

SPECIFICATIONS > FASTENER SPECIFICATIONS

Reusable Threaded Fastener Tightening Specifications



NOTE:

All fasteners listed in this table can be reused after removal

Application	Specification
	Metric (English)
Clutch Actuator Cylinder Bolt	13 N.m (115 lb in)
Clutch Pedal Assembly to Brake Pedal Bolts	20 N.m (15 lb ft)
Clutch Pedal Position Switch Bolt	2.5 N.m (22 lb in)
Clutch Pressure Plate Bolt	See procedure for specific tightening sequence and torque values.
Concentric Actuator Cylinder Bolt	13 N.m (115 lb in)

SPECIFICATIONS > ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Brake/Clutch Fluid	DOT 3 Hydraulic Brake Fluid	88863461	88863462

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 .

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - CLUTCH > VISUAL/PHYSICAL INSPECTION

- 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - CLUTCH > INTERMITTENT

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

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - CLUTCH > 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

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 System 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 Concentric 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: 1. Damaged clutch disc hub splines 2. Bent clutch disc 3. Bent drive straps 4. Broken or warped pressure plate 3. Replace the clutch assembly if any of the above damage is found. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Excessive side loading on the release bearing	1. Inspect the following clutch system components: 1. Worn or damaged pilot bearing 2. Excessive flywheel runout 3. Excessive engine to transmission misalignment 2. Repair or replace any faulty components.

Faulty pilot bearing	Replace the pilot bearing. Refer to Clutch Pilot Bearing Replacement (LGX Engine) Clutch Pilot Bearing Replacement (LT1 Engine) .
Transmission input shaft splines worn or damaged	Replace the transmission input shaft. Refer to Transmission Disassemble (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
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 (MM6 with LT1 Engine)Transmission Replacement (M13 with LGX Engine)Transmission Replacement (M13 with LTG Engine) . 3. Replace the transmission front case half. Refer to Transmission Disassemble (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 Clutch Pedal Position Sensor 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 Concentric 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 - Right Side , and Engine Mount Replacement - Left Side , for the 2.0L (LTG) engine, Engine Mount Replacement - Right Side , and Engine Mount Replacement - Left Side , for the 3.6L (LGX) engine, or Engine Mount Replacement - Right Side , and Engine Mount Replacement - Left Side for the 6.2L (LT1 LT4) engine. 5. Repair or replace the clutch hydraulic hose if it is damaged. Refer to Hydraulic Clutch Hose/Pipe Replacement (M13) Hydraulic Clutch Hose/Pipe Replacement (MM6) .
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 contaminants cannot be removed, replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Worn or damaged flywheel	Replace the engine flywheel. Refer to Engine Flywheel Replacement , for the 2.0L (LTG) engine, Engine Flywheel Replacement , for the 3.6L (LGX) engine, or the Engine Flywheel Replacement for the 6.2L (LT1 LT4) engine..
Worn clutch disc facing	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Burnt or glazed clutch discs	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Input shaft splines worn	Replace the input shaft. Refer to Transmission Disassemble (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
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 , for the 2.0L (LTG) engine, Engine Flywheel Replacement , for the 3.6L (LGX) engine, or the Engine Flywheel Replacement for the 6.2L (LT1 LT4) engine..

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Clutch is improperly installed	Remove the clutch and install it correctly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) . 3. Replace the input shaft. Refer to Transmission Disassemble (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 Clutch Pilot Bearing Replacement (LGX Engine) Clutch Pilot Bearing Replacement (LT1 Engine) .

Release bearing damaged or worn

Replace the release bearing. Refer to Clutch Concentric Actuator Cylinder Replacement .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 Hydraulic Clutch System Bleeding .
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 System 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 Sensor Replacement .

Clutch incorrectly installed	Remove the clutch and install it correctly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
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 (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Release bearing worn or damaged	Replace the release bearing. Refer to Clutch Concentric Actuator Cylinder Replacement .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 Adhesives, Fluids, Lubricants, and Sealers . 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 Adhesives, Fluids, Lubricants, and Sealers .
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 (M13) Hydraulic Clutch Hose/Pipe Replacement (MM6) .
Clutch disc worn too thin	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Clutch adjusts prematurely	Replace the clutch kit. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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.

DIAGNOSTIC INFORMATION AND PROCEDURES > 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 .
Clutch incorrectly installed	Remove the clutch and install it correctly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Pilot bearing worn or damaged	1. Replace the pilot bearing. Refer to Clutch Pilot Bearing Replacement (LGX Engine) Clutch Pilot Bearing Replacement (LT1 Engine) . 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 (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
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 (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
Clutch disc facings damaged	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .
Flywheel housing to clutch housing excessively misaligned	Replace the faulty clutch housing or transmission front case. Refer to Transmission Disassemble (M13 - LGX w/L4Q)Transmission Disassemble (MM6)Transmission Disassemble (M13 - LGX w/o Y4Q, LTG) .
Clutch out of balance	Replace the clutch assembly. Refer to Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission) .

DIAGNOSTIC INFORMATION AND PROCEDURES > 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. Review Symptoms - Clutch and perform the necessary inspections.	
Internal damage to the clutch master cylinder and the hydraulic system	1. Inspect for fluid leaks. 2. Replace the clutch hydraulic system. Refer to Clutch Master Cylinder Replacement , and Hydraulic Clutch Hose/Pipe Replacement (M13) Hydraulic Clutch Hose/Pipe Replacement (MM6) . 3. Replace the clutch master cylinder and the clutch actuator cylinder (CSC). Refer to Clutch Master Cylinder Replacement , and Clutch Concentric Actuator Cylinder Replacement . 4. Re-bleed the clutch hydraulic system. Refer to

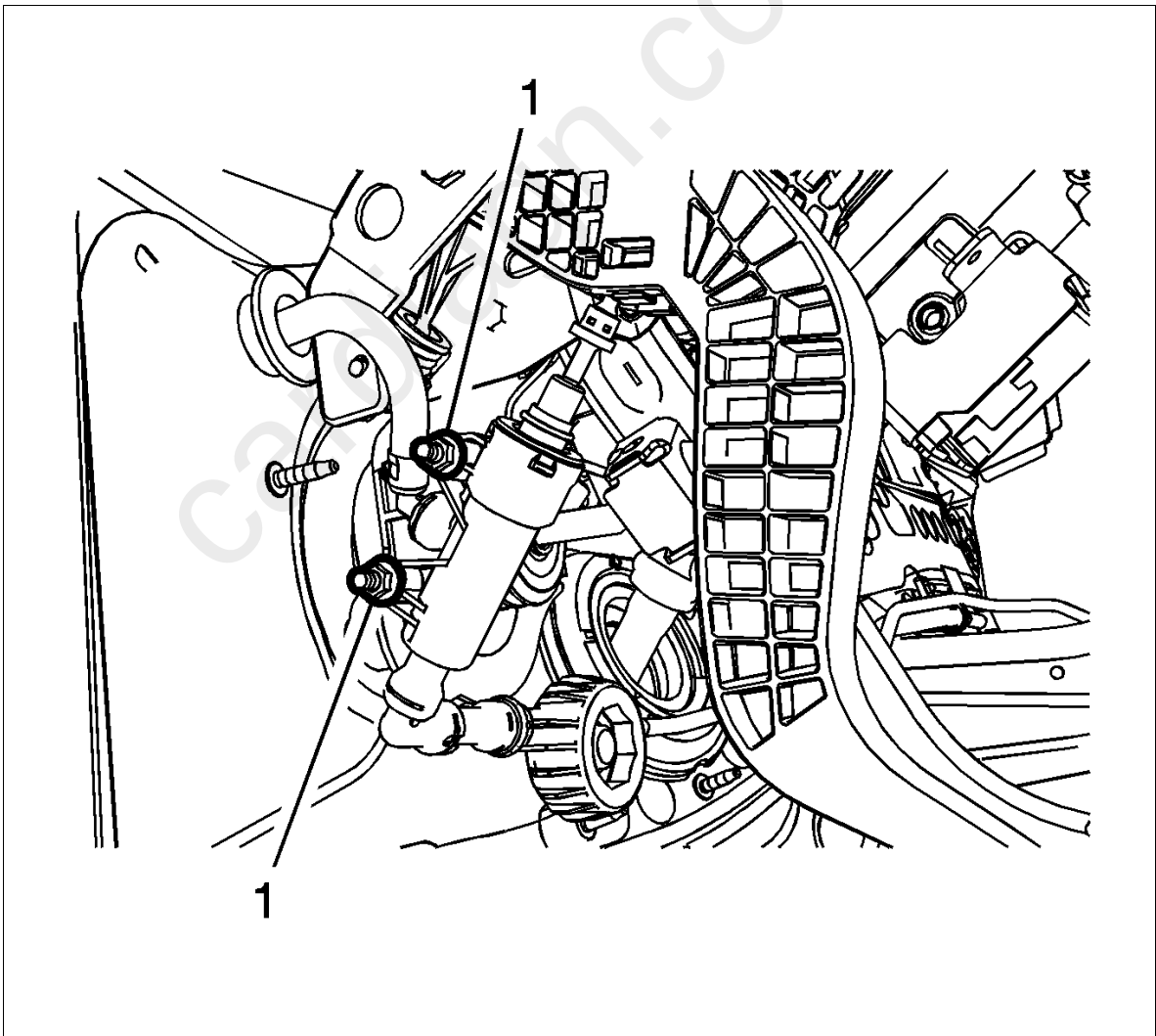
REPAIR INSTRUCTIONS > CLUTCH PEDAL REPLACEMENT > REMOVAL PROCEDURE

1. Remove the instrument panel knee bolster. Instrument Panel Lower Trim Panel Replacement (with UV6) Instrument Panel Lower Trim Panel Replacement (without UV6)
2. Disconnect the clutch pedal position sensor electrical connector.

 NOTE:

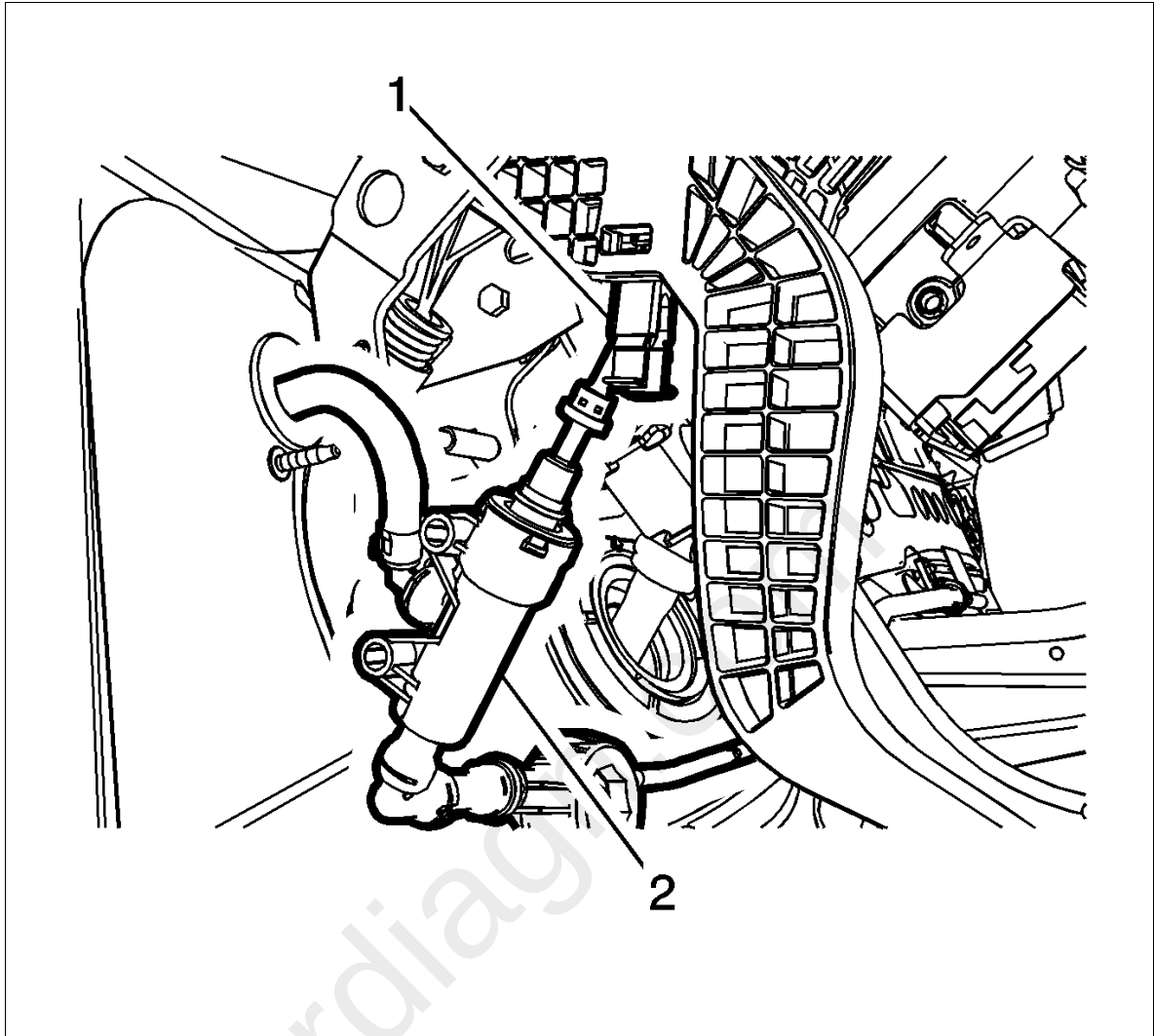
Place shop towels over the carpeting to prevent possible damage.

Fig 1: Clutch Master Cylinder Fasteners



3. Remove the clutch master cylinder fasteners (1).

Fig 2: Clutch Master Cylinder & Pedal Retainer



Courtesy of GENERAL MOTORS COMPANY

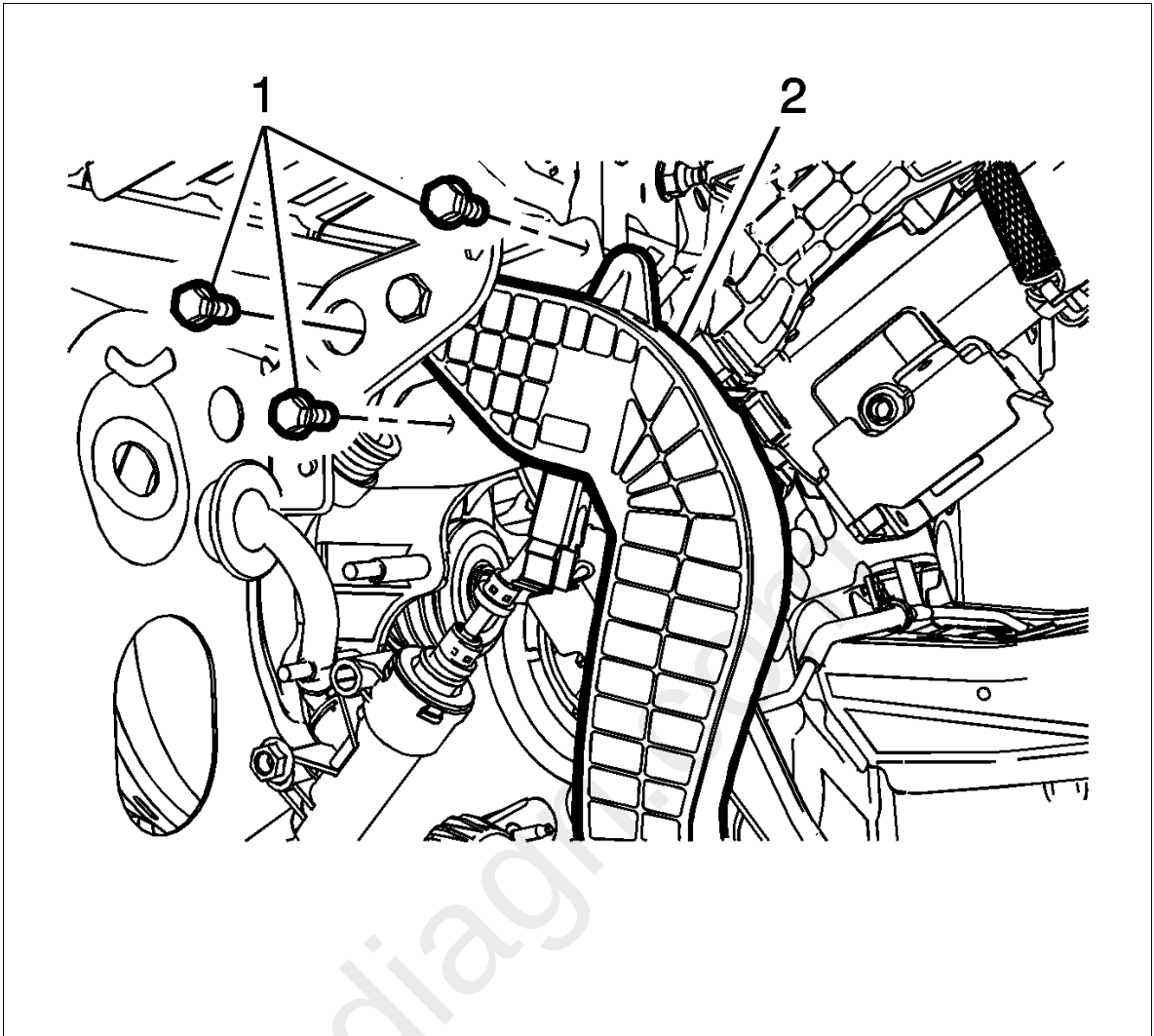
4. Disconnect the clutch master cylinder to clutch pedal retainer (1) from the clutch pedal.

