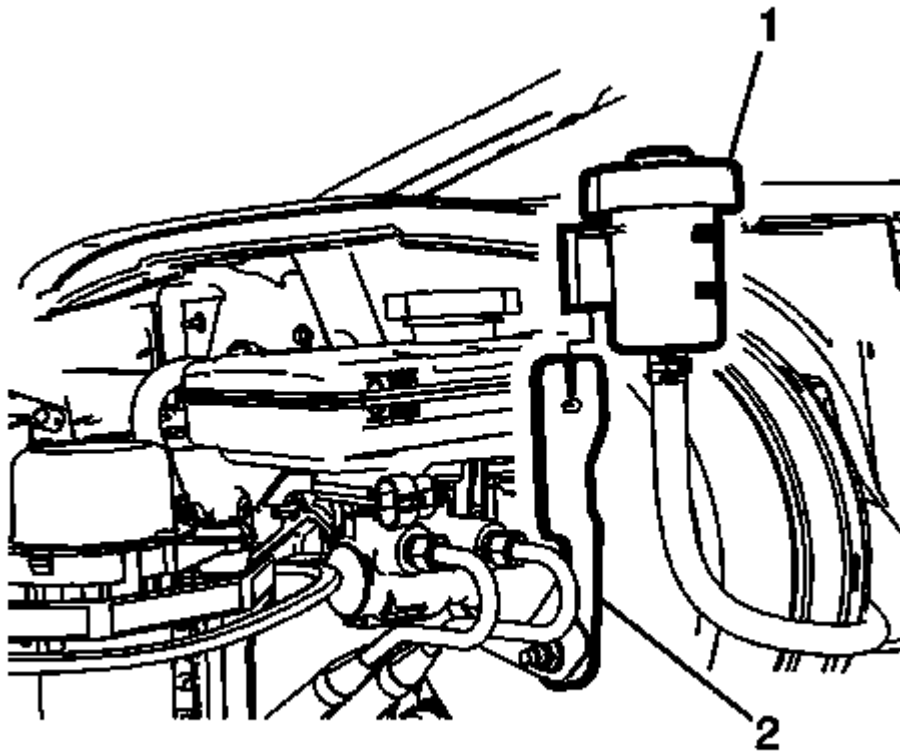


**Fig. 8: Clutch Master Cylinder Reservoir**  
Courtesy of GENERAL MOTORS COMPANY

3. Install the clutch master cylinder reservoir (1) to the reservoir bracket (2).
4. Install the windshield washer solvent container. Refer to **Windshield Washer Solvent Container Replacement** .

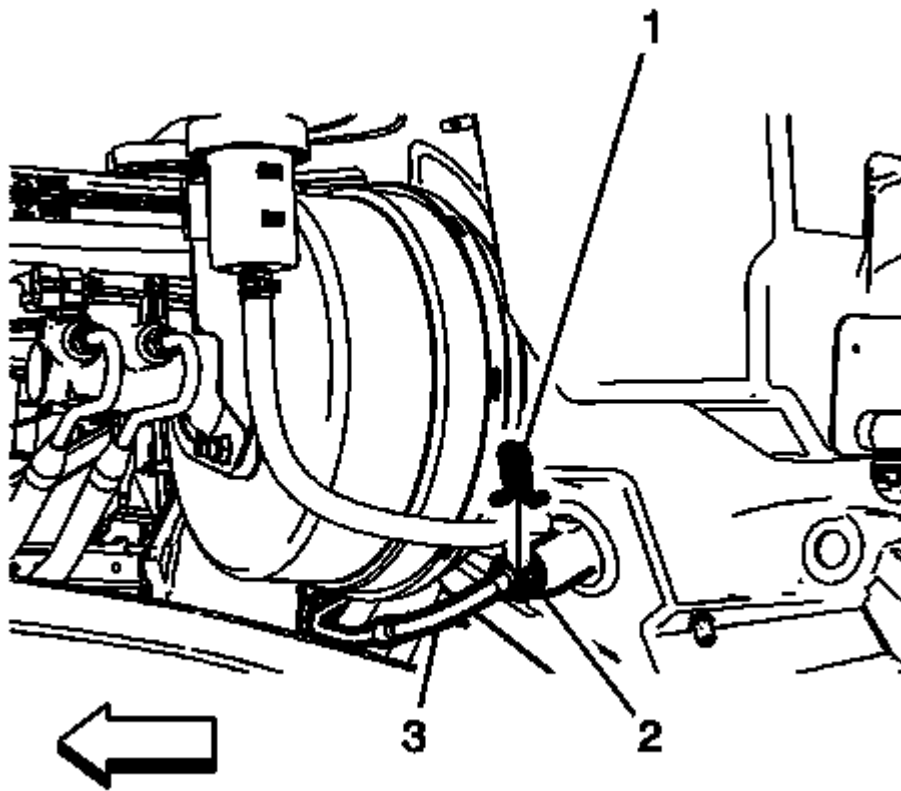


**Fig. 9: Clutch Pipe Connection Retaining Clip**  
Courtesy of GENERAL MOTORS COMPANY

**NOTE:** DO NOT rely on an audible click or a visual verification of the clutch hydraulic pipe connection.

5. Connect the clutch actuator cylinder hose (3) to the clutch master cylinder (2).
6. Install the retaining clip (1).

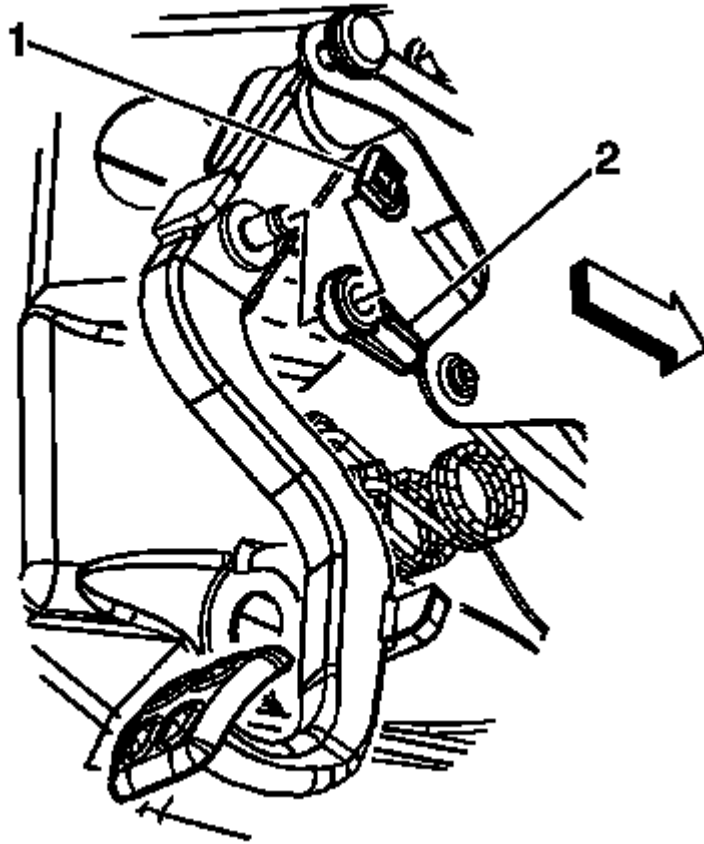


**Fig. 10: Clutch Master Cylinder Rod & Retainer**  
Courtesy of GENERAL MOTORS COMPANY

7. Install the clutch master cylinder rod (2) to the clutch pedal.
8. Install the clutch master cylinder rod retainer (1).
9. Install the left I/P lower insulator panel. Refer to **Instrument Panel Insulator Panel Replacement - Left Side** .
10. Bleed the clutch hydraulic system. Refer to **Hydraulic Clutch System Bleeding**.

#### **HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT**

##### **Removal Procedure**

1. Remove the windshield washer solvent container. Refer to **Windshield Washer Solvent Container Replacement** .

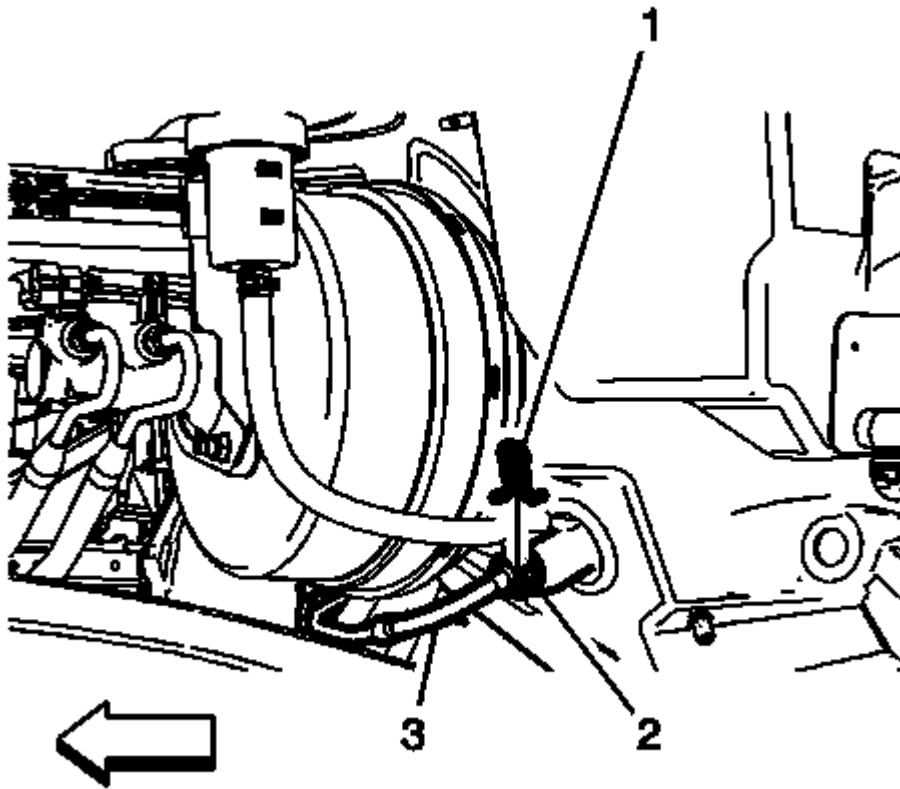


**Fig. 11: Clutch Pipe Connection Retaining Clip**  
Courtesy of GENERAL MOTORS COMPANY

2. Remove the clutch hose/pipe retaining clip from the clutch master cylinder (1).
3. Disconnect the clutch hose/pipe (3) from the clutch master cylinder (2).
4. Remove the clutch actuator cylinder hose/pipe from the hose retaining clip, under the brake master cylinder.
5. Remove the driveline support assembly and transaxle from the vehicle. Refer to **Transmission Replacement**.