 NOTE:

It is Not necessary to disconnect the reservoir hose or clutch pipe from the master cylinder.

5. Reposition the clutch master cylinder (2) away from the clutch pedal assembly.

Fig 3: Clutch Pedal Assembly & Fasteners

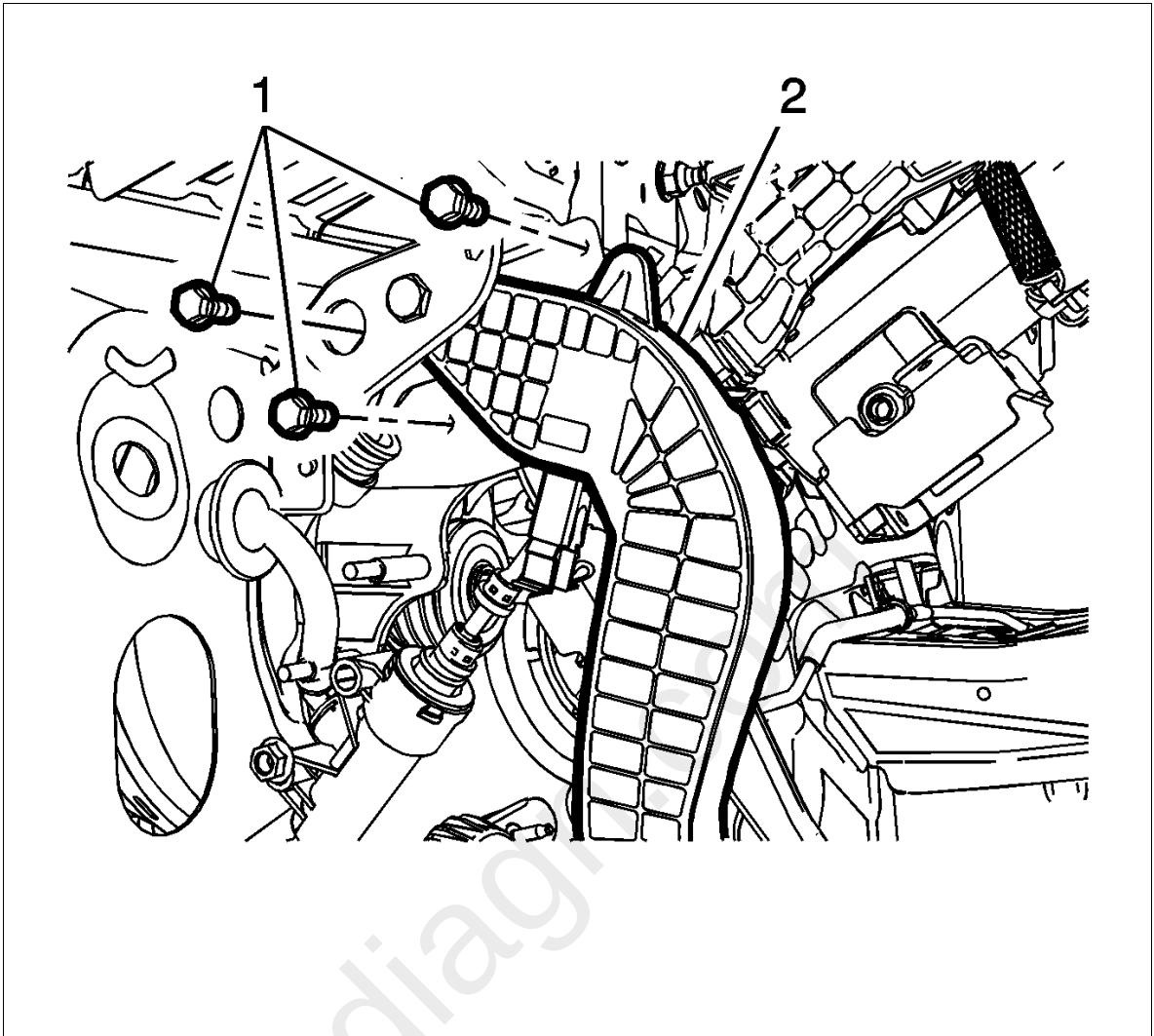


Courtesy of GENERAL MOTORS COMPANY

6. Remove the clutch pedal assembly fasteners (1) from the brake pedal assembly.
7. Remove the clutch pedal assembly (2) from the vehicle.
8. If replacing the clutch pedal, transfer components as necessary.

REPAIR INSTRUCTIONS > CLUTCH PEDAL REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Clutch Pedal Assembly & Fasteners



Courtesy of GENERAL MOTORS COMPANY

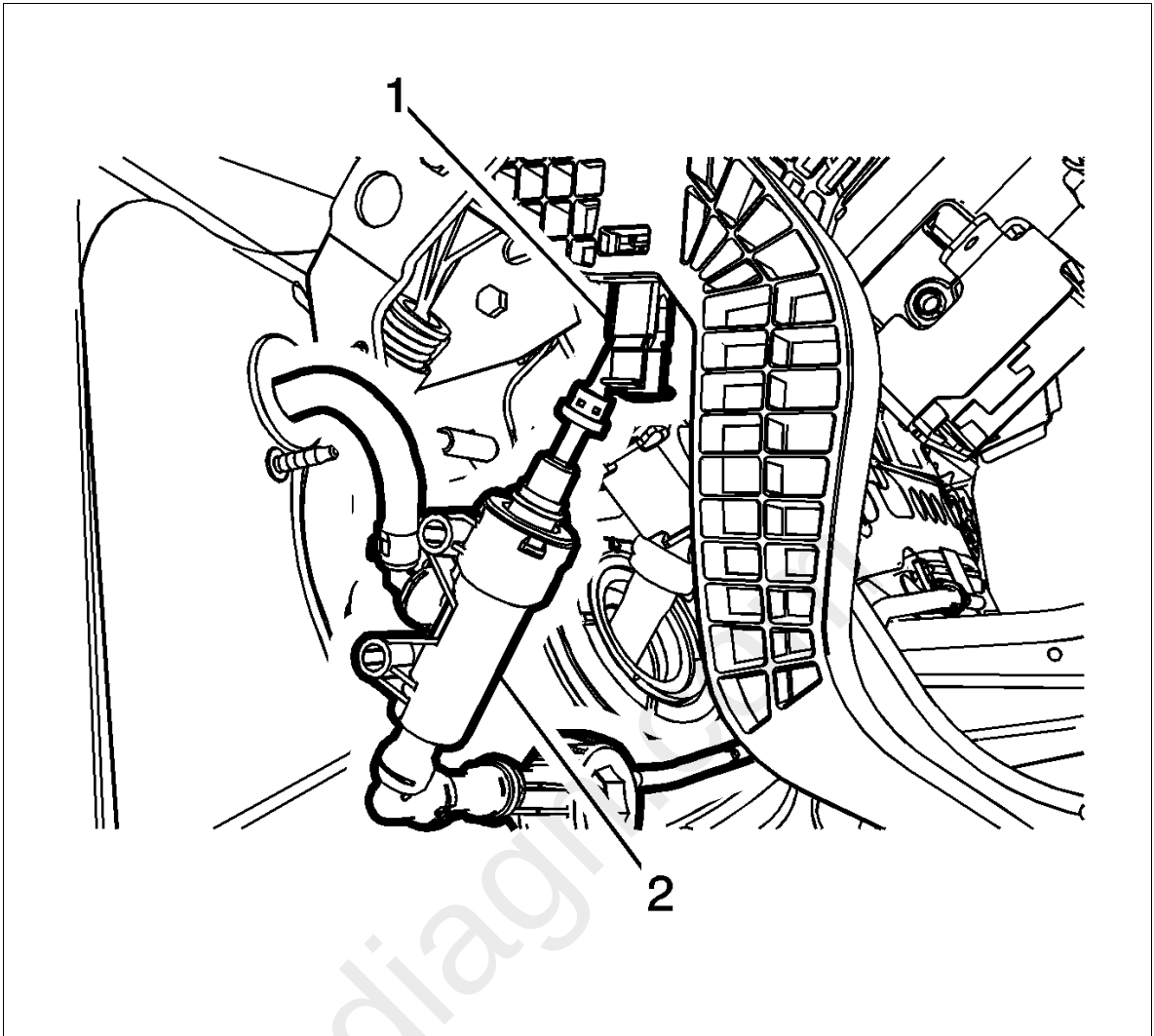
1. Install the clutch pedal assembly (2) into the vehicle.

 **CAUTION:**

Refer to Fastener Caution .

2. Install the fasteners (1) securing the clutch pedal assembly to the brake pedal assembly and tighten to 20 N.m (15 lb ft).

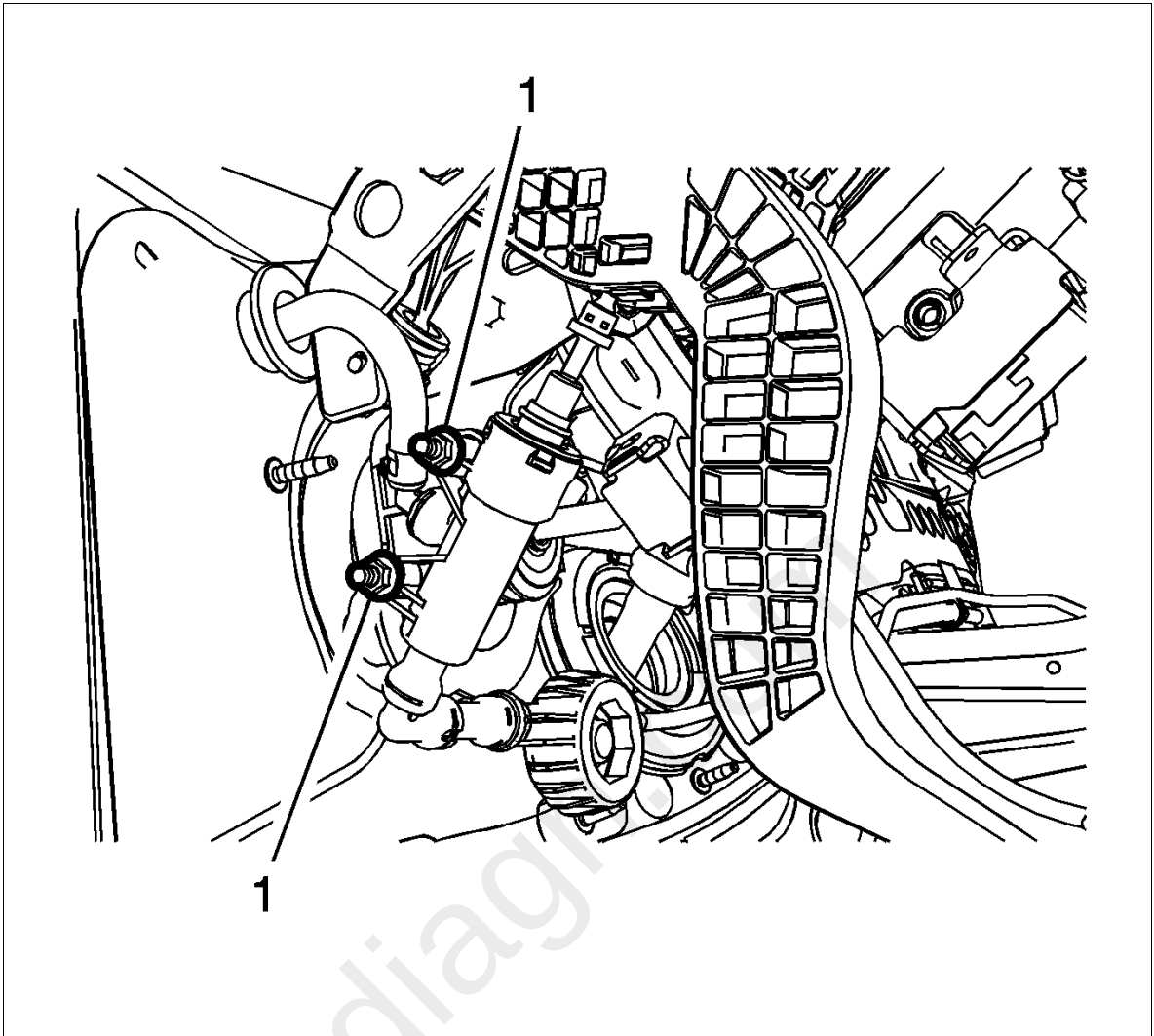
Fig 2: Clutch Master Cylinder & Pedal Retainer



Courtesy of GENERAL MOTORS COMPANY

3. Reposition the clutch master cylinder (2) to the clutch pedal assembly.
4. Connect the clutch master cylinder to clutch pedal retainer (1) to the clutch pedal.

Fig 3: Clutch Master Cylinder Fasteners

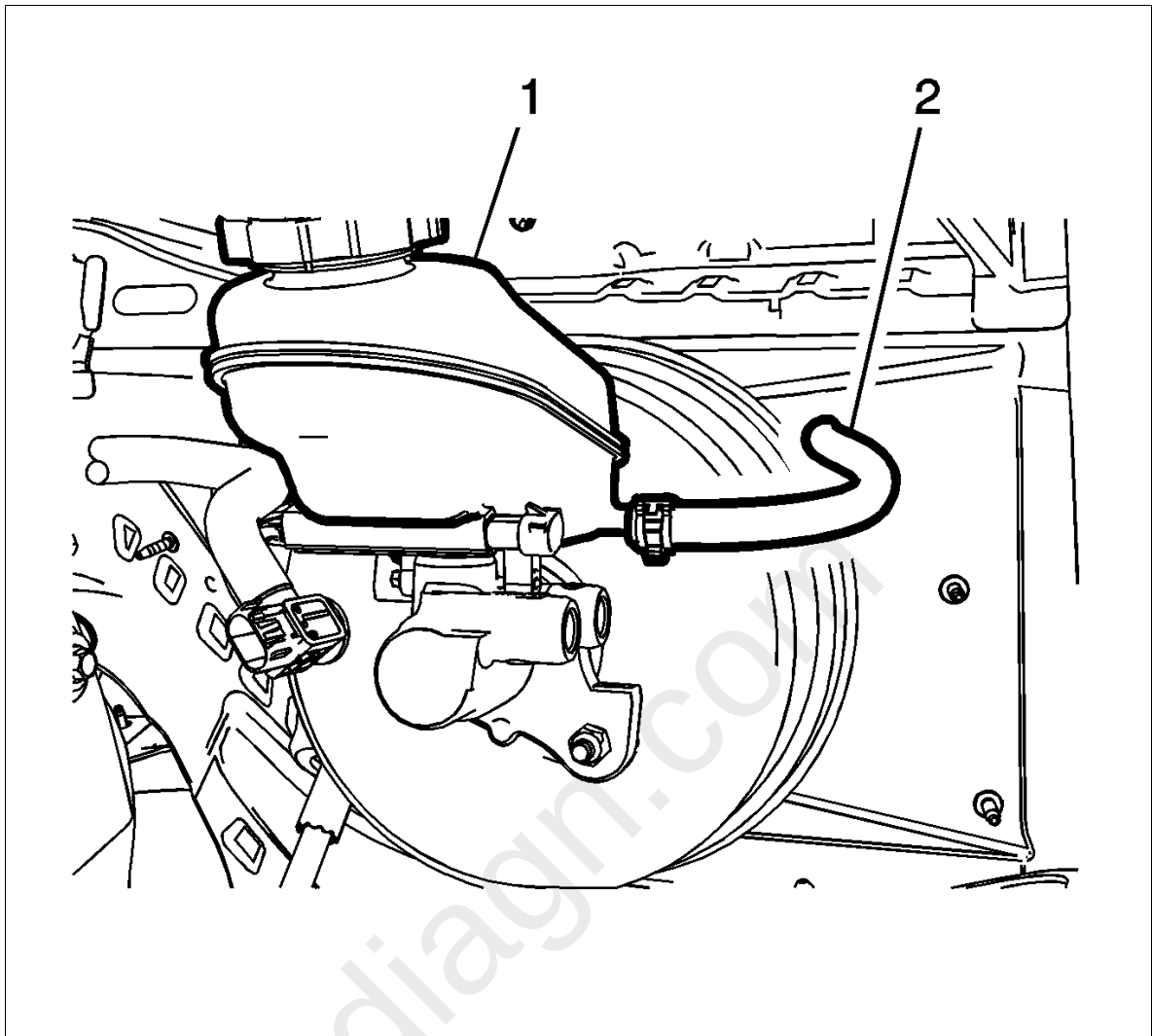


Courtesy of GENERAL MOTORS COMPANY

5. Install the clutch master cylinder fasteners (1).
6. Connect the clutch pedal position sensor electrical connector.
7. Check for proper clutch pedal movement and operation.
8. Install the instrument panel knee bolster. Instrument Panel Lower Trim Panel Replacement (with UV6) Instrument Panel Lower Trim Panel Replacement (without UV6)
9. Perform the clutch pedal position learn procedure. Clutch Pedal Position Sensor Learn