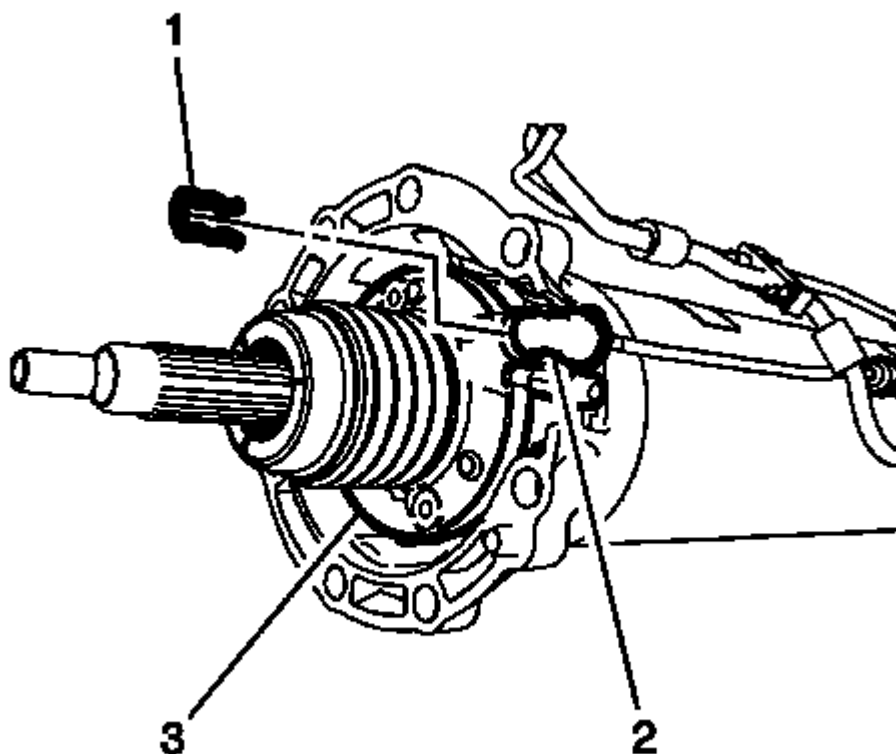


**Fig. 12: Removing Clutch Hose/Pipe To Clutch Actuator Cylinder Retaining Clip**  
**Courtesy of GENERAL MOTORS COMPANY**

6. Remove the clutch hose/pipe to clutch actuator cylinder retaining clip (1).
7. Separate the clutch hose/pipe (2) from the clutch actuator cylinder (3).
8. Protect both hose coupling ends from dirt and damage.

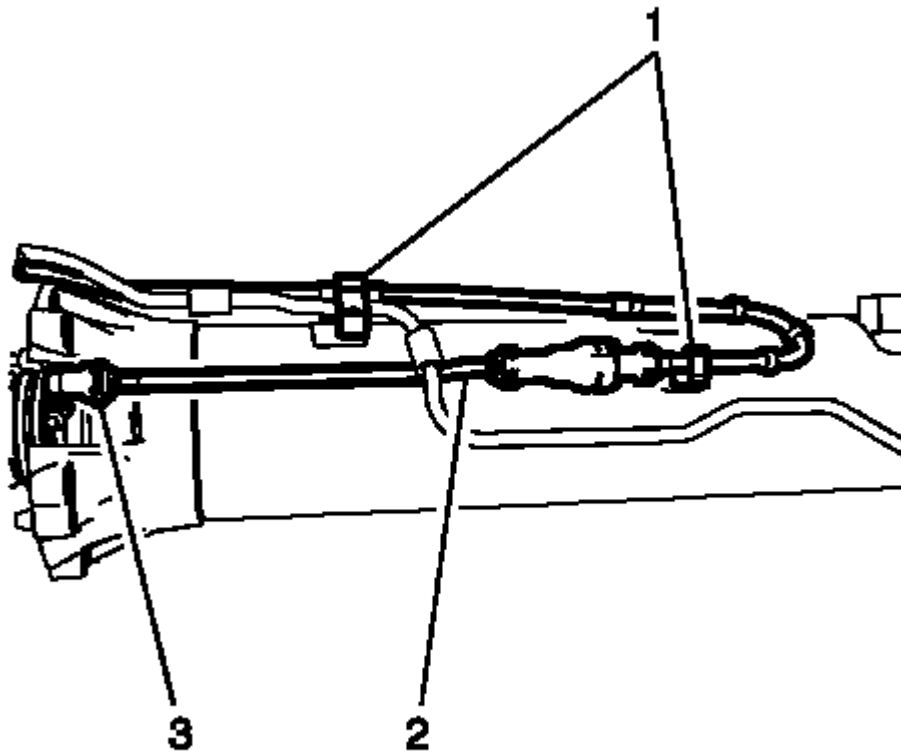


**Fig. 13: Clutch Hose/Pipe Retaining Clips**  
**Courtesy of GENERAL MOTORS COMPANY**

9. Remove the clutch hose/pipe retaining clips (1).
10. Separate the clutch hose/pipe (2) from the driveline support assembly.
11. Protect both the hose and actuator cylinder from dirt and damage.

**Installation Procedure**

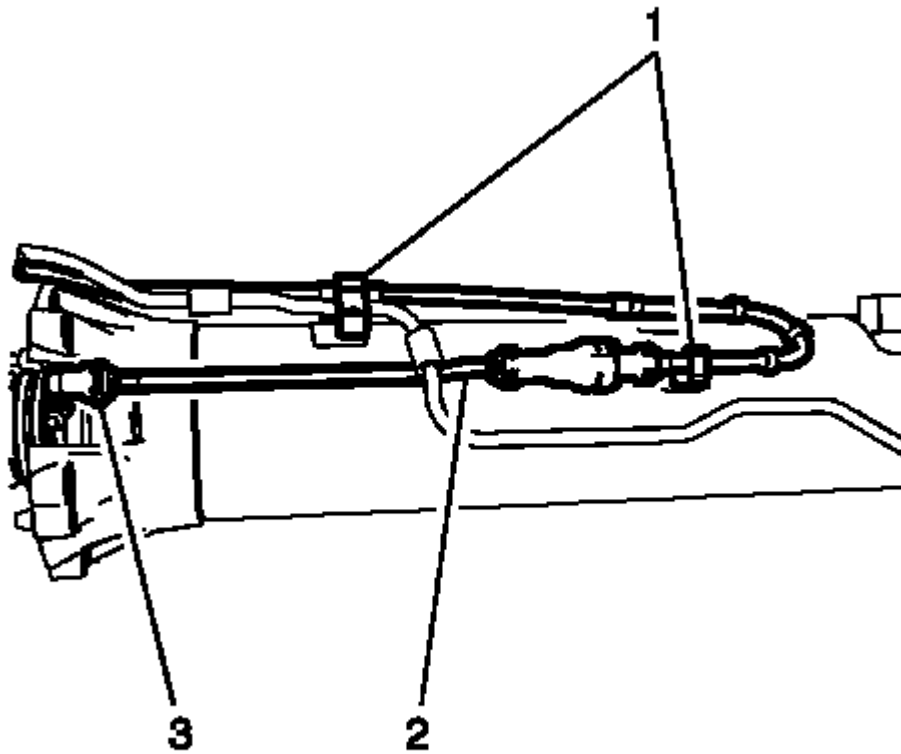


**Fig. 14: Clutch Hose/Pipe Retaining Clips**  
**Courtesy of GENERAL MOTORS COMPANY**

1. Position the clutch hose/pipe (2) to the driveline support assembly.
2. Install the clutch hose/pipe retaining clips (1).

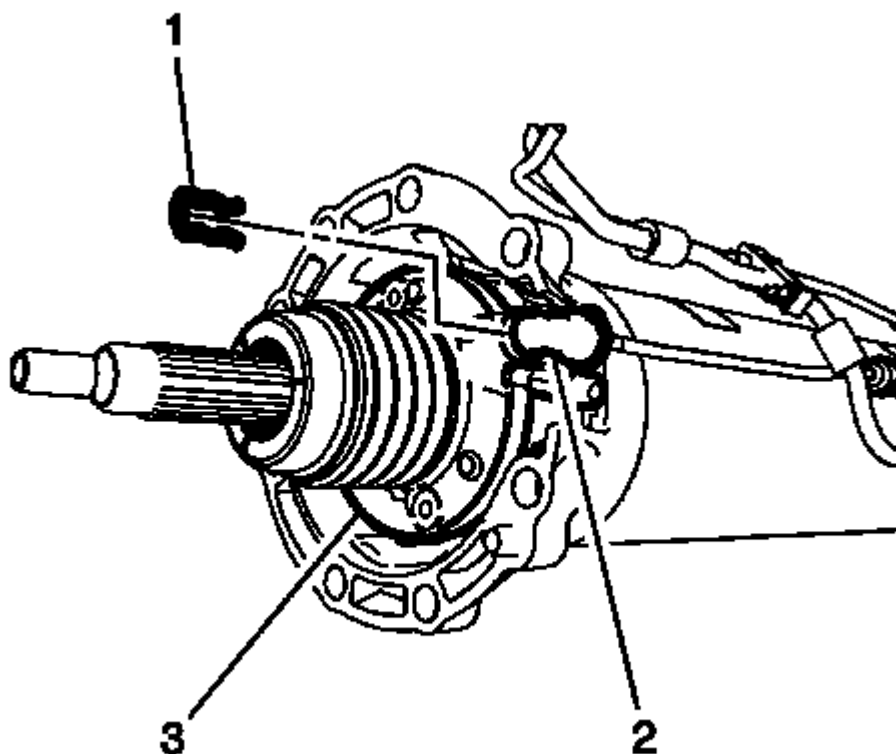


**Fig. 15: Clutch Hose/Pipe To Clutch Actuator Cylinder Retaining Clip**  
**Courtesy of GENERAL MOTORS COMPANY**

3. Connect the clutch hose/pipe (2) to the clutch actuator cylinder (3).
4. Install the clutch hose/pipe to clutch actuator cylinder retaining clip (1).
5. Install the driveline support assembly and transaxle to the vehicle. Refer to **Transmission Replacement** .
6. Install the clutch actuator cylinder hose to the hose retaining clip, under the brake master cylinder.