**REPAIR INSTRUCTIONS > CLUTCH MASTER CYLINDER REPLACEMENT >
REMOVAL PROCEDURE**

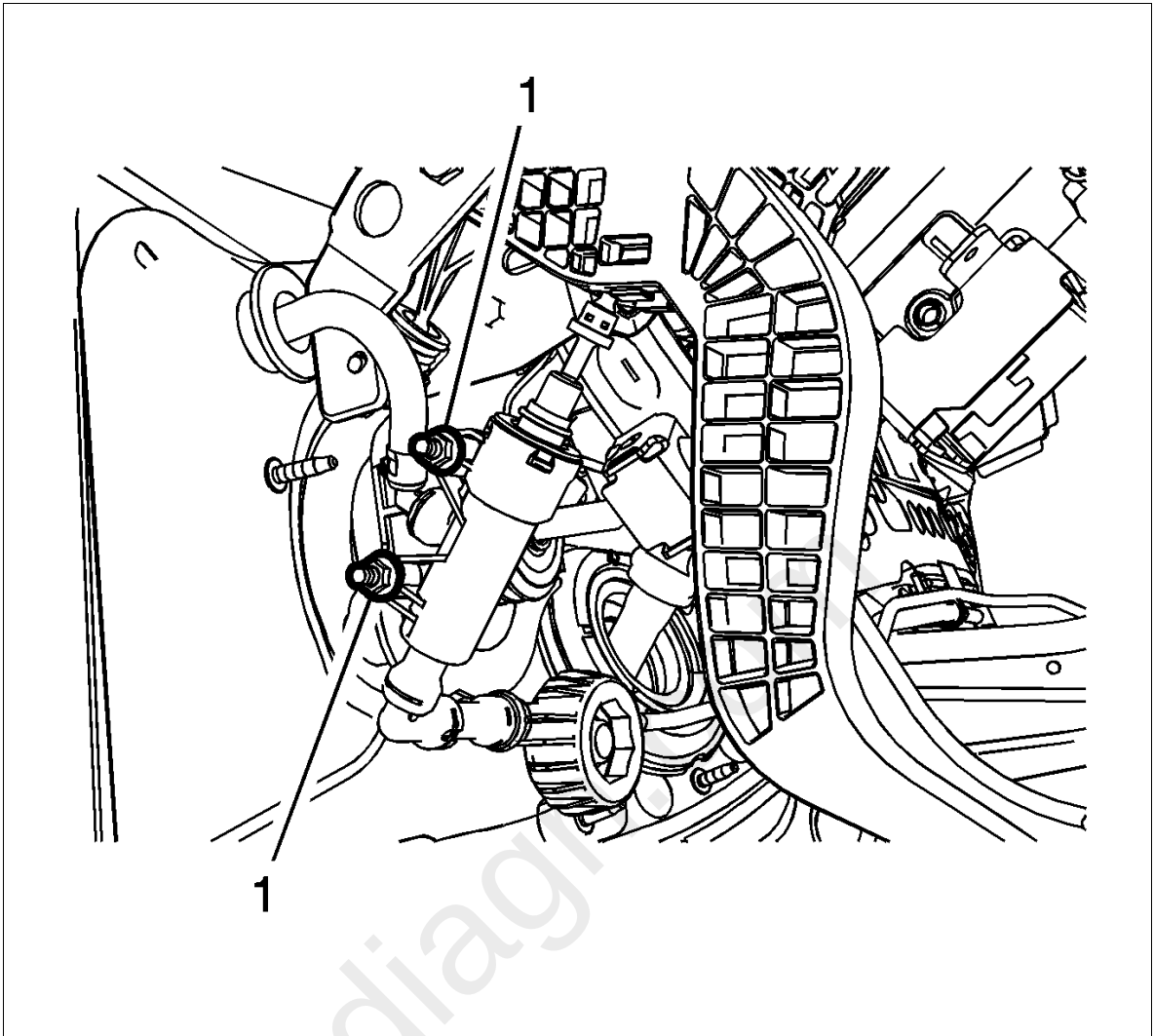
Fig 1: Brake Master Cylinder Reservoir & Clutch Feed Hose



Courtesy of GENERAL MOTORS COMPANY

1. Using a suitable device, remove the brake fluid from the brake master cylinder reservoir (1).
2. Place a suitable container or shop towels under the clutch feed hose (2), then disconnect the hose from the brake master cylinder reservoir.
3. Cap the master cylinder reservoir to prevent fluid loss and fluid contamination.
4. Remove the instrument panel knee bolster. Refer to Instrument Panel Knee Bolster Replacement (Driver Knee Bolster Reinforcement) .
5. Remove the instrument panel lower trim panel. Refer to Instrument Panel Lower Trim Panel Replacement (with UV6)Instrument Panel Lower Trim Panel Replacement (without UV6) .

Fig 2: Clutch Master Cylinder Fasteners



Courtesy of GENERAL MOTORS COMPANY

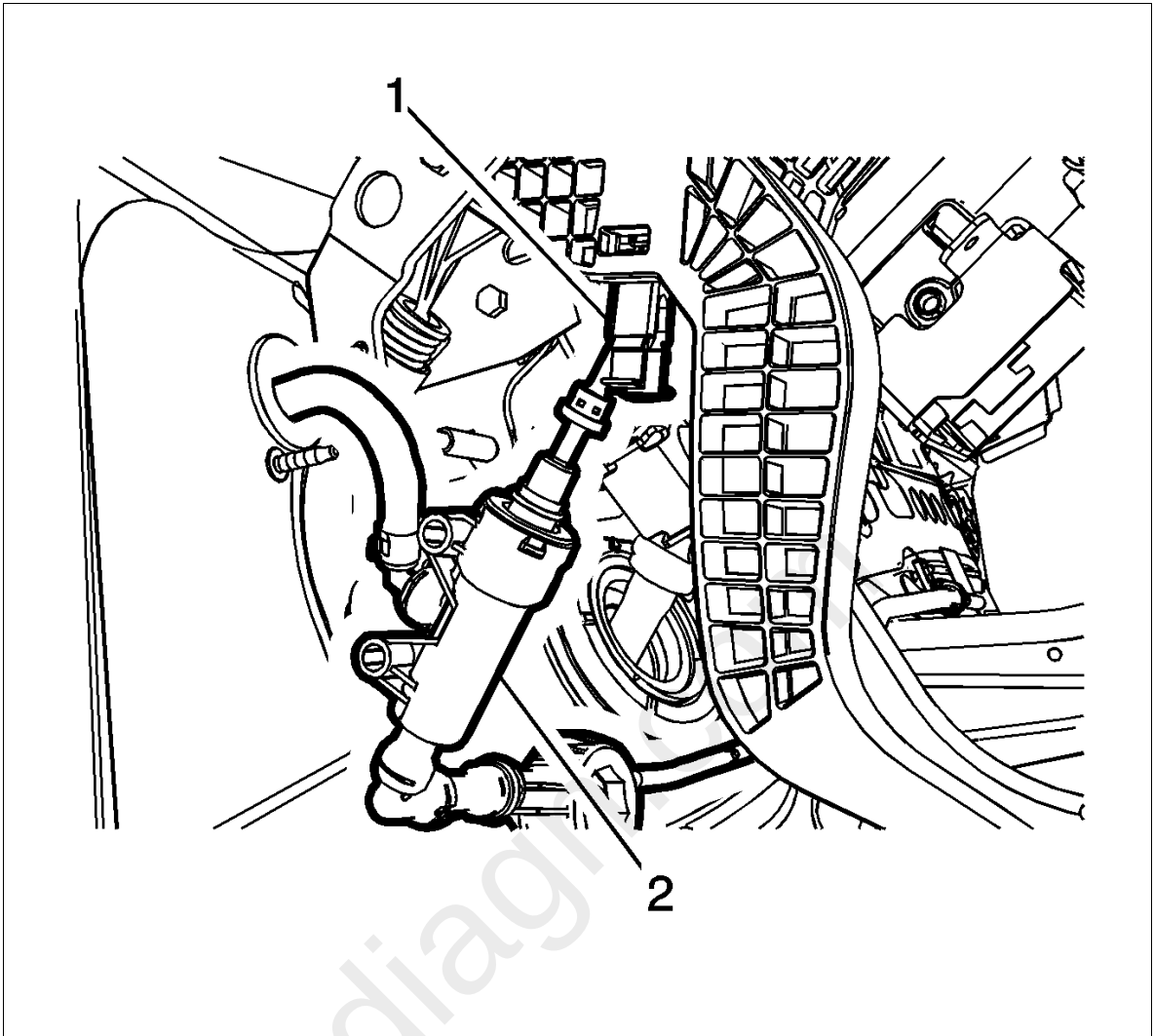


NOTE:

Place shop towels over the carpeting to prevent possible damage.

6. Remove the clutch master cylinder fasteners (1).

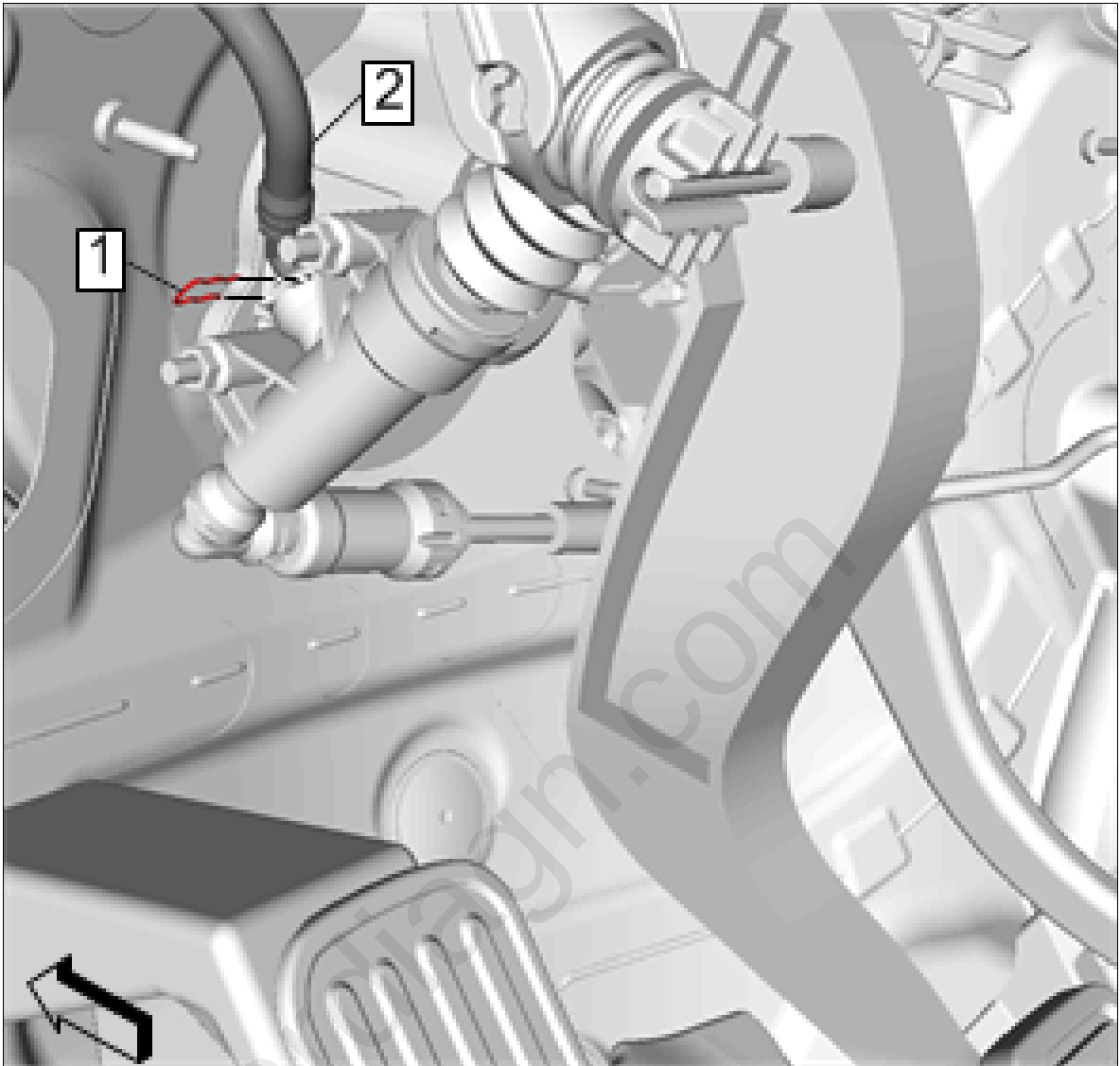
Fig 3: Clutch Master Cylinder & Pedal Retainer



Courtesy of GENERAL MOTORS COMPANY

7. Disconnect the clutch master cylinder to clutch pedal retainer (1) from the clutch pedal by squeezing the tabs together and pushing the clutch pedal up.

Fig 4: Clutch Master Cylinder Feed Hose And Retaining Clip



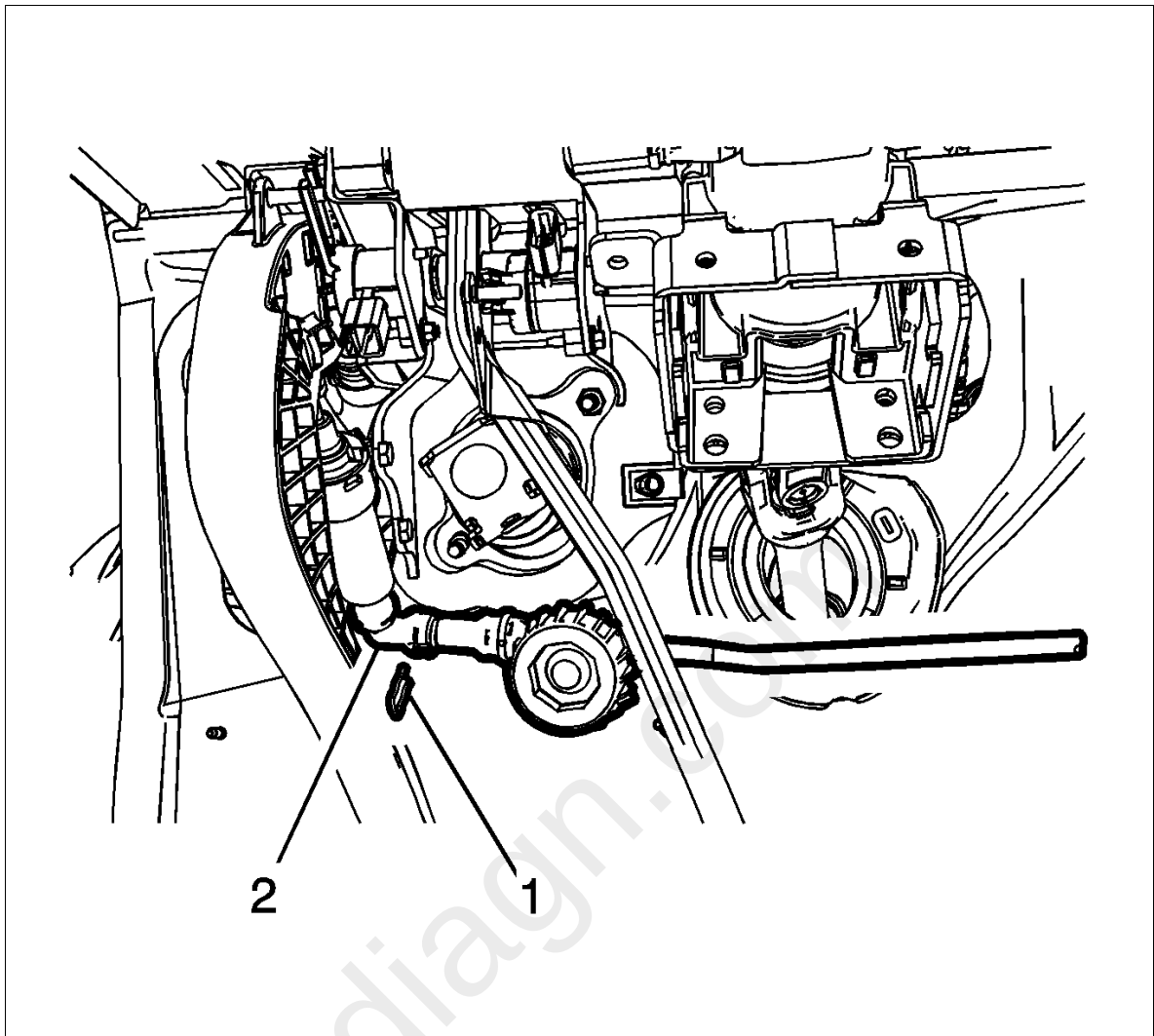
Courtesy of GENERAL MOTORS COMPANY

 NOTE:

After disconnecting the feed hose, cap hose end and position upward to avoid leakage.