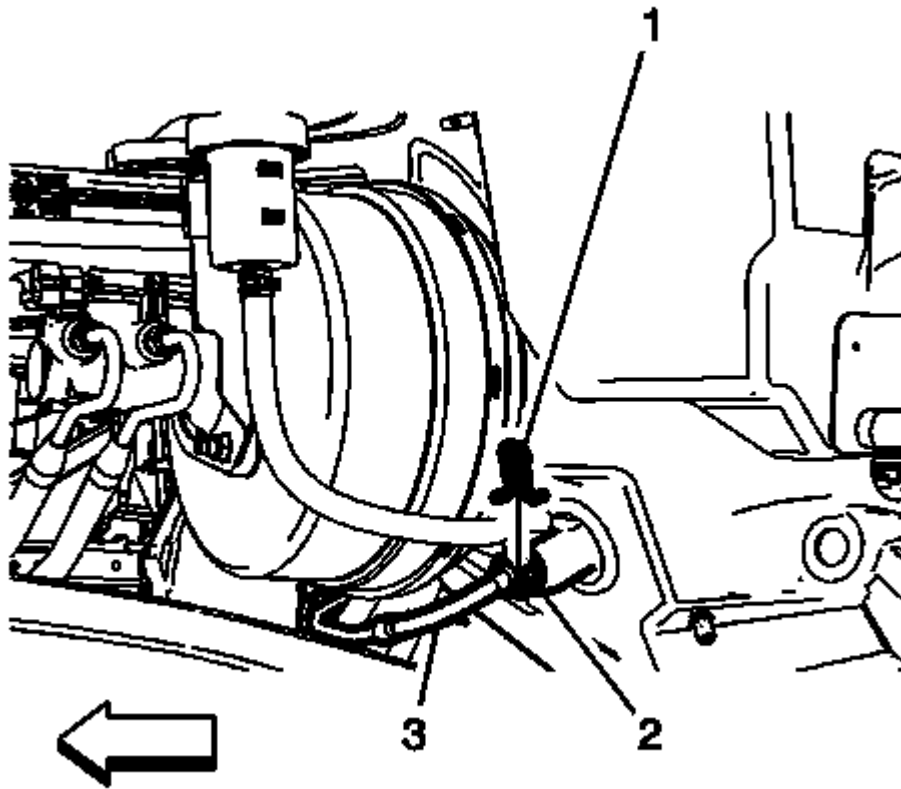


**Fig. 16: Clutch Pipe Connection Retaining Clip**  
Courtesy of GENERAL MOTORS COMPANY

7. Connect the clutch hose/pipe (3) to the clutch master cylinder (2).
8. Install the clutch hose/pipe retaining clip to the clutch master cylinder (1).
9. Install the windshield washer solvent container. Refer to Windshield Washer Solvent Container Replacement .
10. Bleed the clutch hydraulic system. Refer to Hydraulic Clutch System Bleeding.

#### HYDRAULIC CLUTCH SYSTEM BLEEDING

**CAUTION: 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.

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

2. Remove the clutch master cylinder reservoir cap with diaphragm.
3. Fill the clutch master cylinder reservoir with clutch hydraulic fluid. Refer to **Adhesives, Fluids, Lubricants and Sealers**.
4. Remove the left catalytic converter. Refer to **Catalytic Converter Replacement - Left Side**.
5. Have an assistant depress the clutch pedal fully and hold.

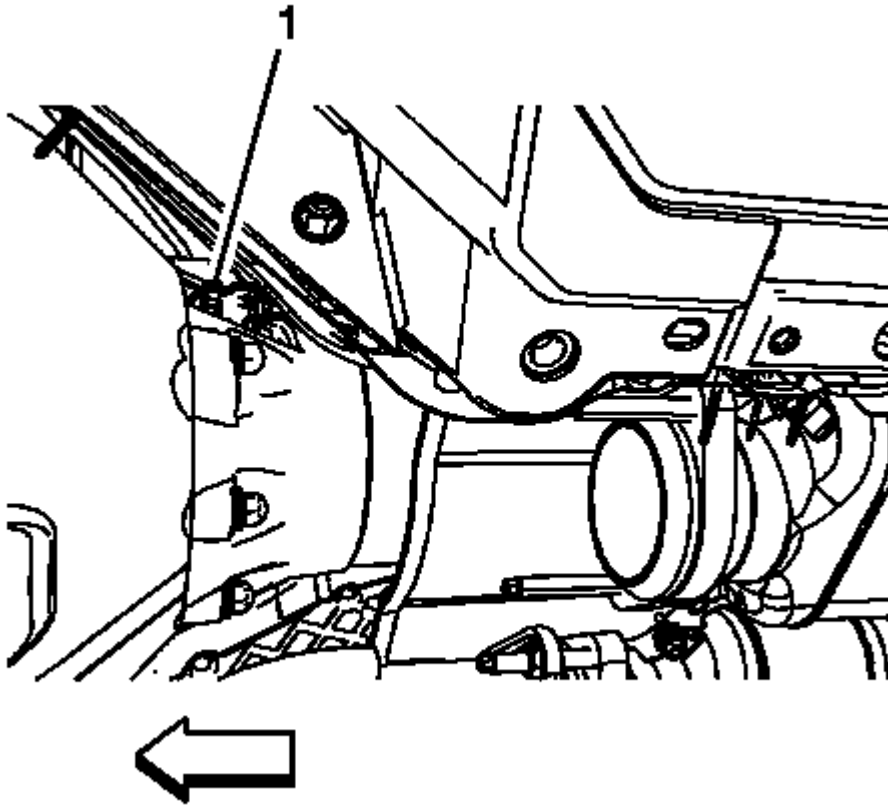


**Fig. 17: Bleeder Screw**

Courtesy of GENERAL MOTORS COMPANY

6. Loosen the bleeder screw (1) on the clutch actuator cylinder to purge air.
7. Tighten the bleeder screw (1).
8. Release the clutch pedal.
9. Repeat steps 7-10 until all air is completely evacuated.

Check and refill the clutch master cylinder reservoir with clutch hydraulic fluid as necessary in order to prevent air from being drawn through the clutch master cylinder. Refer to **Adhesives, Fluids, Lubricants and Sealers**.

10. Fill the clutch master cylinder reservoir with clutch hydraulic fluid. Refer to **Adhesives, Fluids,**

11. Install the left catalytic converter. Refer to **Catalytic Converter Replacement - Left Side** .

**CLUTCH PEDAL POSITION SENSOR REPLACEMENT**

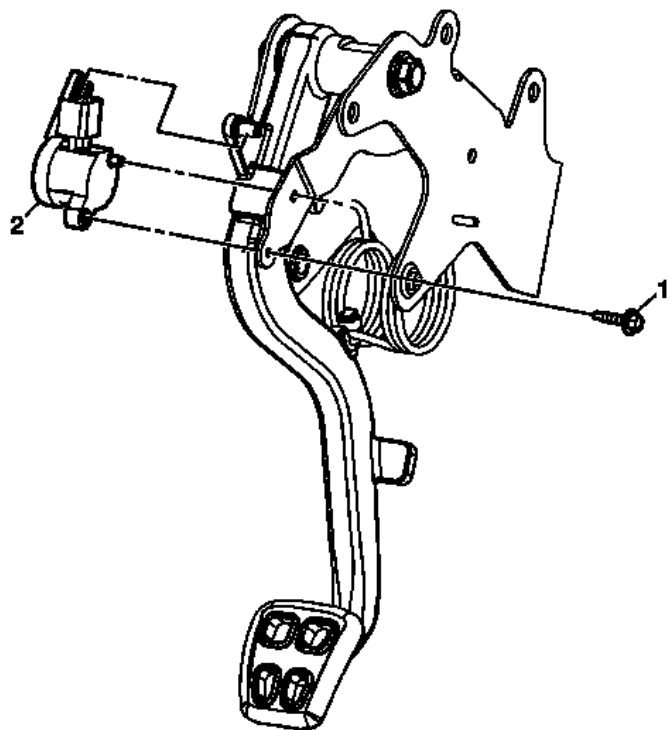


**Fig. 18: Clutch Pedal Position Sensor**  
Courtesy of GENERAL MOTORS COMPANY

**Clutch Pedal Position Sensor Replacement**

| Callout                                                                                                                                                                                                                                       | Component Name                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>Preliminary Procedure</b><br>Disconnect the clutch pedal position switch electrical connector.<br>Remove the left instrument panel (I/P) lower insulator panel. Refer to <b>Instrument Panel Insulator Panel Replacement - Left Side</b> . |                                                                                                                                        |
| 1                                                                                                                                                                                                                                             | Clutch Pedal Position Switch Bolt<br><br><b>CAUTION:</b><br>Refer to <b>Fastener Caution</b> .<br><br><b>Tighten</b><br>2.5 (22 lb in) |
|                                                                                                                                                                                                                                               | Clutch Pedal Position Switch<br><br><b>WARNING:</b>                                                                                    |

2

Replacement or reprogramming of the ECM or replacement of the clutch pedal position sensor (CPPS) or clutch pedal requires that a CPPS learn procedure be performed. Failure to perform the CPPS learn procedure may result in personal injury or damage to the vehicle or its components if the vehicle is in gear and the starter motor is accidentally engaged.

**Procedure**

Perform a sensor learn. Refer to **Control Module References** .

## CLUTCH PILOT BEARING REPLACEMENT

### Special Tools

- **J 8433** Two Jaw Puller
- **J 23907** Slide Hammer Bearing Adapter
- **J 23907-1** Slide Hammer and Shaft
- **J 45949** Pilot Bearing and Flywheel Locator Installer

For equivalent regional tools, refer to **Special Tools**.

### Removal Procedure

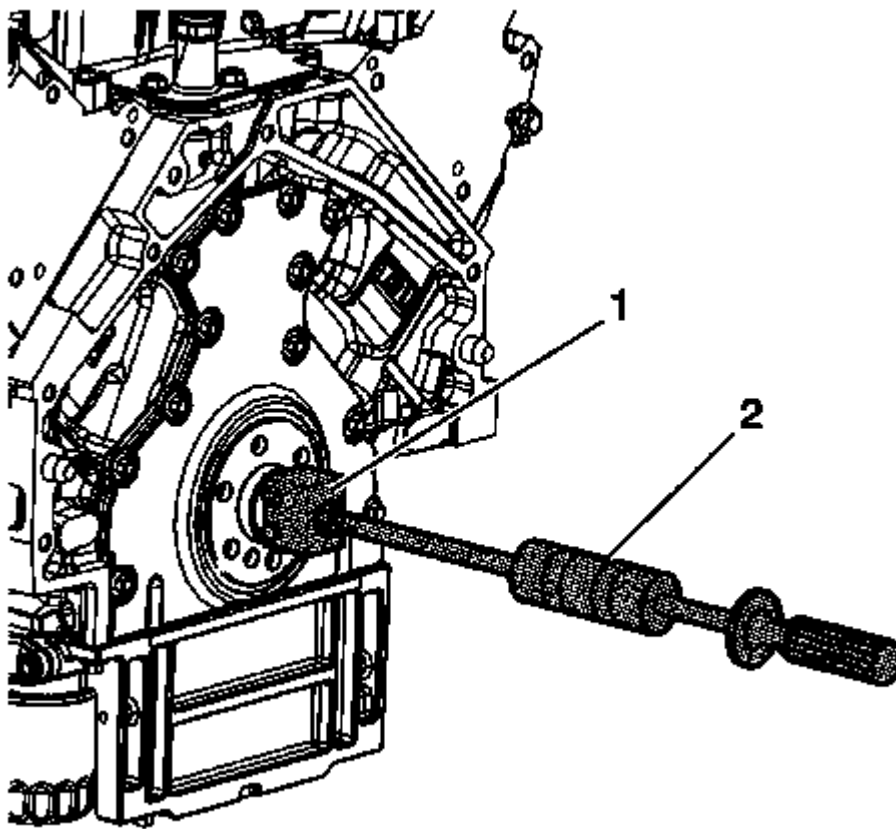


**Fig. 19: Removing Clutch Pilot Bearing**  
Courtesy of GENERAL MOTORS COMPANY

1. Remove the clutch pilot bearing using the **J 23907** adapter (1) and **J 23907-1** hammer and shaft (2).
  1. Install the legs of the **J 23907** adapter (1) into the clutch pilot bearing.
  2. Rotate the shaft of the tool until the legs of the tool are snug and contacting the I.D. surface of the bearing.
  3. Install the **J 23907-1** hammer and shaft (2) to the **J 23907** adapter (1).
  4. Remove the bearing from the rear of the crankshaft.
  5. Remove the **J 23907** adapter (1) and **J 23907-1** hammer and shaft (2) from the bearing.

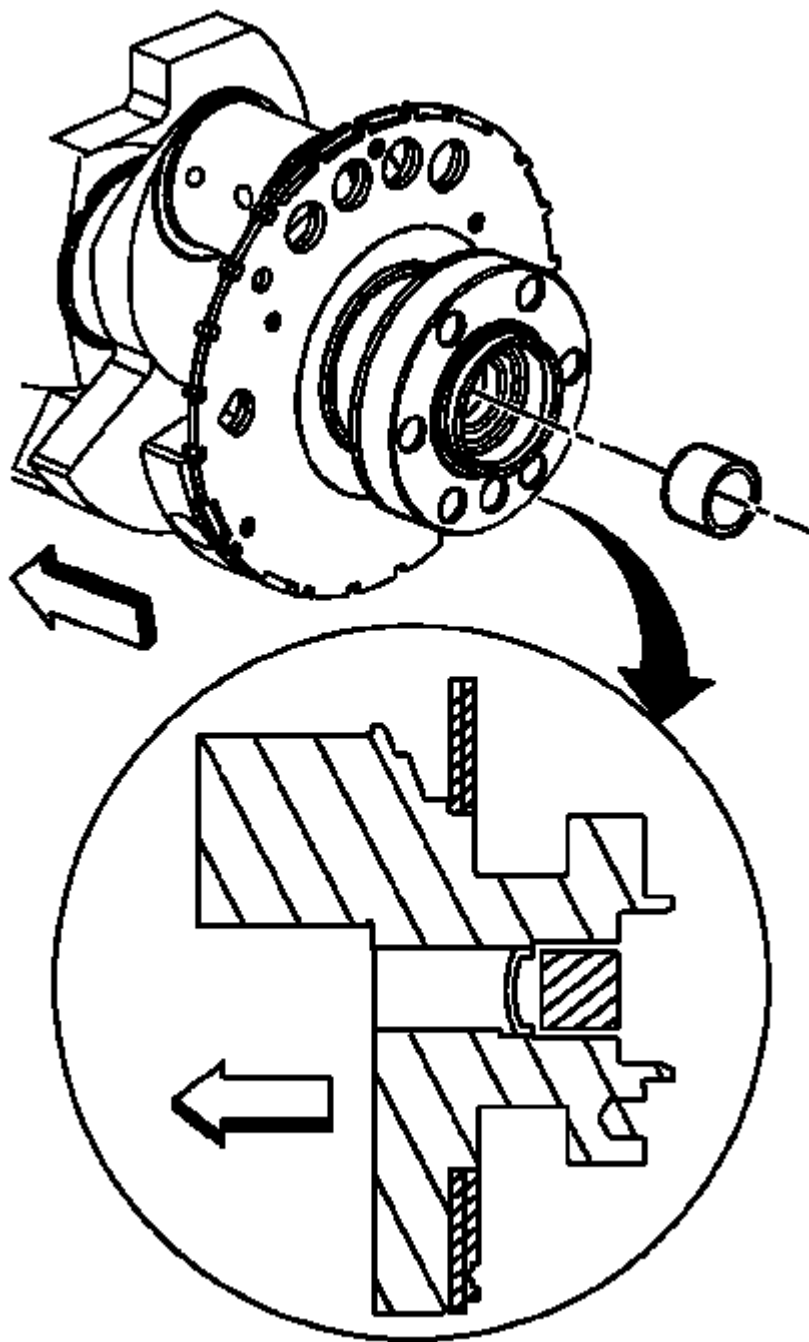


**Fig. 20: Locating Clutch Pilot Bearing**  
Courtesy of GENERAL MOTORS COMPANY

2. Discard the bearing.

**Installation Procedure**

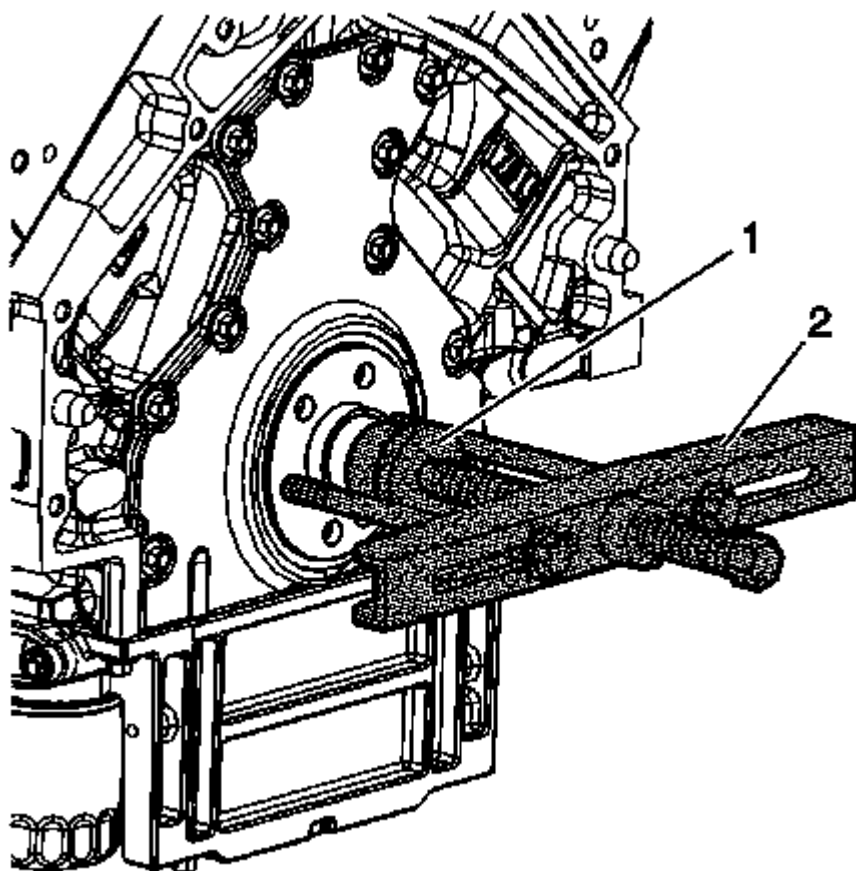


**Fig. 21: Identifying Special Tools**  
**Courtesy of GENERAL MOTORS COMPANY**

1. Position the bearing to the rear of the crankshaft.
2. Assemble the **J 8433** puller (2), the **J 45949** installer (1) and bolts to the rear of the crankshaft.