8. Remove the clutch master cylinder feed hose retaining clip (1) from the hose.
9. Disconnect the clutch master cylinder feed hose (2) from the clutch master cylinder.

Fig 5: Clutch Pipe & Retaining Clip



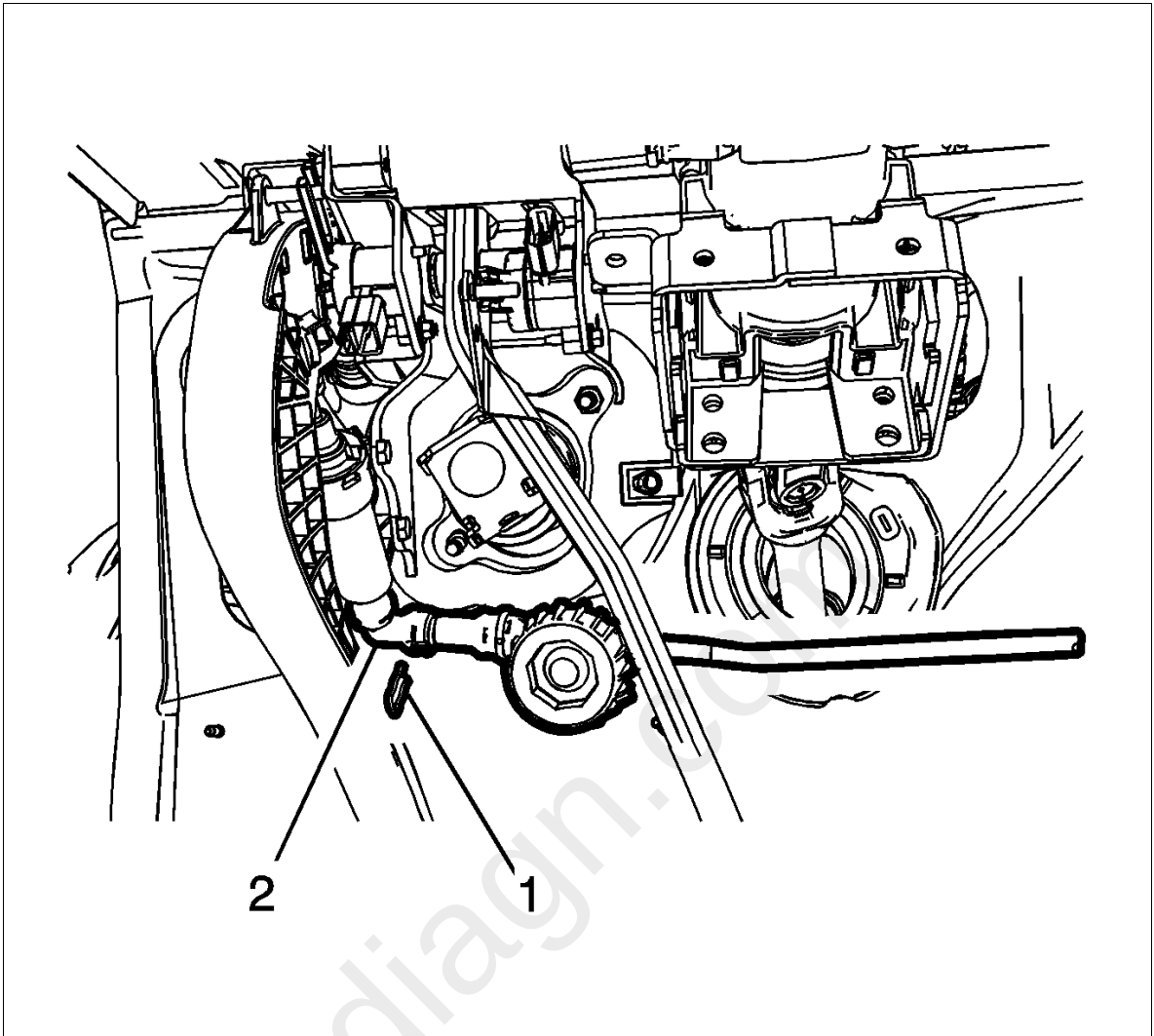
Courtesy of GENERAL MOTORS COMPANY

10. Remove the clutch pipe retaining clip (1) from the clutch pipe.
11. Disconnect the clutch pipe (2) from the clutch master cylinder, then cap pipe end.
12. Carefully remove the clutch master cylinder from the vehicle.

REPAIR INSTRUCTIONS > CLUTCH MASTER CYLINDER REPLACEMENT > INSTALLATION PROCEDURE

1. Position the clutch master cylinder to the brake pedal assembly.

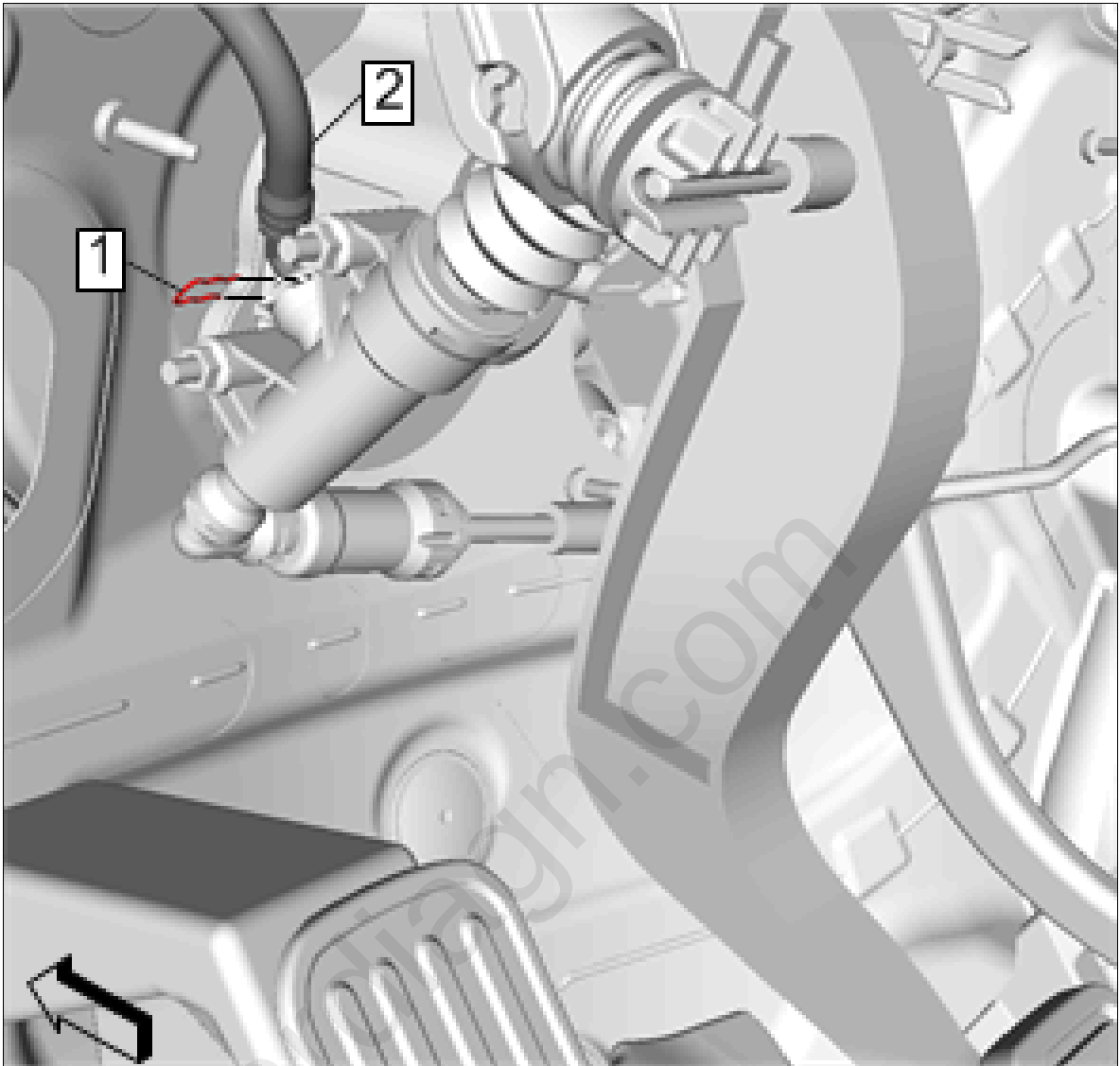
Fig 1: Clutch Pipe & Retaining Clip



Courtesy of GENERAL MOTORS COMPANY

2. Connect the clutch pipe (2) to the clutch master cylinder.
3. Install the clutch pipe retaining clip (1) to the clutch pipe.

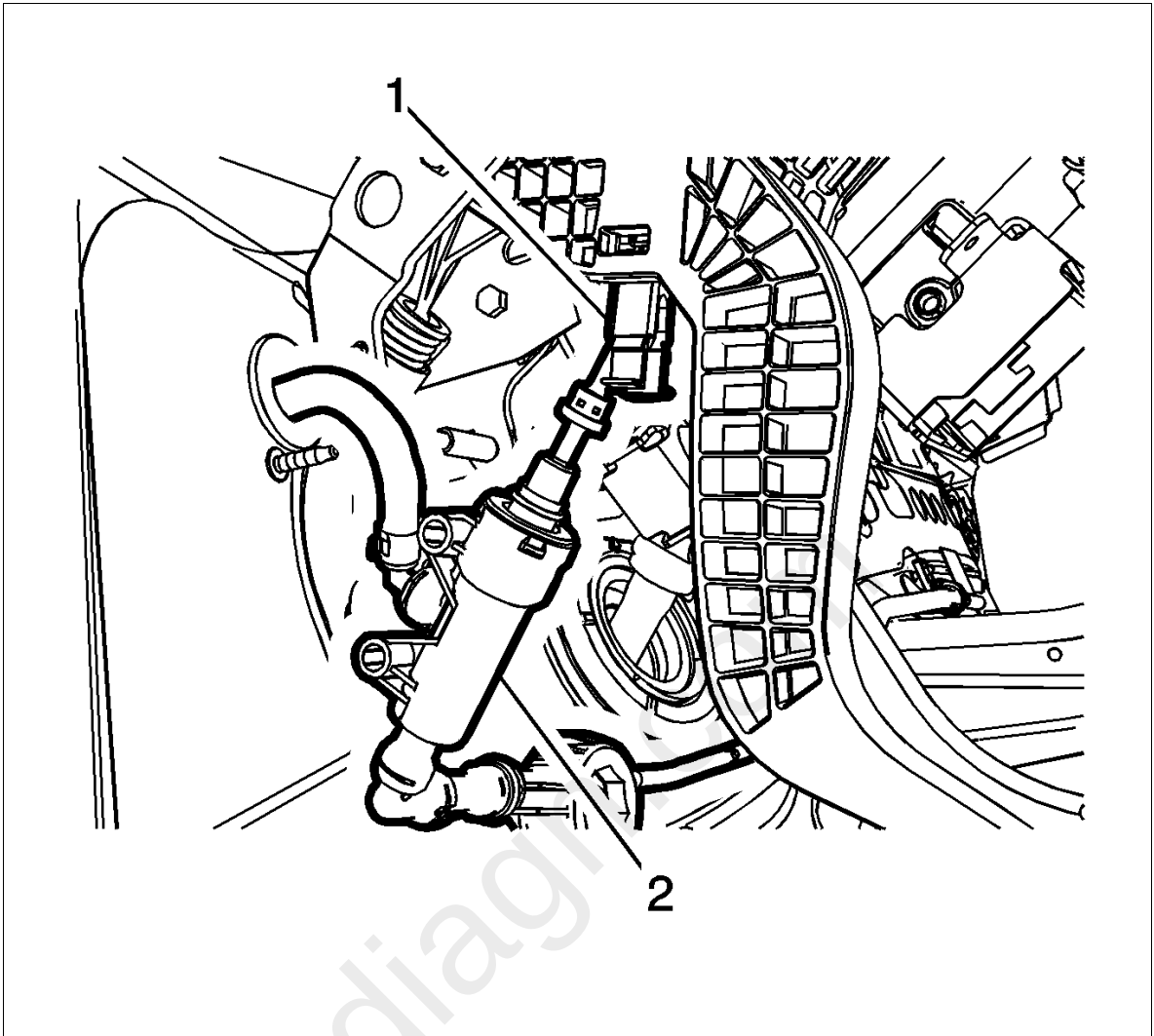
Fig 2: Clutch Master Cylinder Feed Hose And Retaining Clip



Courtesy of GENERAL MOTORS COMPANY

4. Connect the clutch master cylinder feed hose (2) to the clutch master cylinder.
5. Install the clutch master cylinder feed hose retaining clip (1) to the hose.

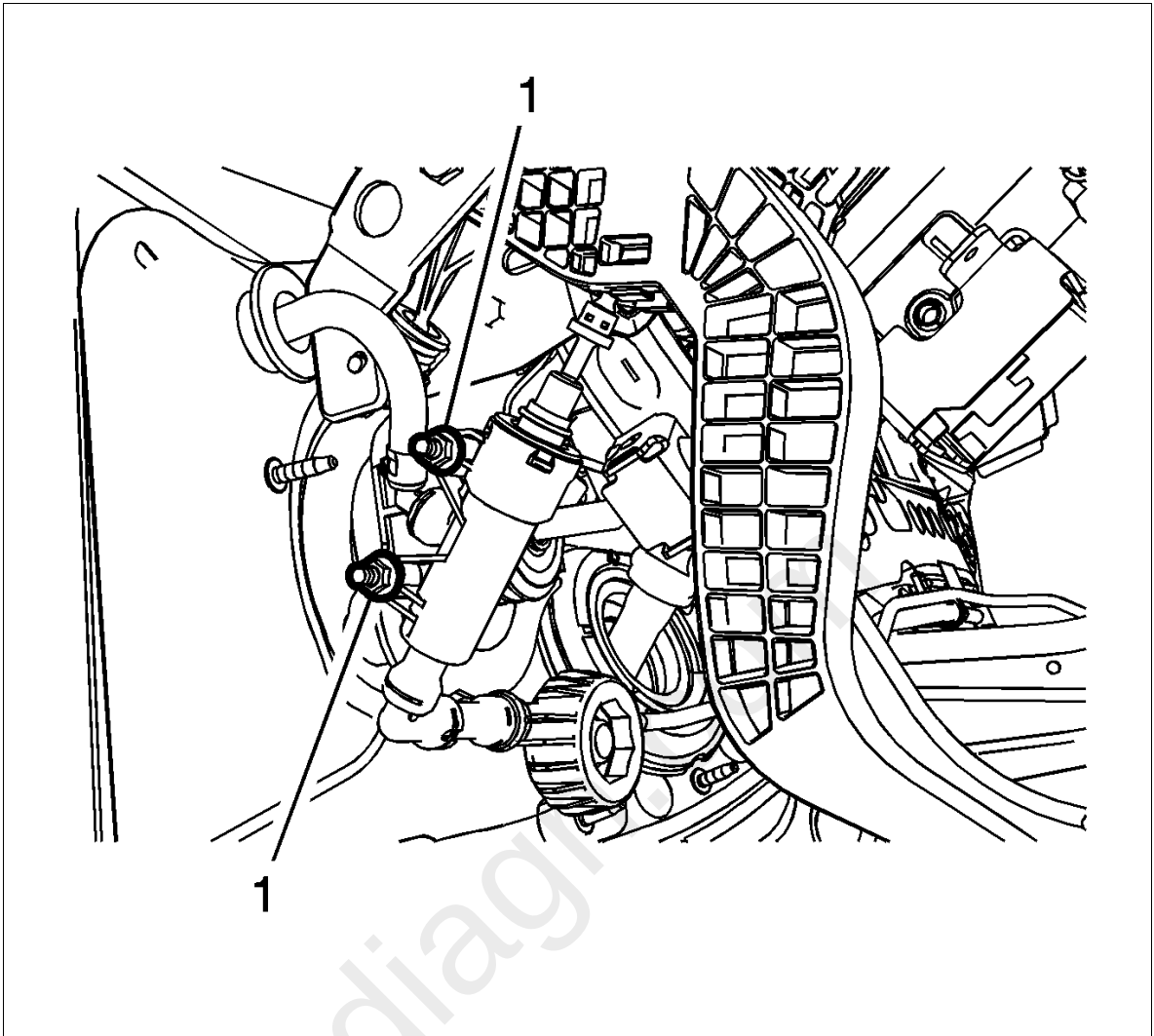
Fig 3: Clutch Master Cylinder & Pedal Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Connect the clutch master cylinder to clutch pedal retainer (1) in the clutch pedal.