Tighten the bolts until snug.

3. Rotate the bolt of the **J 8433** puller (2) until the bearing is seated in the bore of the crankshaft.
4. Remove the tools.

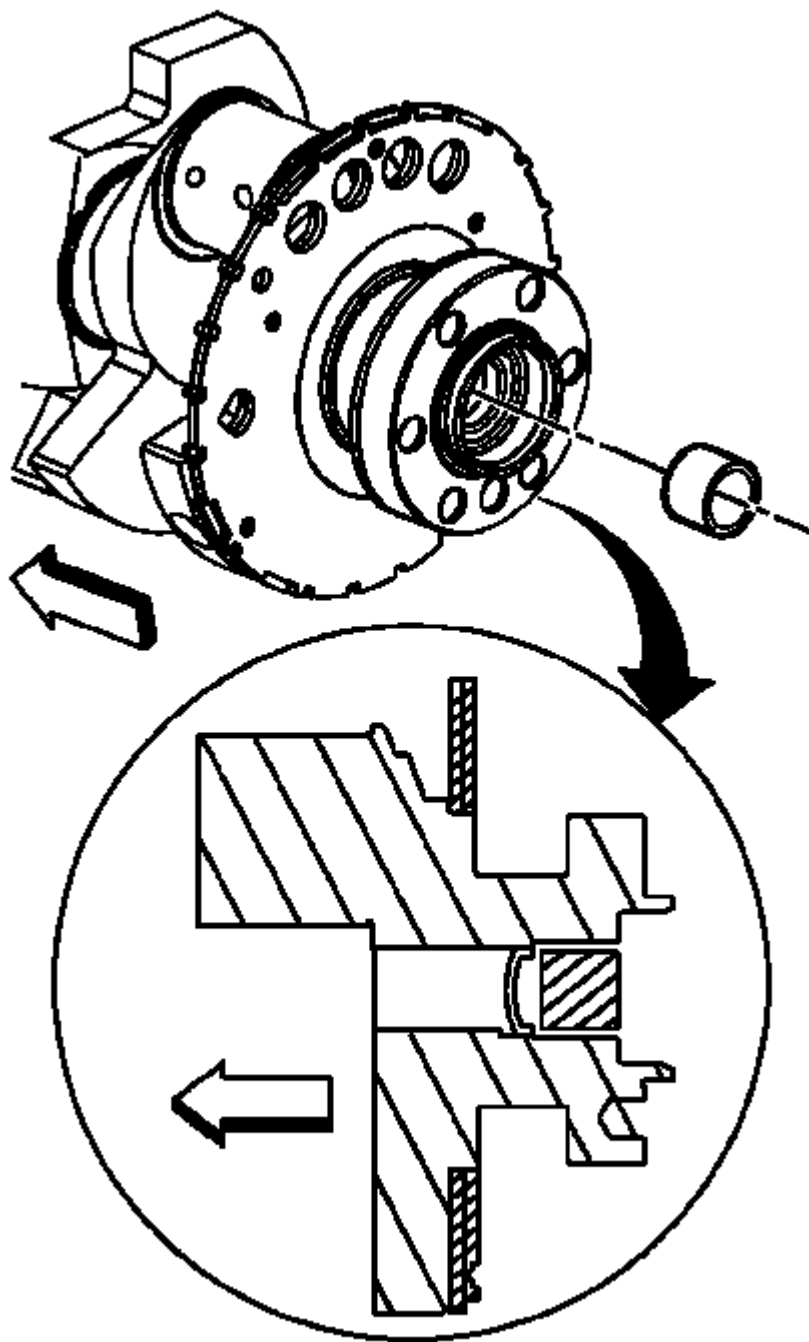


**Fig. 22: Locating Clutch Pilot Bearing**  
Courtesy of GENERAL MOTORS COMPANY

5. Inspect the clutch pilot bearing for proper installation.

#### **CLUTCH ASSEMBLY REPLACEMENT**

## Special Tools

- **DT-49267** Dual Clutch Alignment Tool
- **J 42386-A** Flywheel Holding Tool

For equivalent regional tools, refer to **Special Tools**.

## Removal Procedure

1. Remove the driveline support assembly with the transaxle. Refer to **Transmission Replacement**.

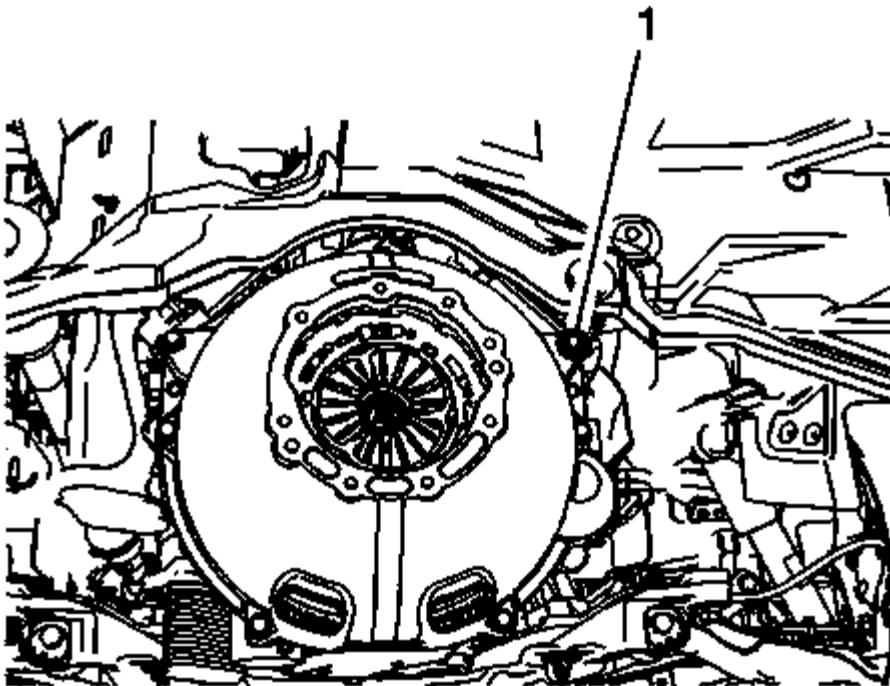


**Fig. 23: Flywheel Housing Bolts**  
**Courtesy of GENERAL MOTORS COMPANY**

2. Remove the eight bell housing bolts (1). The upper bolts can be accessed by lowering the engine cradle approximately 25 mm (1 in) and tipping the engine back.
3. If reusing the pressure plate assembly, place an alignment mark on the pressure plate and flywheel for proper alignment during installation.

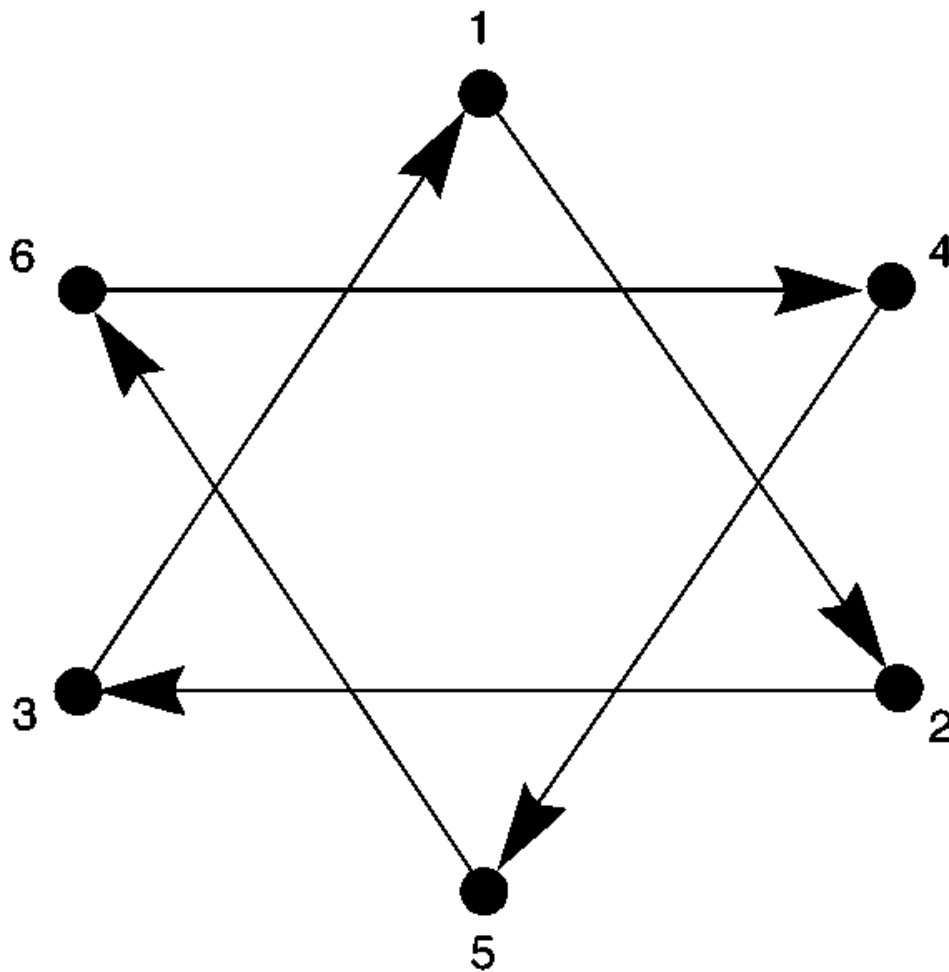


**Fig. 24: Clutch Pressure Plate Bolts Tightening Sequence (4.8L, 5.3L and 6.0L Engines)**  
Courtesy of GENERAL MOTORS COMPANY

**NOTE:** Do Not use air tools to remove the clutch pressure plate bolts.

4. Loosen the clutch pressure plate bolts using the following sequence:
  1. Loosen bolts 1 and 2 one full turn, then stop.
  2. Loosen bolts 3 and 4 one full turn, then stop.
  3. Loosen bolts 5 and 6 one full turn, then stop.
  4. Repeat steps 4.1 through 4.3 until all the bolts are loose.
5. Remove the clutch pressure plate bolts from the flywheel.
6. Remove the clutch pressure plate and the clutch driven plates.

#### Installation Procedure

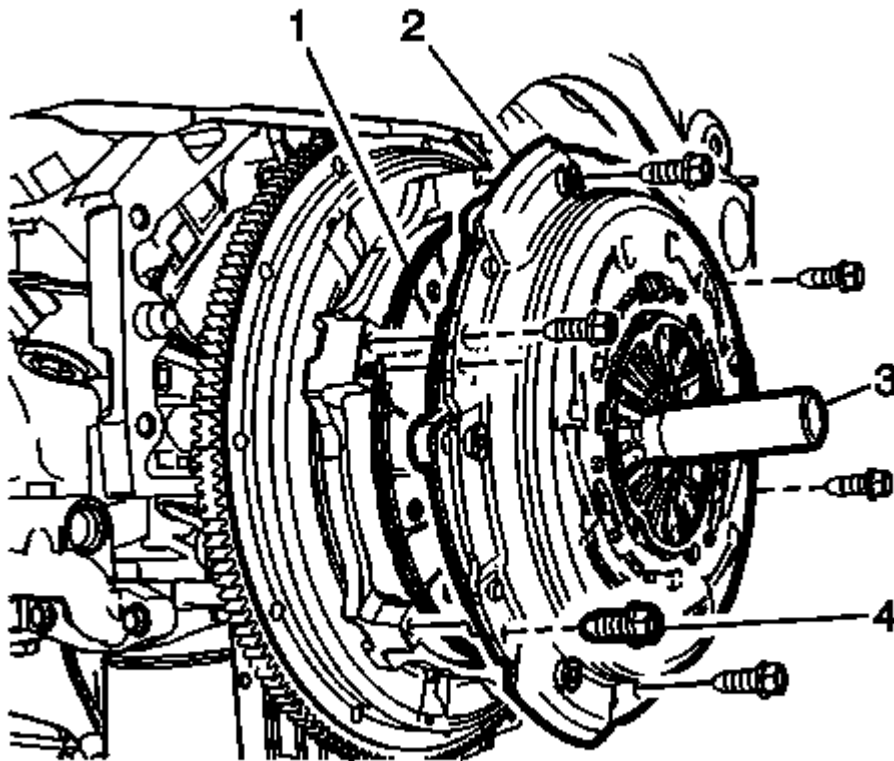


**Fig. 25: Clutch Pressure Plate And Clutch Driven Plates**  
Courtesy of GENERAL MOTORS COMPANY

1. Inspect the clutch pressure plate (2) and the clutch driven plates (1) for wear or damage. Repair or replace as necessary.
2. Using the **DT-49267** tool (3), align the two clutch driven plates.

**NOTE:**

- Use **NEW** clutch pressure plate bolts in order to maintain proper torque. Apply sealant to the threads to make certain the bolts do not come loose. Refer to Adhesives, Fluids, Lubricants and Sealers.
  - Do Not use air tools to install the clutch pressure plate bolts.
3. Install the clutch driven plate and clutch pressure plate to the engine flywheel with the clutch alignment tool still installed in the clutch assembly.
  4. If reusing the clutch pressure plate, align the previously created mark on the flywheel with the alignment mark on the pressure plate.
  5. Install the six **NEW** clutch pressure plate bolts (4) finger tight.

**CAUTION:** Refer to Fastener Caution .

6. Install **J 42386-A** tool and bolts. Use one M10 1.5 X 25 mm and one M10 1.5 X 45 mm bolt for proper tool operation.

Tighten the **J 42386-A** tool bolts to 50 (37 lb ft).

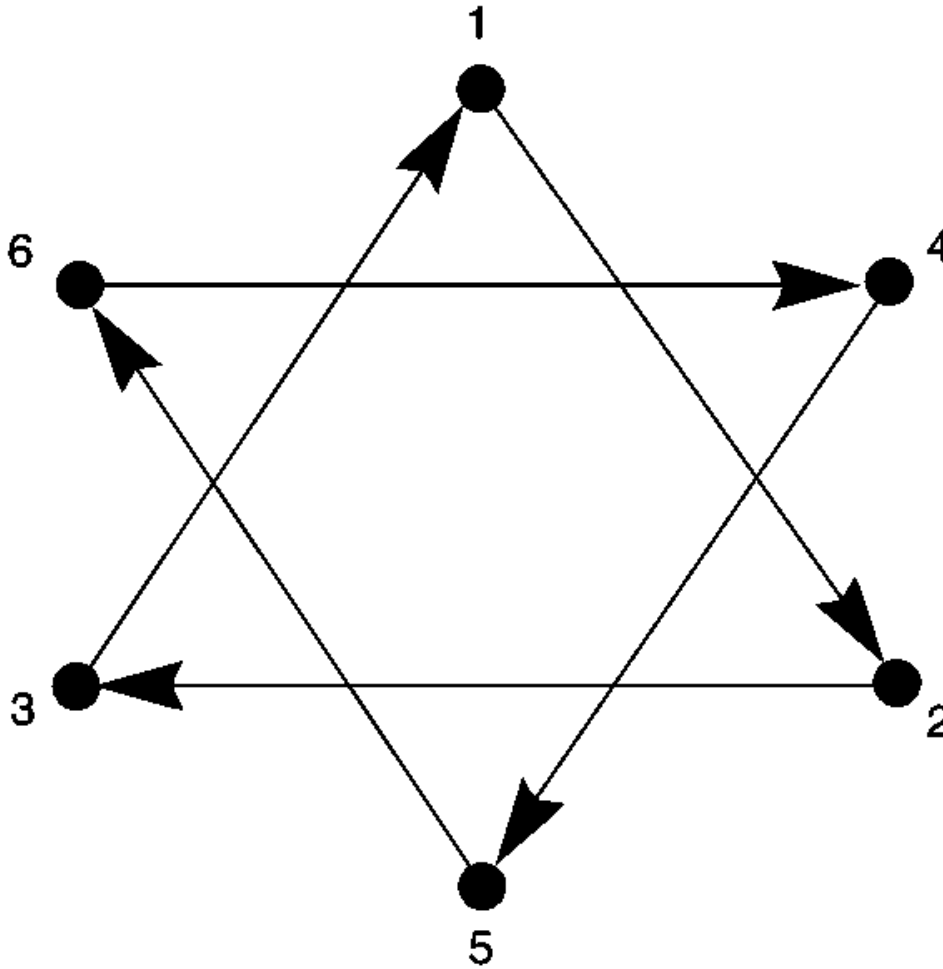


**Fig. 26: Clutch Pressure Plate Bolts Tightening Sequence (4.8L, 5.3L and 6.0L Engines)**  
**Courtesy of GENERAL MOTORS COMPANY**

7. Tighten the clutch pressure plate bolts using the following sequence:
1. Tighten all the clutch pressure plate bolts in sequence and evenly to 15 (11 lb ft).
  2. Tighten all the clutch pressure plate bolts in sequence and evenly to 35 (26 lb ft).
  3. Tighten all the clutch pressure plate bolts in sequence and evenly to 70 (52 lb ft).

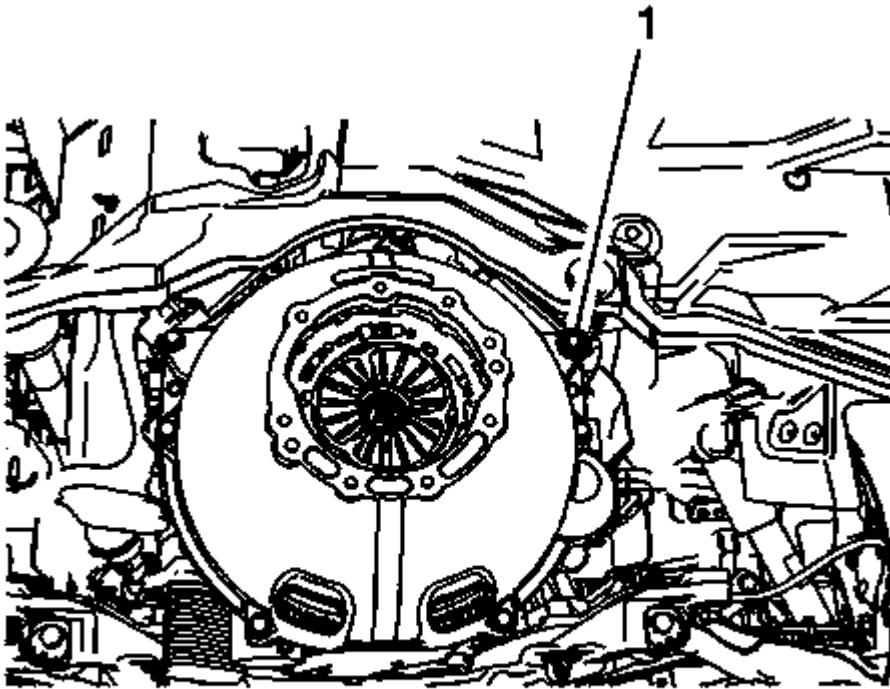


**Fig. 27: Flywheel Housing Bolts**  
Courtesy of GENERAL MOTORS COMPANY

8. Install the eight bell housing bolts (1) and tighten to 50 (37 lb ft).
9. Remove the driveline support assembly with the transaxle. Refer to **Transmission Replacement**.
10. Lower the vehicle.