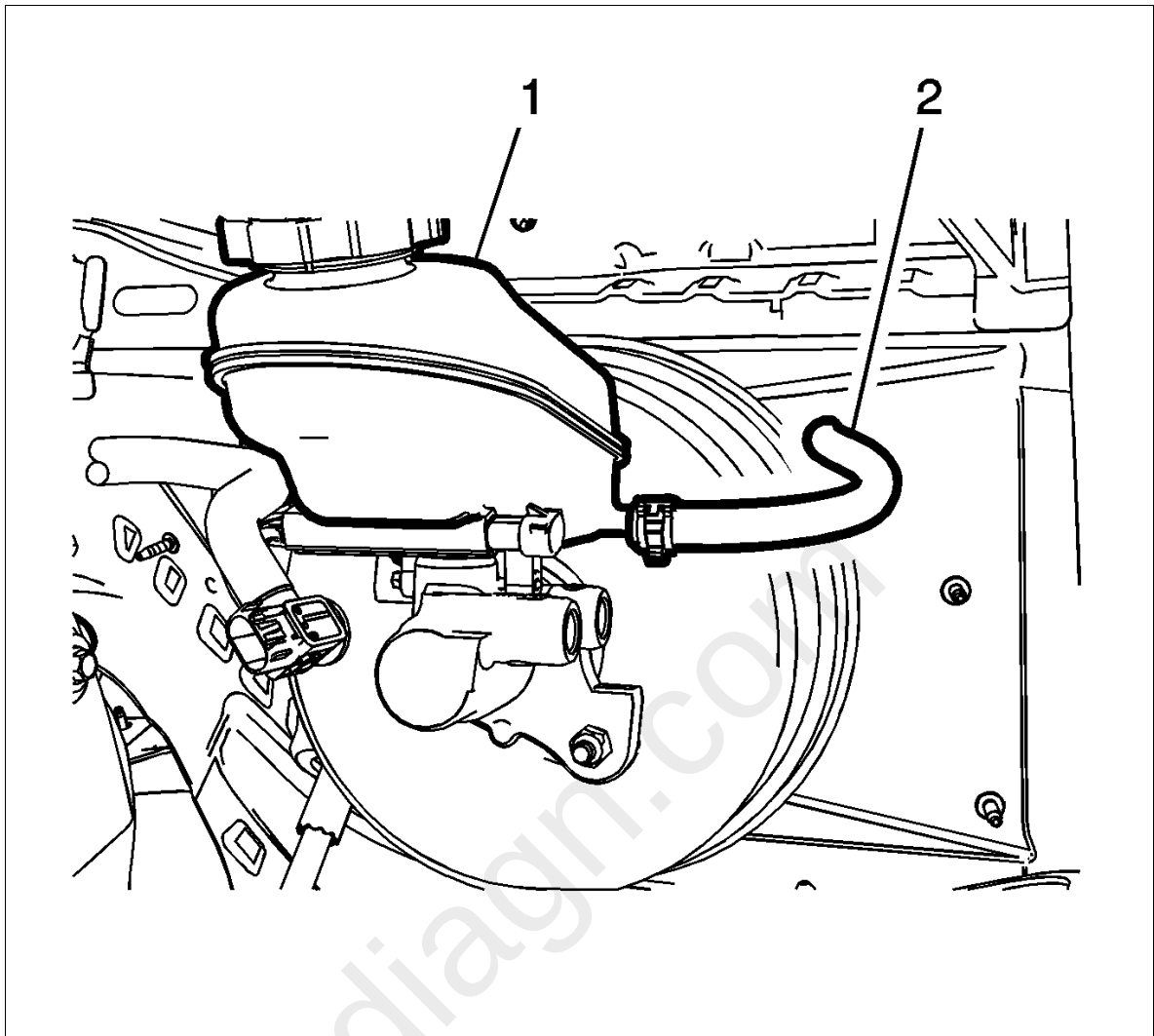
Fig 4: Clutch Master Cylinder Fasteners



Courtesy of GENERAL MOTORS COMPANY

7. Install the clutch master cylinder fasteners (1).
8. Install the instrument panel knee bolster. Refer to Instrument Panel Knee Bolster Replacement (Driver Knee Bolster Reinforcement) .
9. Install the instrument panel lower trim panel. Refer to Instrument Panel Lower Trim Panel Replacement (with UV6)Instrument Panel Lower Trim Panel Replacement (without UV6) .

Fig 5: Brake Master Cylinder Reservoir & Clutch Feed Hose



Courtesy of GENERAL MOTORS COMPANY

10. Connect the clutch feed hose (2) to the brake master cylinder reservoir.
11. Fill the brake master cylinder reservoir (1) with fluid. Refer to Adhesives, Fluids, Lubricants, and Sealers .
12. Bleed the clutch hydraulic system. Refer to Hydraulic Clutch System Bleeding .
13. Check for proper clutch pedal movement and operation.

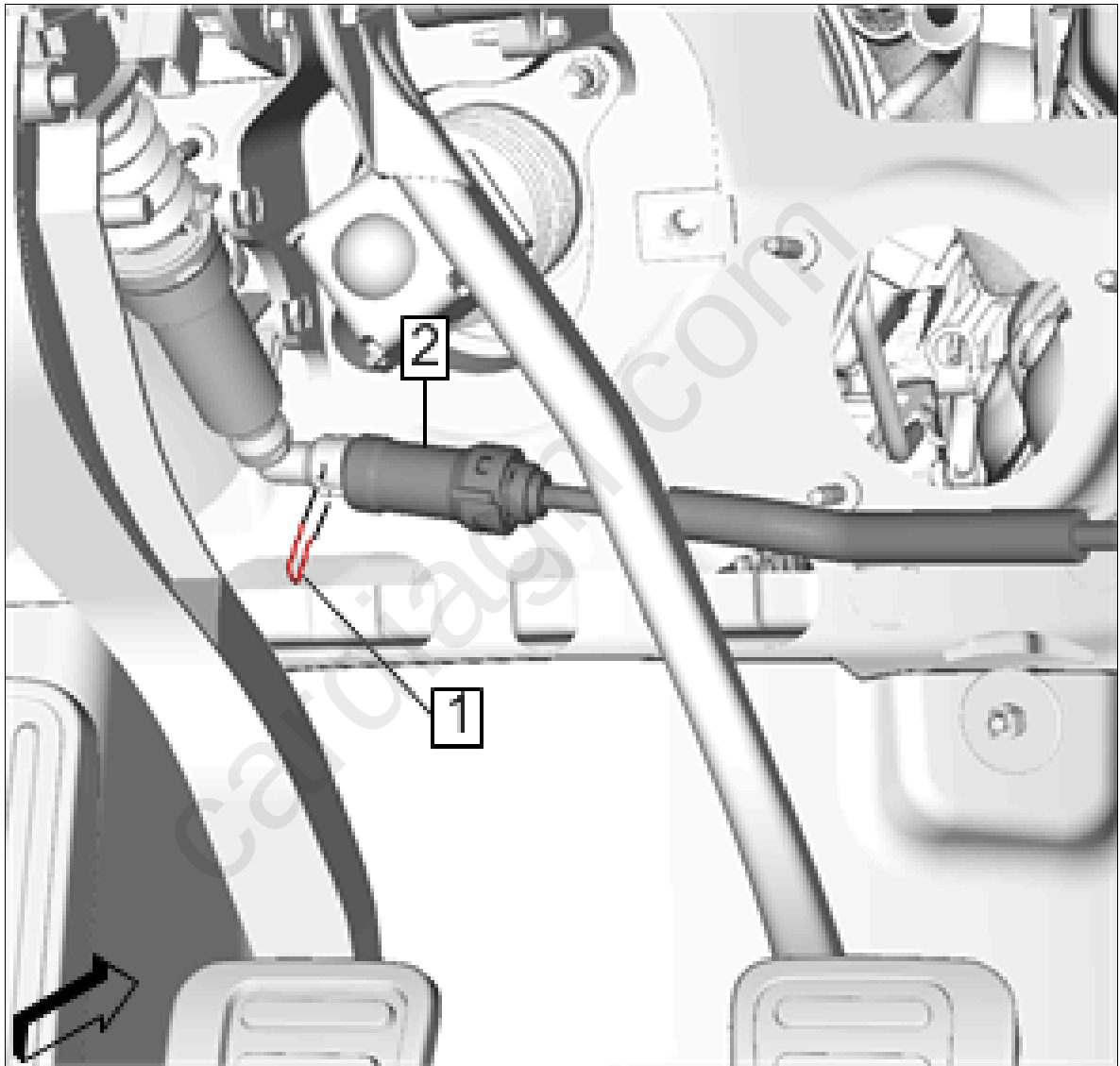
REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT (M13) > REMOVAL PROCEDURE

 CAUTION:

Refer to Brake Fluid Effects on Paint and Electrical Components Caution .

1. Remove the heater and air conditioning evaporator and blower module from the vehicle. Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LT1) Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LGX)

Fig 1: Hydraulic Clutch Hose/Pipe And Clip



Courtesy of GENERAL MOTORS COMPANY

 NOTE:

Place shop towels over the carpeting to prevent possible damage.

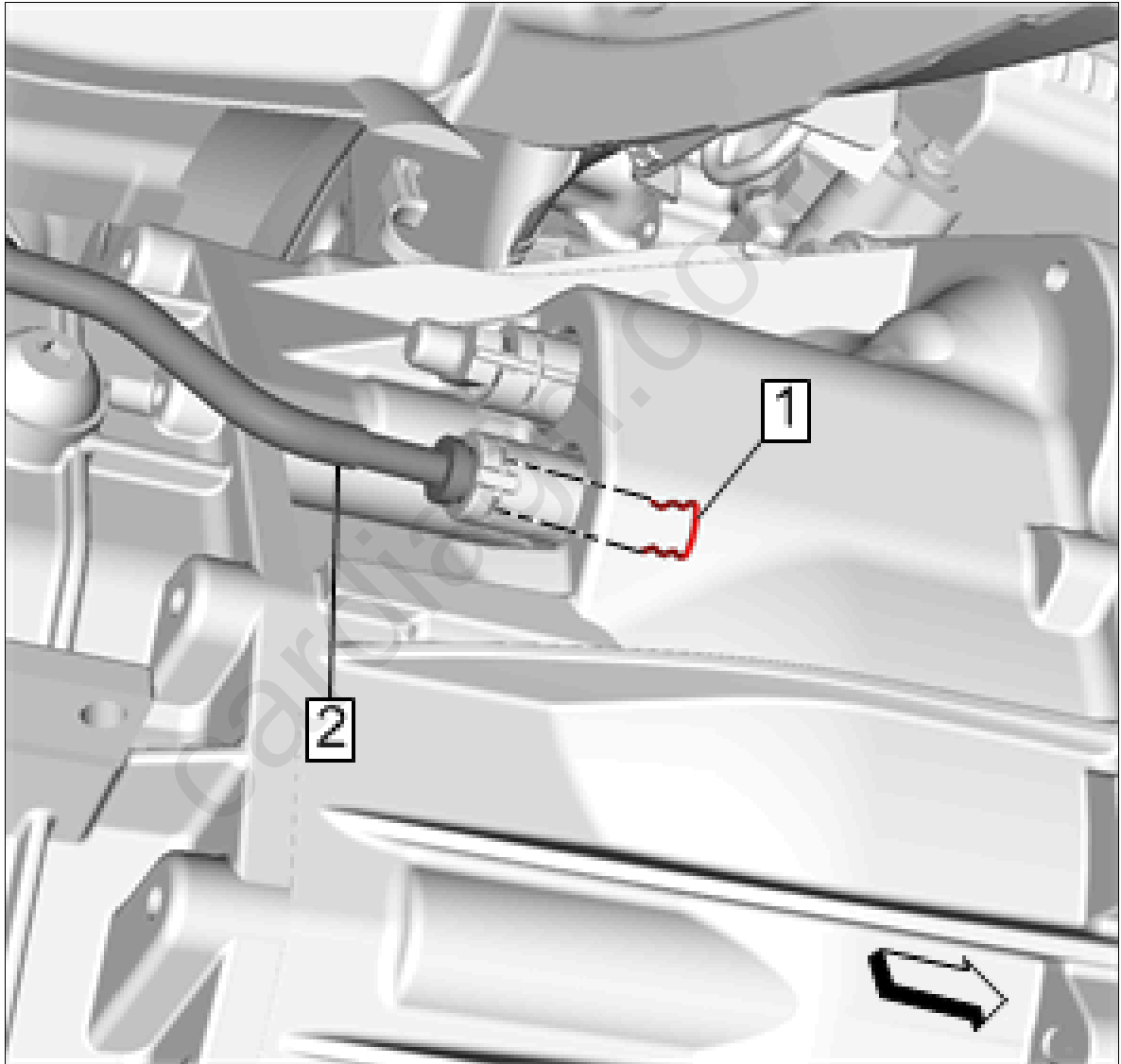
2. Remove the hydraulic clutch hose/pipe retaining clip (1) from the clutch master cylinder.

 NOTE:

Install a cap or plug to the exposed hose and clutch master cylinder fittings in order to prevent fluid loss and contamination.

3. Disconnect the hydraulic clutch hose/pipe (2) from the clutch master cylinder.
4. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)

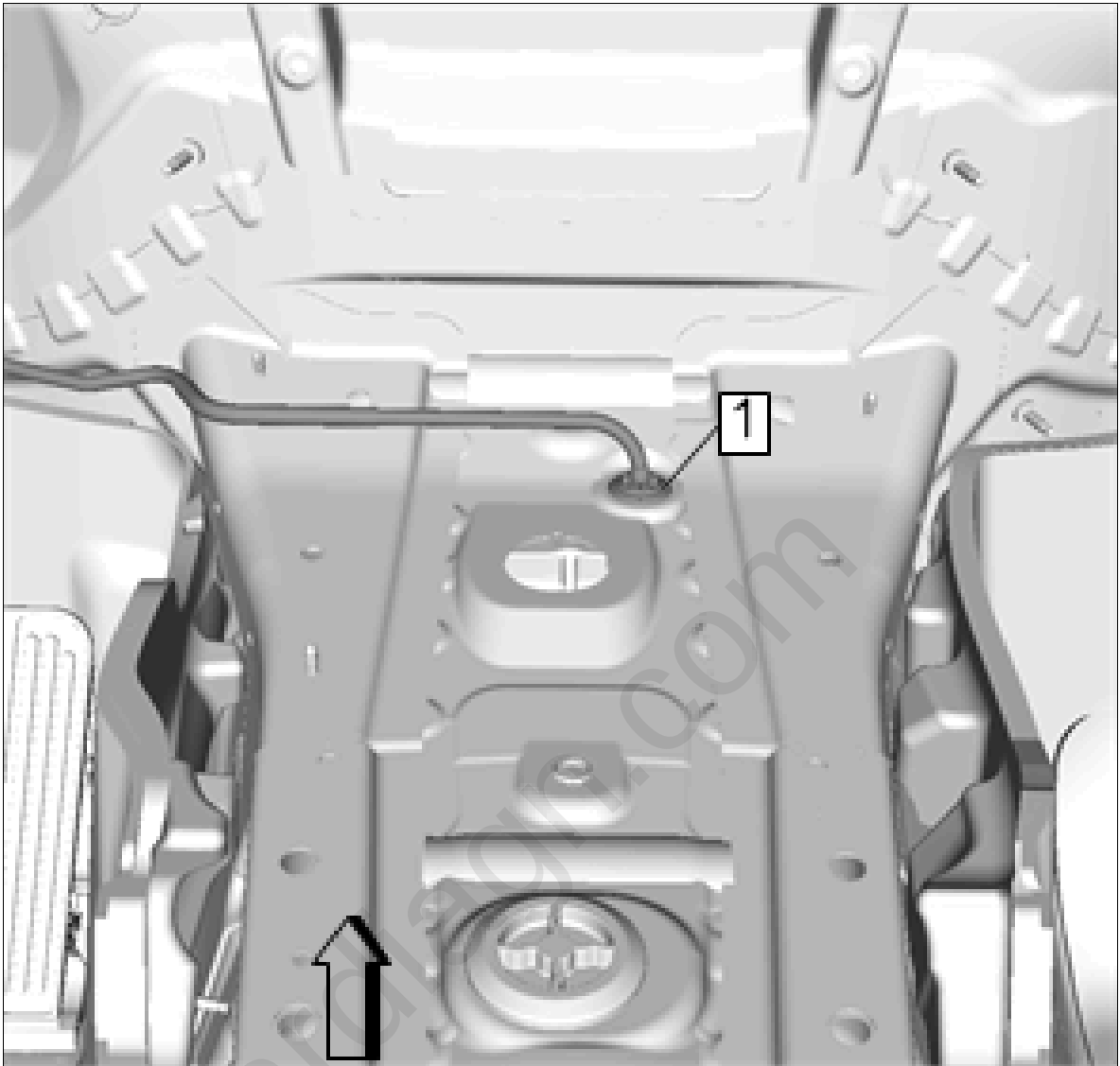
Fig 2: Lower Slave Cylinder Hose



Courtesy of GENERAL MOTORS COMPANY

5. Remove the hydraulic clutch hose/pipe (2) retaining clip from the clutch slave cylinder.
6. Disconnect the hydraulic clutch hose/pipe (2) from the clutch slave cylinder. Plug the lower hose end.
7. Lower the vehicle.