## **CLUTCH ACTUATOR CYLINDER REPLACEMENT**

### **Removal Procedure**

1. Remove the driveline support assembly and transaxle from the vehicle. Refer to **Transmission Replacement**.

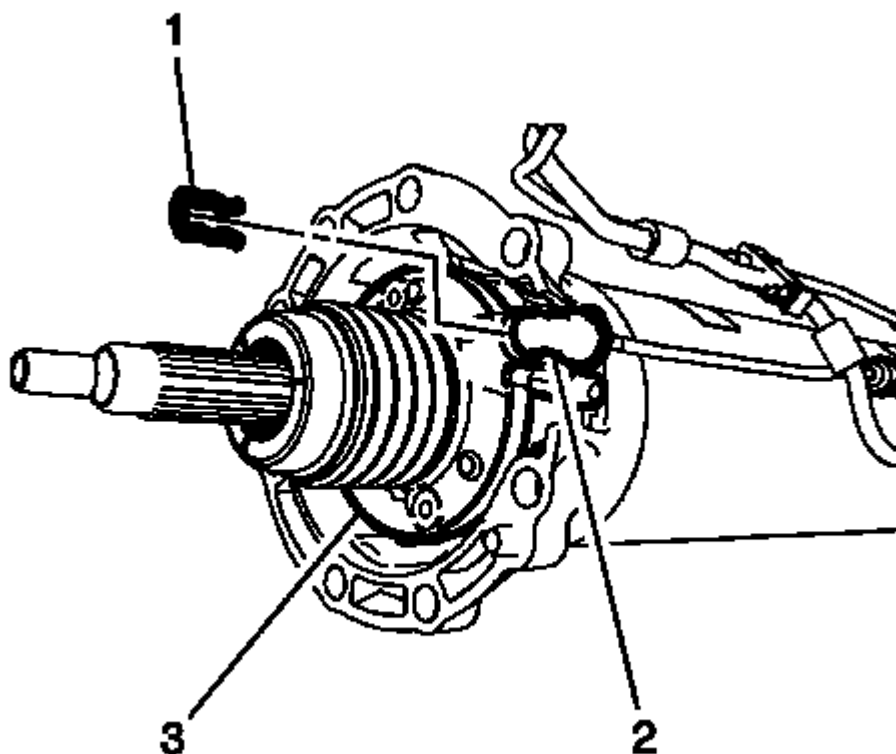


**Fig. 28: Clutch Hose/Pipe To Clutch Actuator Cylinder Retaining Clip**  
**Courtesy of GENERAL MOTORS COMPANY**

2. Remove the clutch hose/pipe to clutch actuator cylinder retaining clip (1).
3. Separate the clutch hose/pipe (2) from the clutch actuator cylinder (3).
4. Protect both clutch hose/pipe coupling ends from dirt and damage.

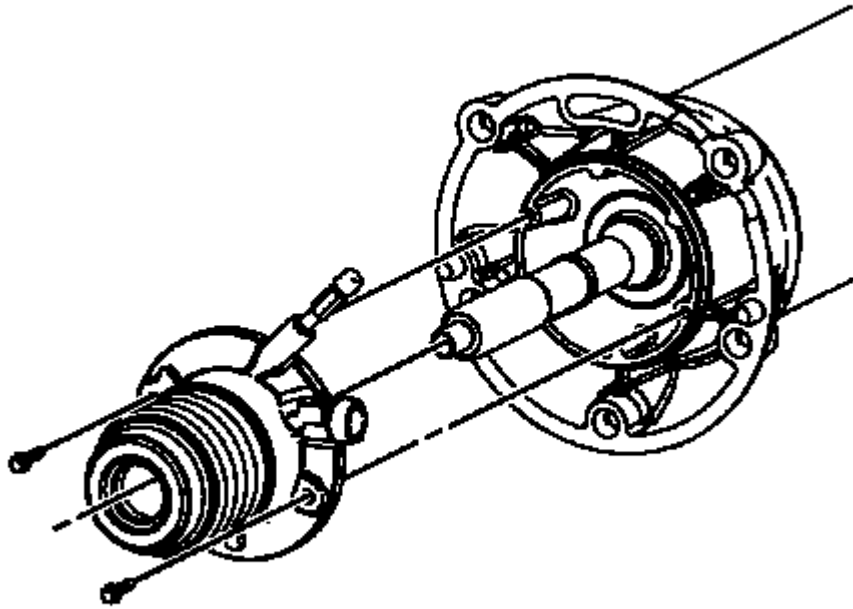


**Fig. 29: View Of Driveline Support Assembly, Clutch Actuator Cylinder & Mounting Bolts**  
Courtesy of GENERAL MOTORS COMPANY

5. Remove the clutch actuator cylinder mounting bolts.
6. Remove the clutch actuator cylinder from the driveline support assembly.

#### **Installation Procedure**

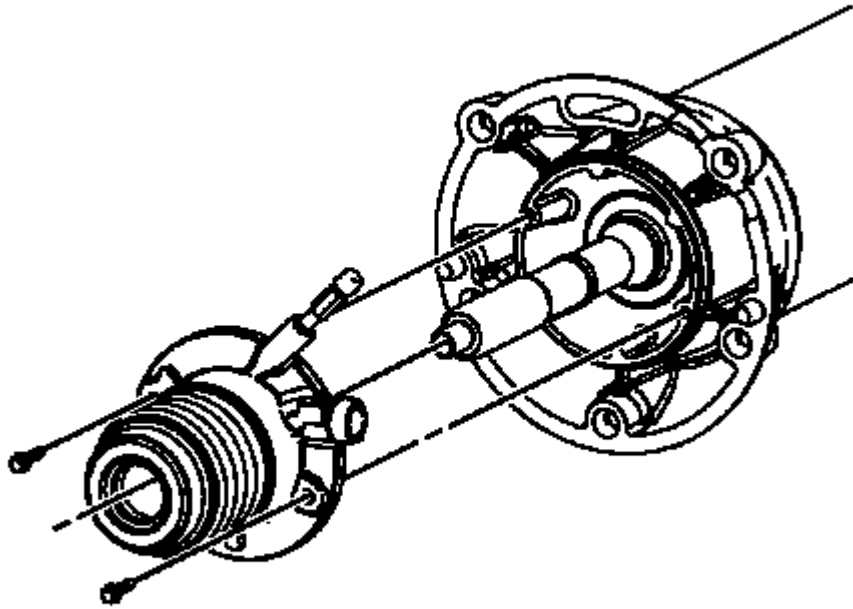


**Fig. 30: View Of Driveline Support Assembly, Clutch Actuator Cylinder & Mounting Bolts**  
Courtesy of GENERAL MOTORS COMPANY

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

**CAUTION: Refer to Fastener Caution .**

2. Install the actuator cylinder mounting bolts and tighten to 12 (106 lb in).

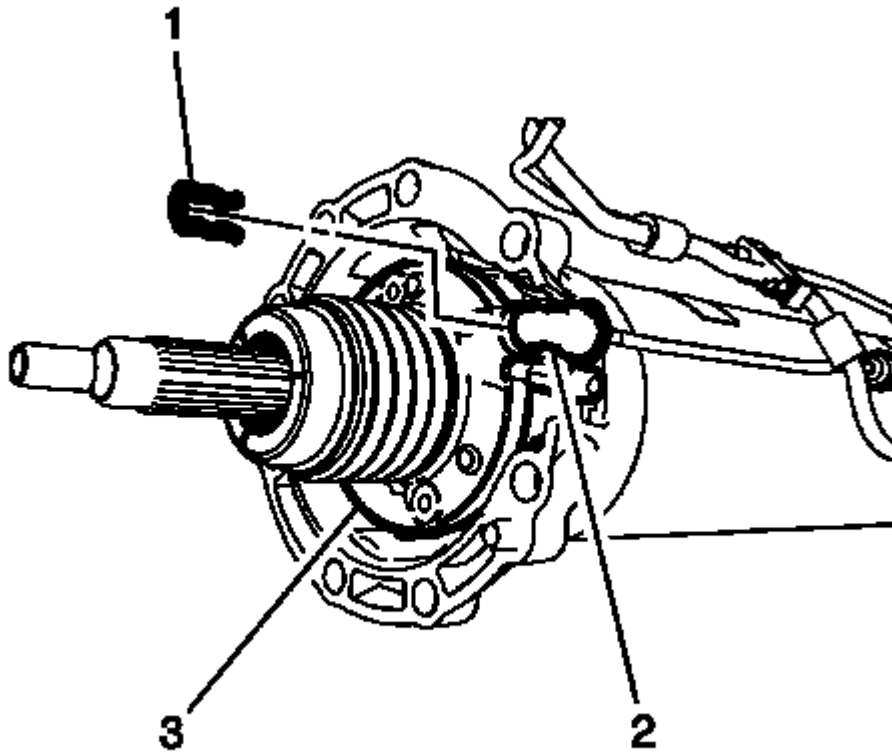


**Fig. 31: Clutch Hose/Pipe To Clutch Actuator Cylinder Retaining Clip**  
Courtesy of GENERAL MOTORS COMPANY

3. Connect the clutch hose/pipe (2) to the clutch actuator cylinder (3).
4. Install the clutch hose/pipe to clutch actuator cylinder retaining clip (1).
5. Install the driveline support assembly and transaxle to the vehicle. Refer to Transmission Replacement .
6. Bleed the clutch hydraulic system. Refer to Hydraulic Clutch System Bleeding.