Fig 3: Floor Panel Grommet



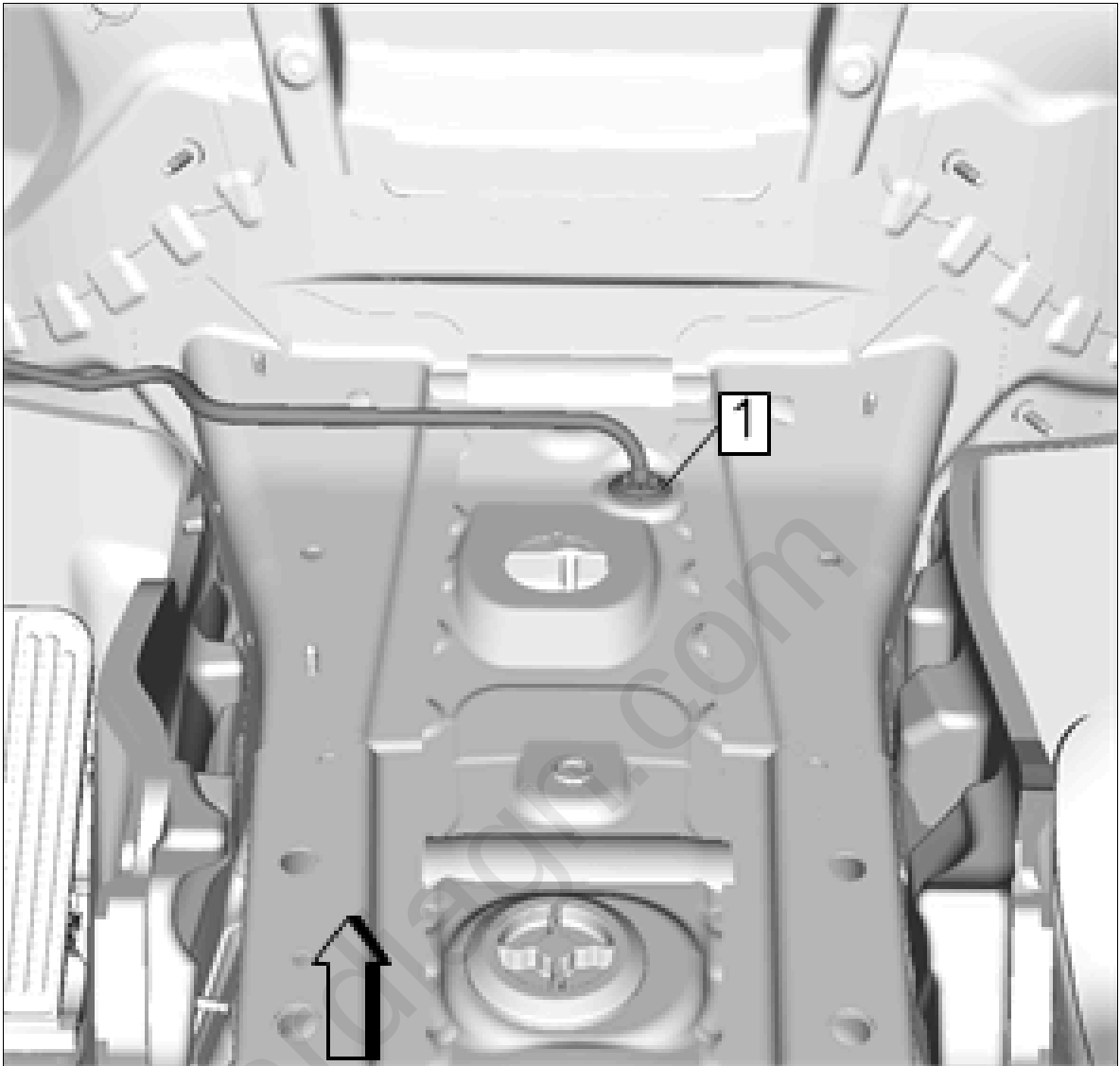
Courtesy of GENERAL MOTORS COMPANY

8. Remove grommet (1) from the floor panel and then remove the hydraulic clutch hose/pipe.

REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT (M13) > INSTALLATION PROCEDURE

1. Position the hydraulic clutch hose/pipe in the vehicle.

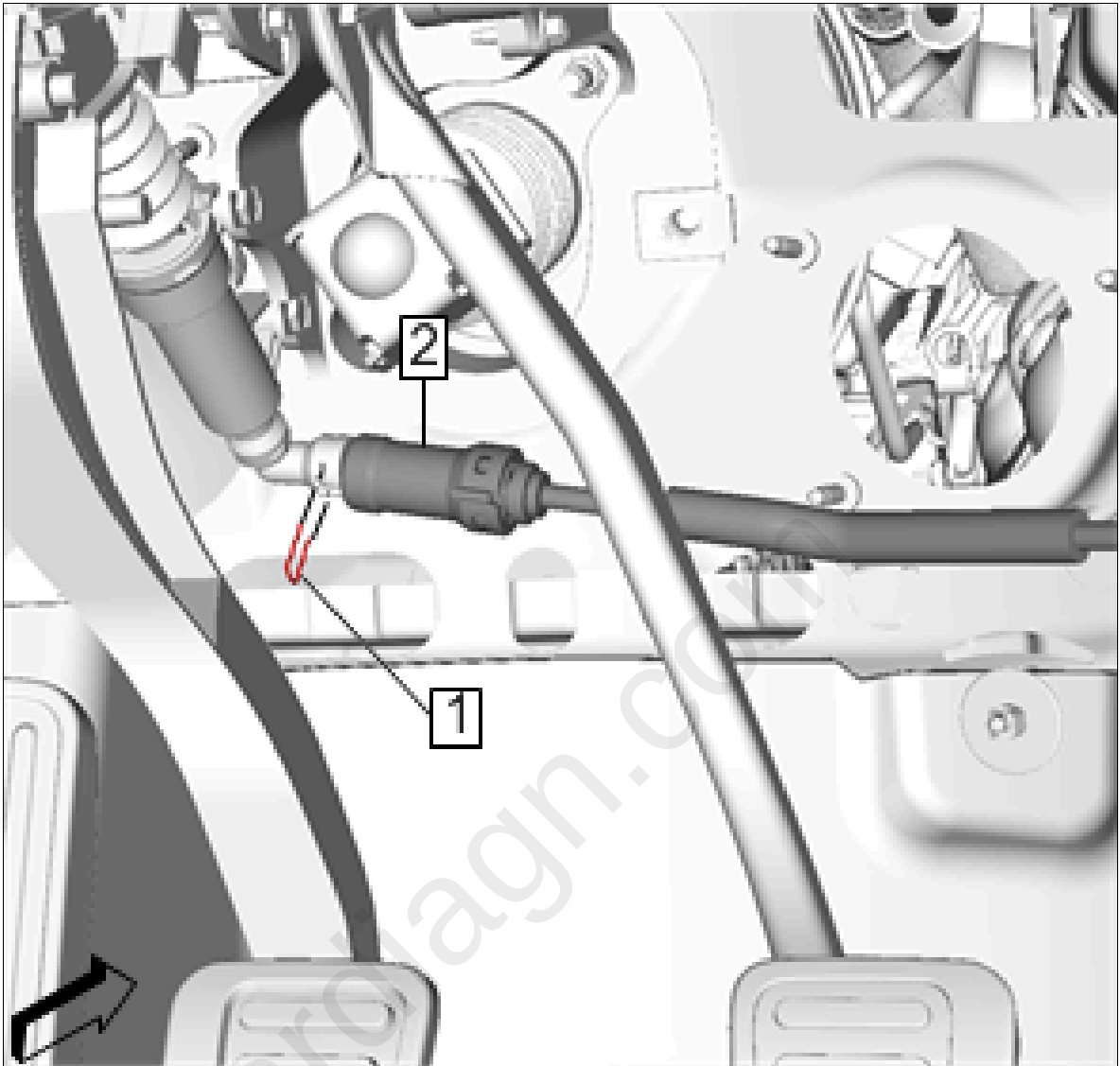
Fig 1: Floor Panel Grommet



Courtesy of GENERAL MOTORS COMPANY

2. Seat the grommet (1) into the floor.

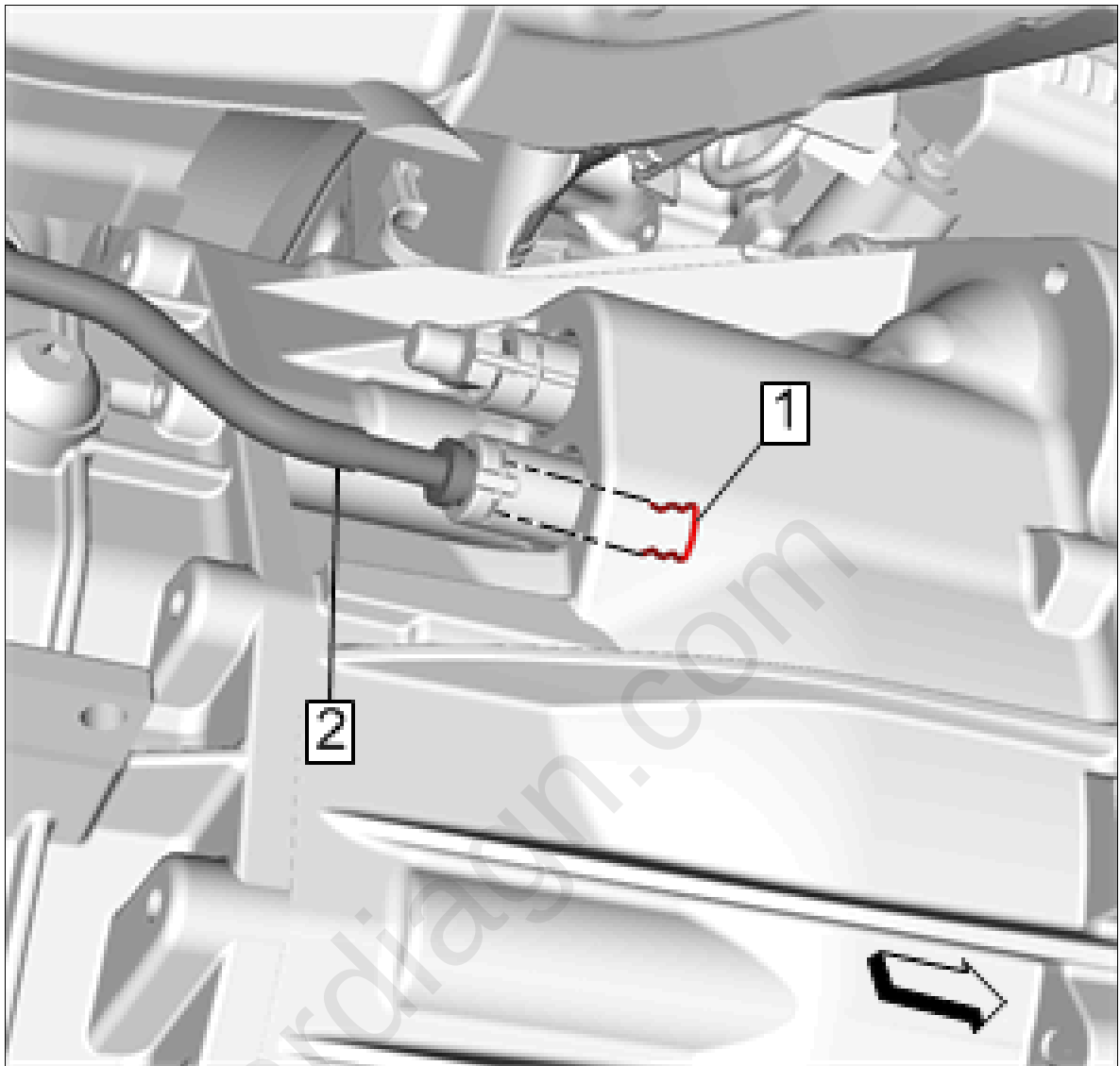
Fig 2: Hydraulic Clutch Hose/Pipe And Clip



Courtesy of GENERAL MOTORS COMPANY

3. Connect the hydraulic clutch hose/pipe (2) to the clutch master cylinder.
4. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch master cylinder.
5. Raise the vehicle.

Fig 3: Lower Slave Cylinder Hose



Courtesy of GENERAL MOTORS COMPANY

6. Connect the lower slave cylinder hose (2) to the slave cylinder.
7. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch slave cylinder.
8. Bleed the clutch hydraulic system. Hydraulic Clutch System Bleeding
9. Lower the vehicle.
10. Install the heater and air conditioning evaporator and blower module in the vehicle. Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LT1) Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LGX)

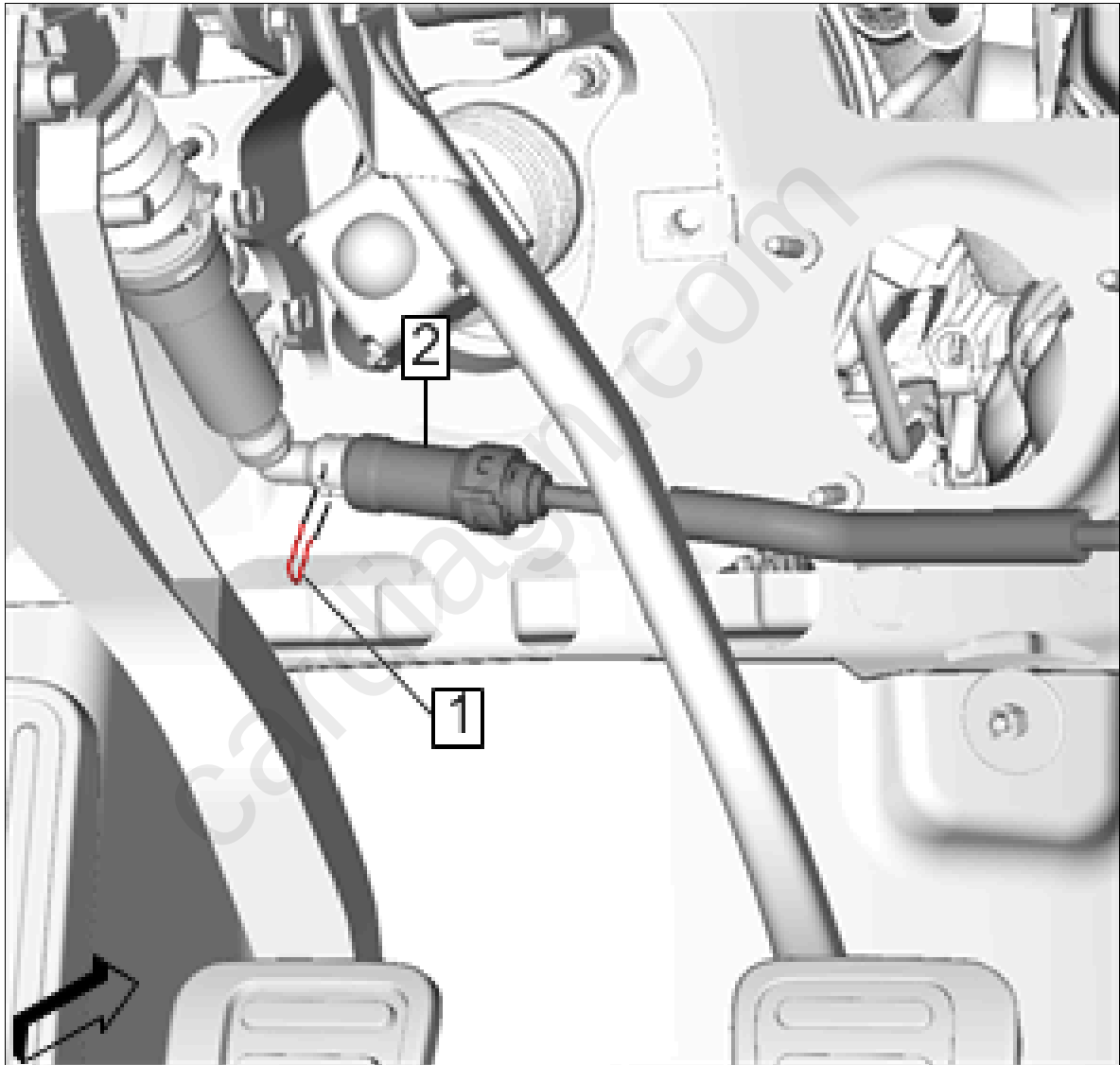
REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT (MM6) > REMOVAL PROCEDURE

 CAUTION:

Refer to Brake Fluid Effects on Paint and Electrical Components Caution .

1. Remove the heater and air conditioning evaporator and blower module from the vehicle. Refer to Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LT1)Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LGX)

Fig 1: Hydraulic Clutch Hose/Pipe And Clip



Courtesy of GENERAL MOTORS COMPANY

 NOTE:

Place shop towels over the carpeting to prevent possible damage.

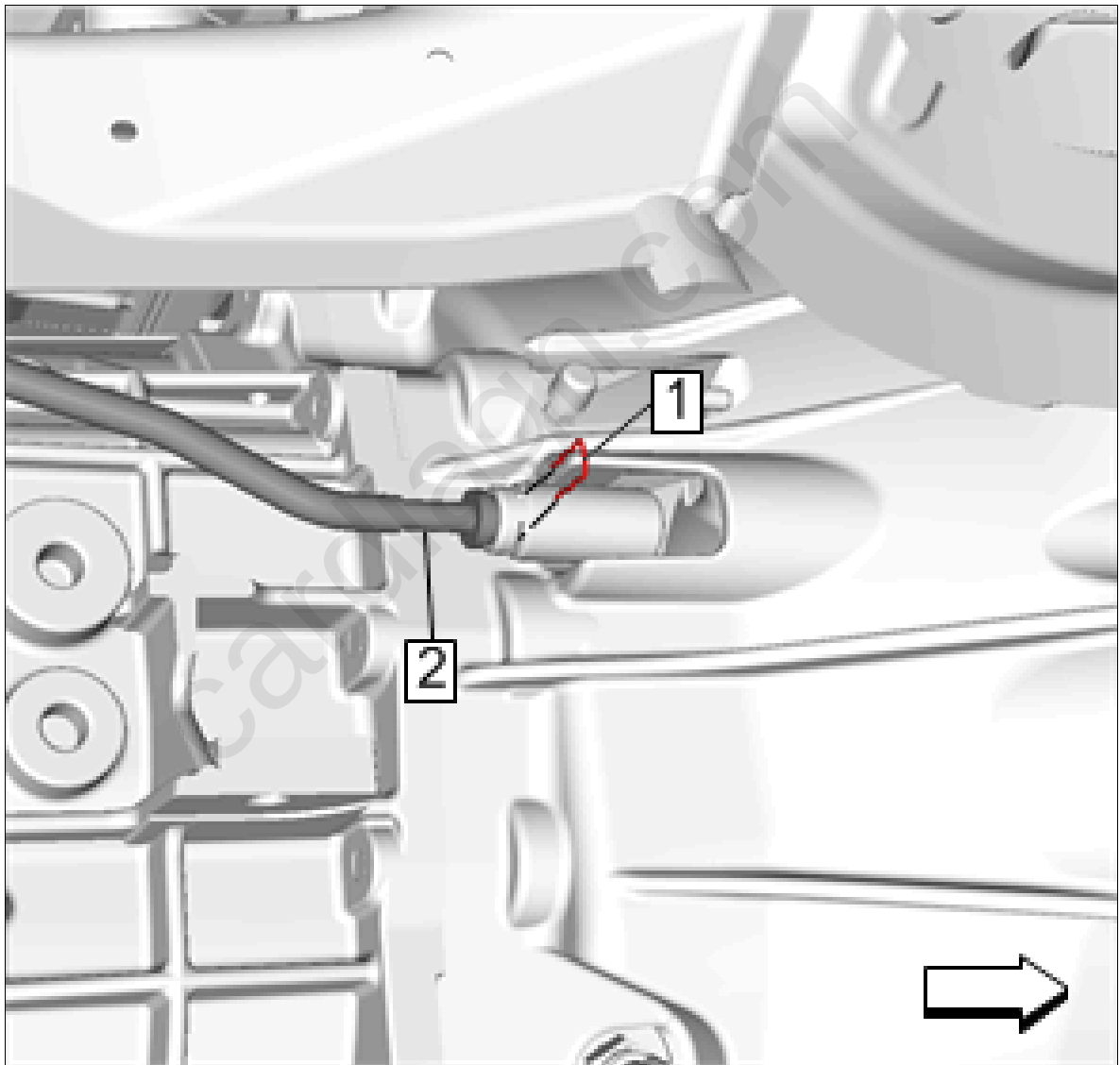
2. Remove the hydraulic clutch hose/pipe retaining clip (1) from the clutch master cylinder.

 **NOTE:**

Install a cap or plug to the exposed hose and clutch master cylinder fittings in order to prevent fluid loss and contamination.

3. Disconnect the hydraulic clutch hose/pipe (2) from the clutch master cylinder.
4. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)

Fig 2: Hydraulic Clutch Hose/Pipe Retaining Clip From Clutch Slave Cylinder

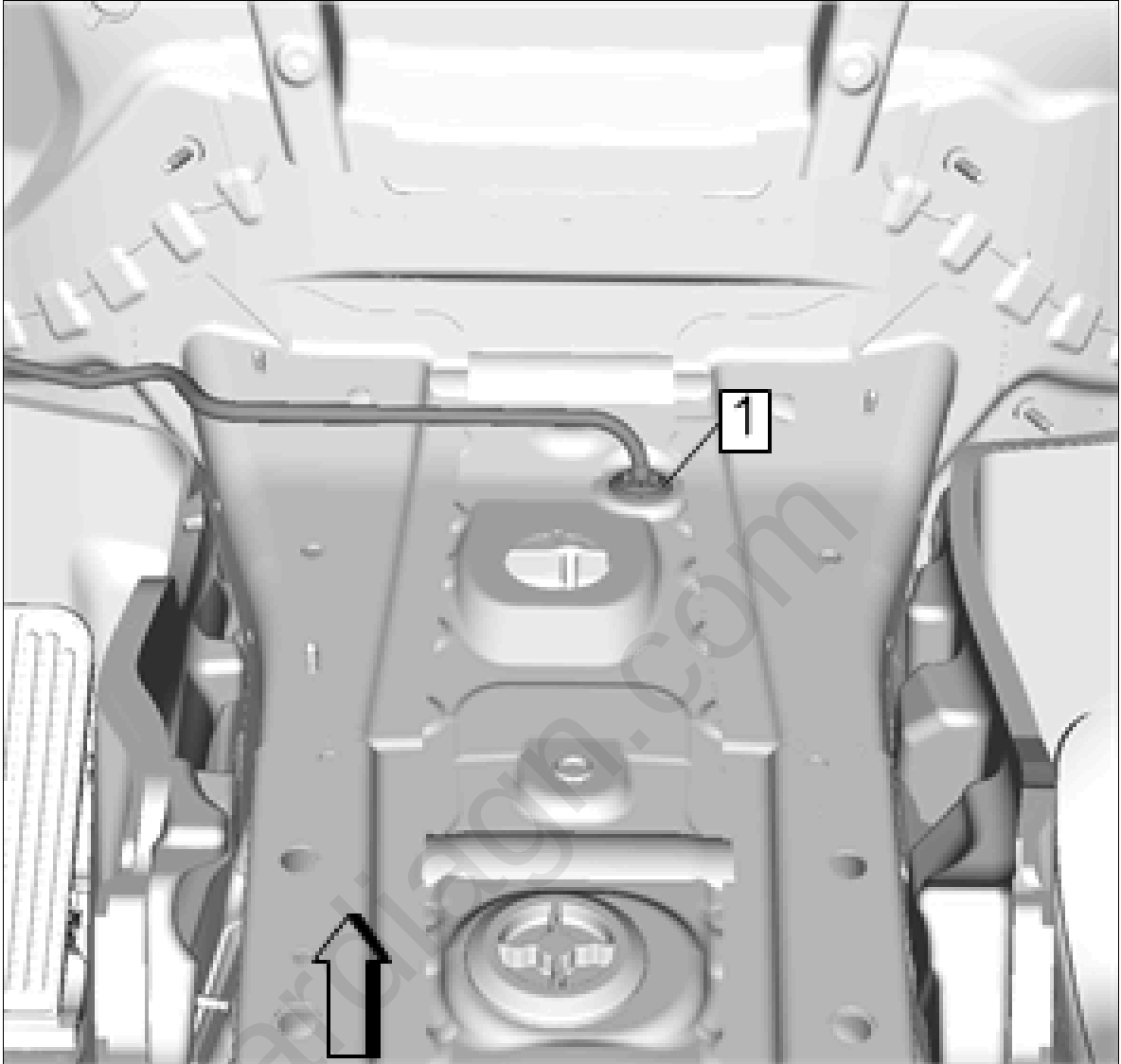


Courtesy of GENERAL MOTORS COMPANY

5. Remove the hydraulic clutch hose/pipe (2) retaining clip from the clutch slave cylinder.
6. Disconnect the hydraulic clutch hose/pipe (2) from the clutch slave cylinder. Plug the lower hose end.