#### CLUTCH PRESSURE PLATE ADJUSTMENT (TREMEC 6-SPEED)

**NOTE:** If clutch adjustment is required, do not adjust the clutch. Order a new clutch and replace. Refer to Clutch Assembly Replacement.

## DESCRIPTION AND OPERATION

### CLUTCH SYSTEM DESCRIPTION AND OPERATION

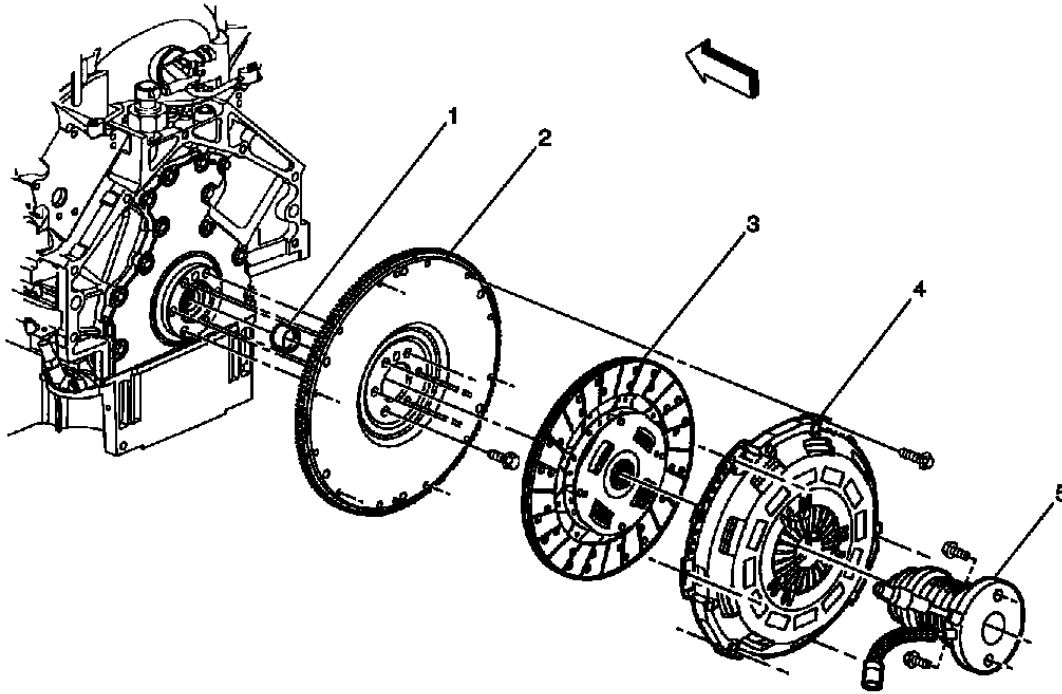


**Fig. 32: Exploded View Of Clutch System**  
 Courtesy of GENERAL MOTORS COMPANY

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

The following components are the main parts 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

### **Clutch Driving Members**

The clutch driving members consist of 2 flat surfaced iron plates, machined to a smooth finish. 1 of these surfaces is the rear face of the engine flywheel and the other is a comparatively heavy flat ring, with 1 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 1-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. As the clutch disc wears, the diaphragm spring fingers move forward forcing the release bearing 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**

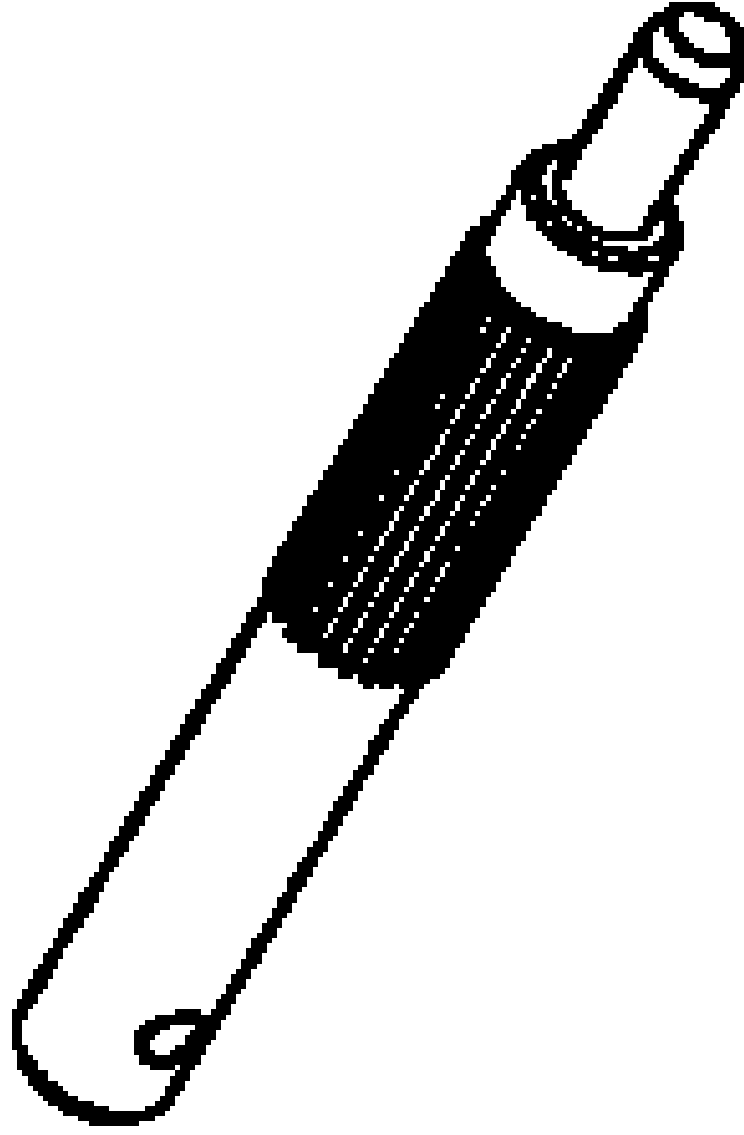
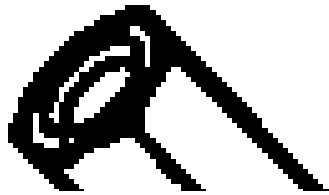
The clutch hydraulic system consists of a master cylinder and an actuator cylinder. When pressure is applied to the clutch pedal, pedal depressed, the pushrod contacts the plunger and pushes it down the bore of the master cylinder. In the first 0.8 mm (0.031 in) of movement, the compensation port seal 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 over-center spring. The clutch pedal over-center spring provides load at the top of stroke and reduces clutch effort at the bottom of stroke. This reduces driver fatigue during stop and go traffic.

**SPECIAL TOOLS AND EQUIPMENT**

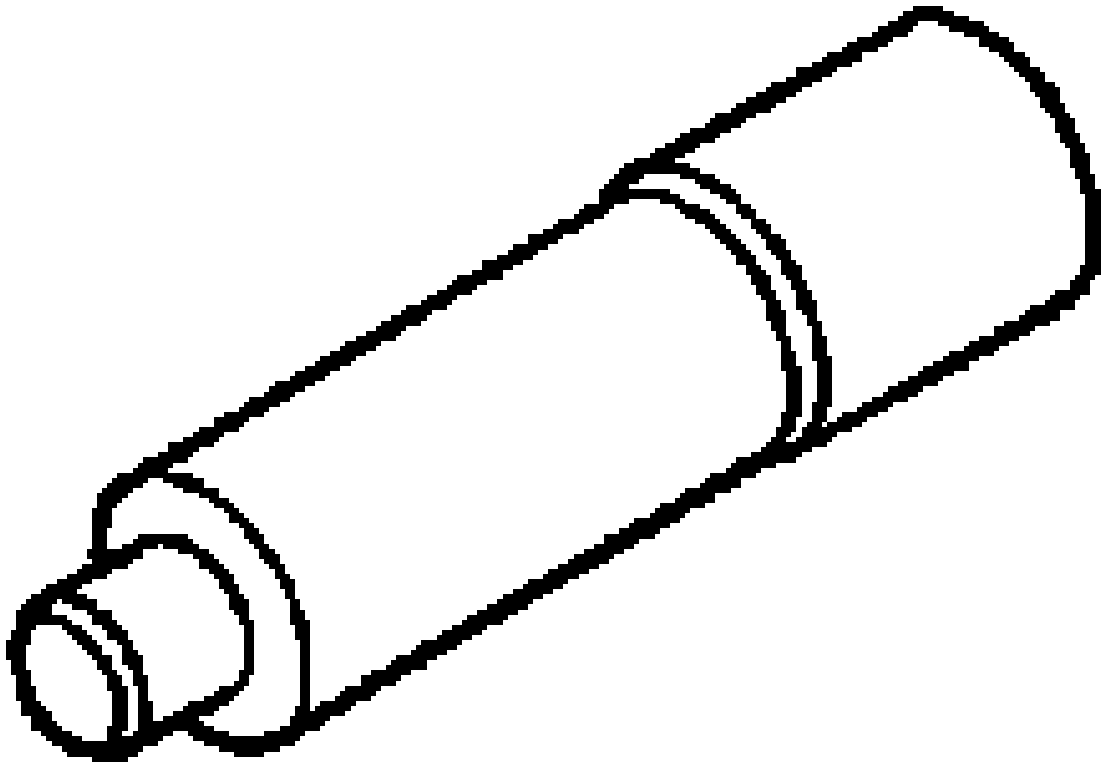
**SPECIAL TOOLS**

| Illustration | Tool Number / Description              |
|--------------|----------------------------------------|
|              | DT-49267<br>Dual Clutch Alignment Tool |



J-23907  
Slide  
Hammer  
with  
Bearing  
Adapter

J-38836  
Bushing  
Installer and  
Clutch  
Arbor



J-42386-A  
Flywheel  
Holding  
Tool