7. Lower the vehicle.

Fig 3: Floor Panel Grommet



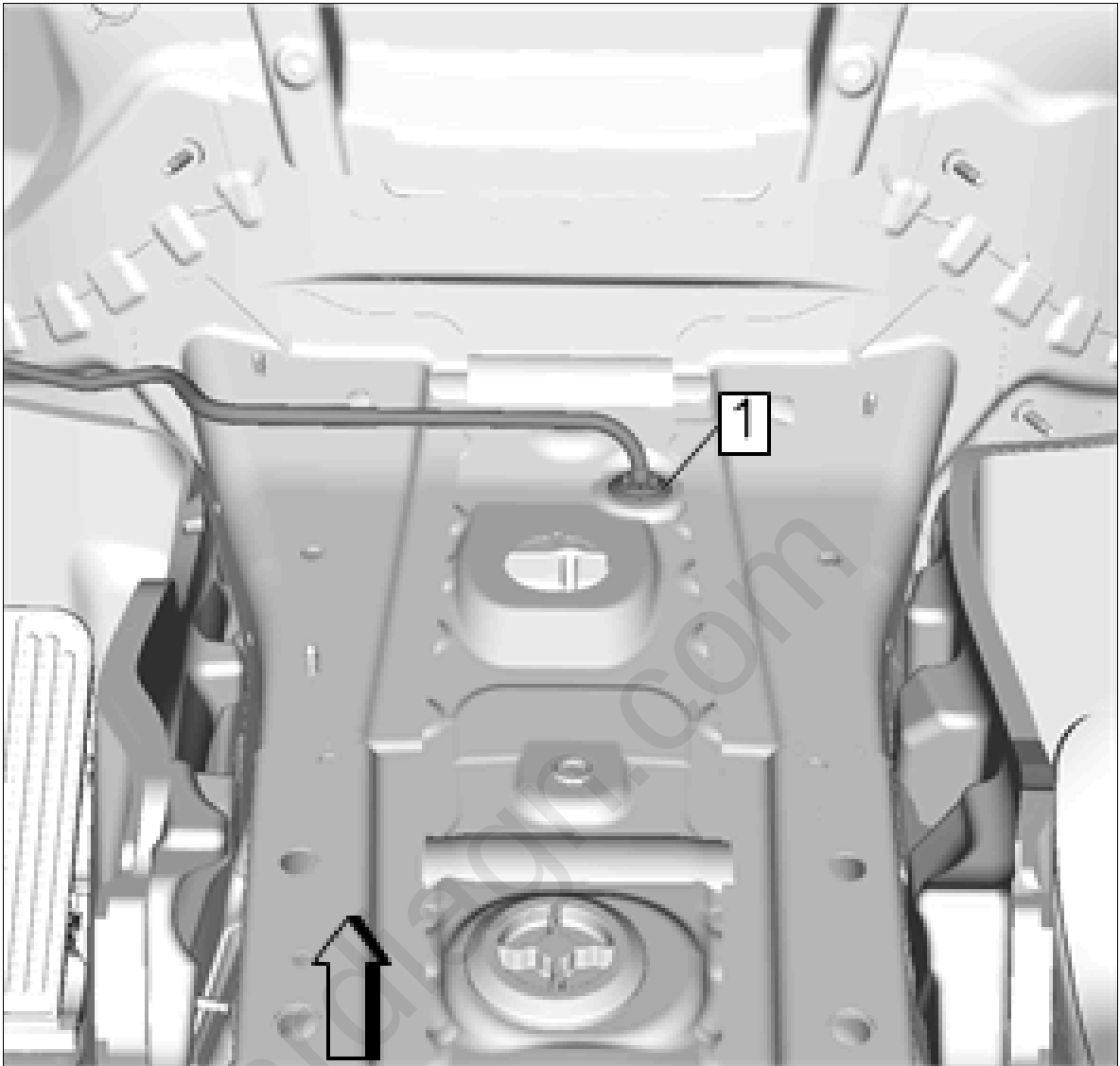
Courtesy of GENERAL MOTORS COMPANY

8. Remove the grommet (1) from the floor panel and then remove the hydraulic clutch hose/pipe.

REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH HOSE/PIPE REPLACEMENT (MM6) > INSTALLATION PROCEDURE

1. Position the hydraulic clutch hose/pipe in the vehicle.

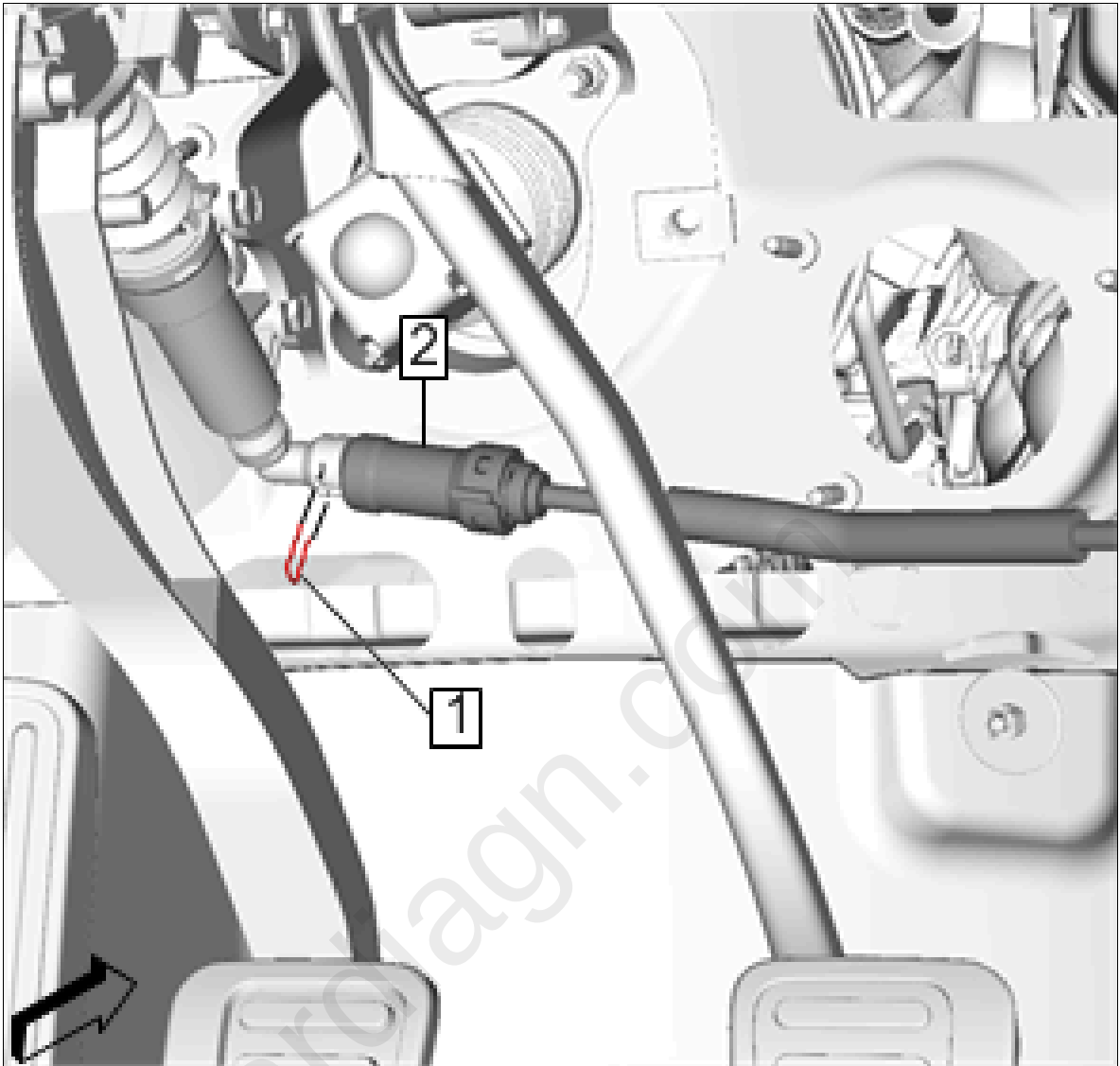
Fig 1: Floor Panel Grommet



Courtesy of GENERAL MOTORS COMPANY

2. Seat the grommet (1) into the floor.

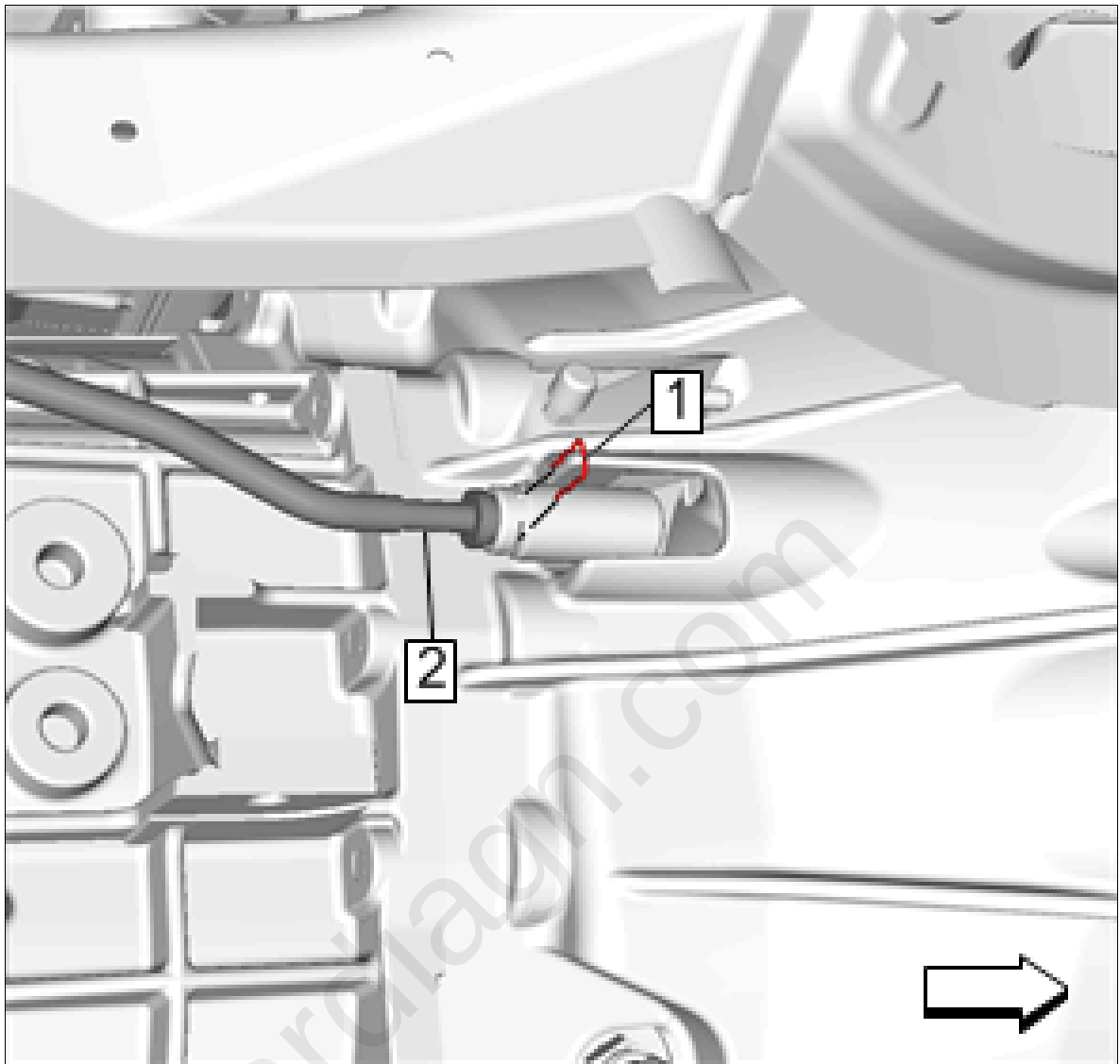
Fig 2: Hydraulic Clutch Hose/Pipe And Clip



Courtesy of GENERAL MOTORS COMPANY

3. Connect the hydraulic clutch hose/pipe (2) to the clutch master cylinder.
4. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch master cylinder.
5. Raise the vehicle.

Fig 3: Hydraulic Clutch Hose/Pipe Retaining Clip To Clutch Slave Cylinder



Courtesy of GENERAL MOTORS COMPANY

6. Connect the lower slave cylinder hose (2) to the slave cylinder.
7. Install the hydraulic clutch hose/pipe retaining clip (1) to the clutch slave cylinder.
8. Bleed the clutch hydraulic system. Hydraulic Clutch System Bleeding
9. Lower the vehicle.
10. Install the heater and air conditioning evaporator and blower module in the vehicle. Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LT1) Heater and Air Conditioning Evaporator and Blower Module Removal and Installation (LGX)

REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH SYSTEM BLEEDING

Special Tools<!--Title-->

- **CH-44894-A** Brake Pressure Bleeder Adapter
- **GE-23738-A** Vacuum Pump

Equivalent regional tools:Special Tools

 WARNING:

Refer to Brake Fluid Irritant Warning .

 CAUTION:

Refer to Brake Fluid Effects on Paint and Electrical Components Caution .

 CAUTION:

Brake fluid must not come in contact with mineral oils and greases. The smallest amount of such could lead to malfunction or breakdown of the clutch.

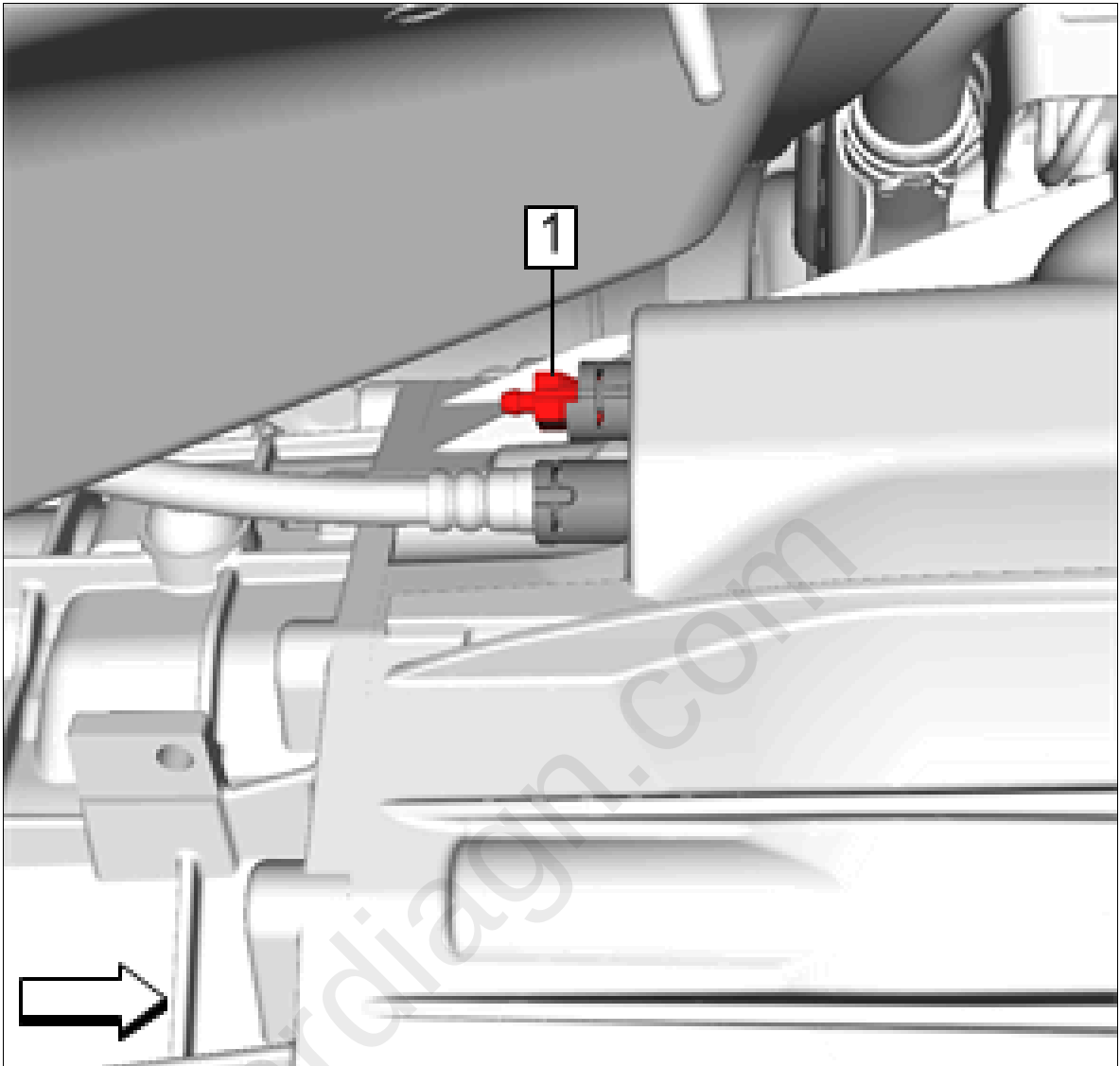
 NOTE:

The hydraulic clutch system can be bled by one of the following two methods. While performing either method, ensure that the brake fluid reservoir is always full and does not run dry.

REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH SYSTEM BLEEDING > METHOD 1 - USING THE BLEEDER VALVE

1. Remove the valve cap from the bleeder valve.

Fig 1: Hose To Bleeder Valve



Courtesy of GENERAL MOTORS COMPANY

2. Temporarily install a hose to the bleeder valve (1) to drain the brake fluid into a suitable container.
3. Fill brake fluid reservoir up to "MAX" marking. Adhesives, Fluids, Lubricants, and Sealers

 NOTE:

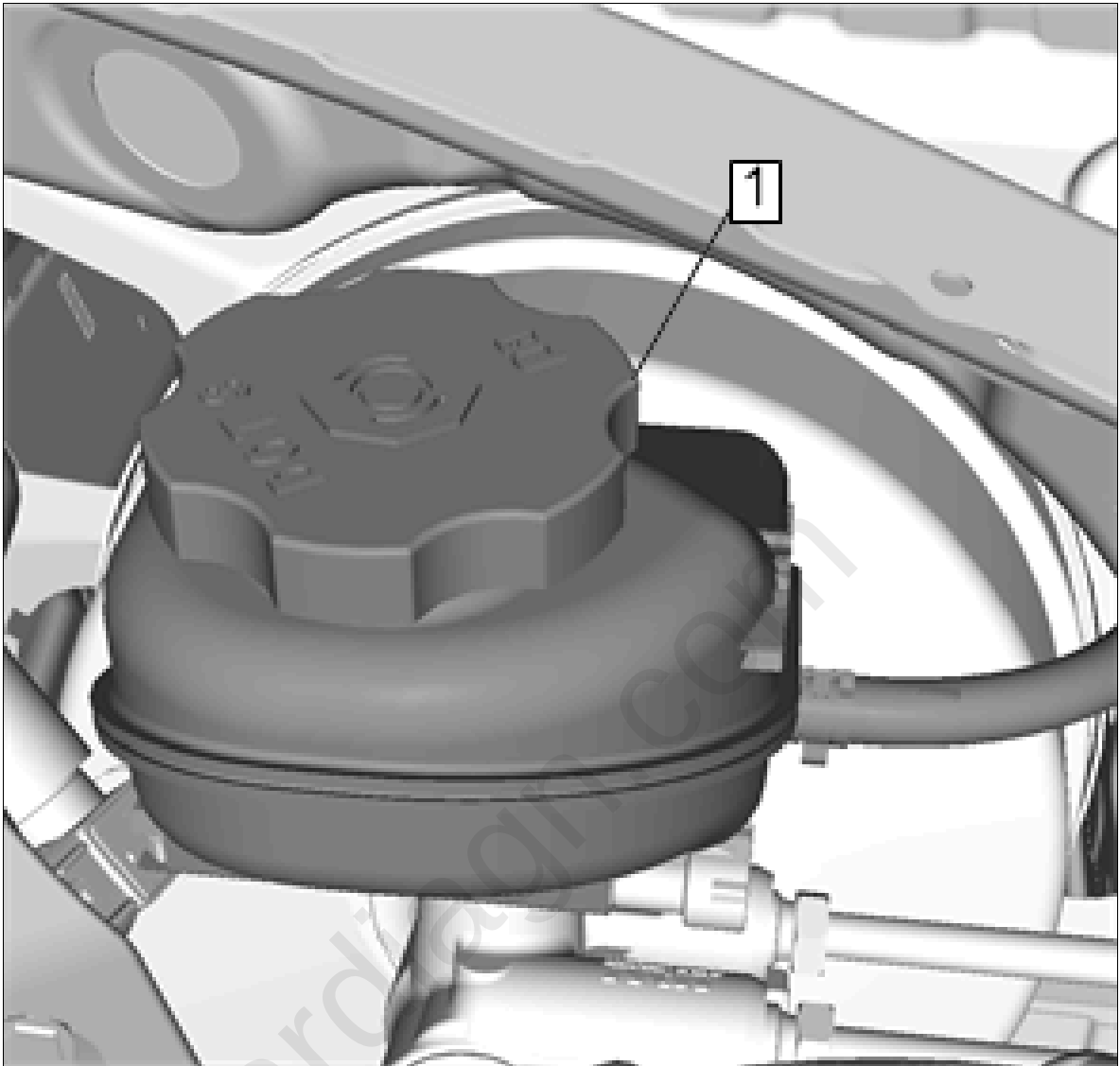
The clutch pedal may need to be stroked by hand due to the over center spring not returning the clutch pedal to the up position.

4. Pump the clutch pedal 5-7 times, then press and hold clutch pedal.
5. Open bleeder valve until air or air/brake fluid mixture flows through the hose into the container.
6. Slowly close the bleeder valve.

7. Release the clutch pedal slowly.
8. Wait approximately 5 seconds.
9. Repeat this bleeding process until a steady flow of fluid comes out each time, then repeat 3 more times.
10. Tighten bleeder valve.
11. Push valve cap onto bleeder valve to protect the bleeder valve.
12. Ensure fluid is still at the full mark, add fluid if necessary. Adhesives, Fluids, Lubricants, and Sealers
13. Pump the brake pedal to ensure there is no air in the braking system.
14. If a NEW transmission has been installed, check the transmission fluid level. Transmission Fluid Level Inspection (MM6) Transmission Fluid Level Inspection (M13 Without Y4Q)
15. Check shifting for ease of movement with vehicle stationary, with engine running and with clutch disengaged.
16. Road test the vehicle to ensure proper operation. Undertake road test using varying RPM ranges and frequent gear changes, bring vehicle to operating temperature during this process. Ensure the brake and clutch system is operating correctly.

REPAIR INSTRUCTIONS > HYDRAULIC CLUTCH SYSTEM BLEEDING > METHOD 2 - USING A VACUUM PUMP AT THE FLUID RESERVOIR

Fig 1: Brake Fluid Reservoir



Courtesy of GENERAL MOTORS COMPANY

1. Remove the cap (1) from the brake fluid reservoir.
2. Fill the reservoir up to "Max" marking. Adhesives, Fluids, Lubricants, and Sealers
3. Attach **CH-44894-A** adapter to the reservoir.
4. Thread a 1/4 inch NPT x 1/4 inch barb fitting into the top of **CH-44894-A** adapter.

 NOTE:

The clutch pedal must be held up while pulling vacuum on the reservoir, it cannot be depressed.

5. Using **GE-23738-A** vacuum pump, attach to the fitting on reservoir and pull a vacuum of 24 in Hg.

6. Once the vacuum level has been reached, hold the vacuum for five minutes.
7. Remove the vacuum from the system and remove the tool from the brake reservoir, leaving the reservoir uncapped.

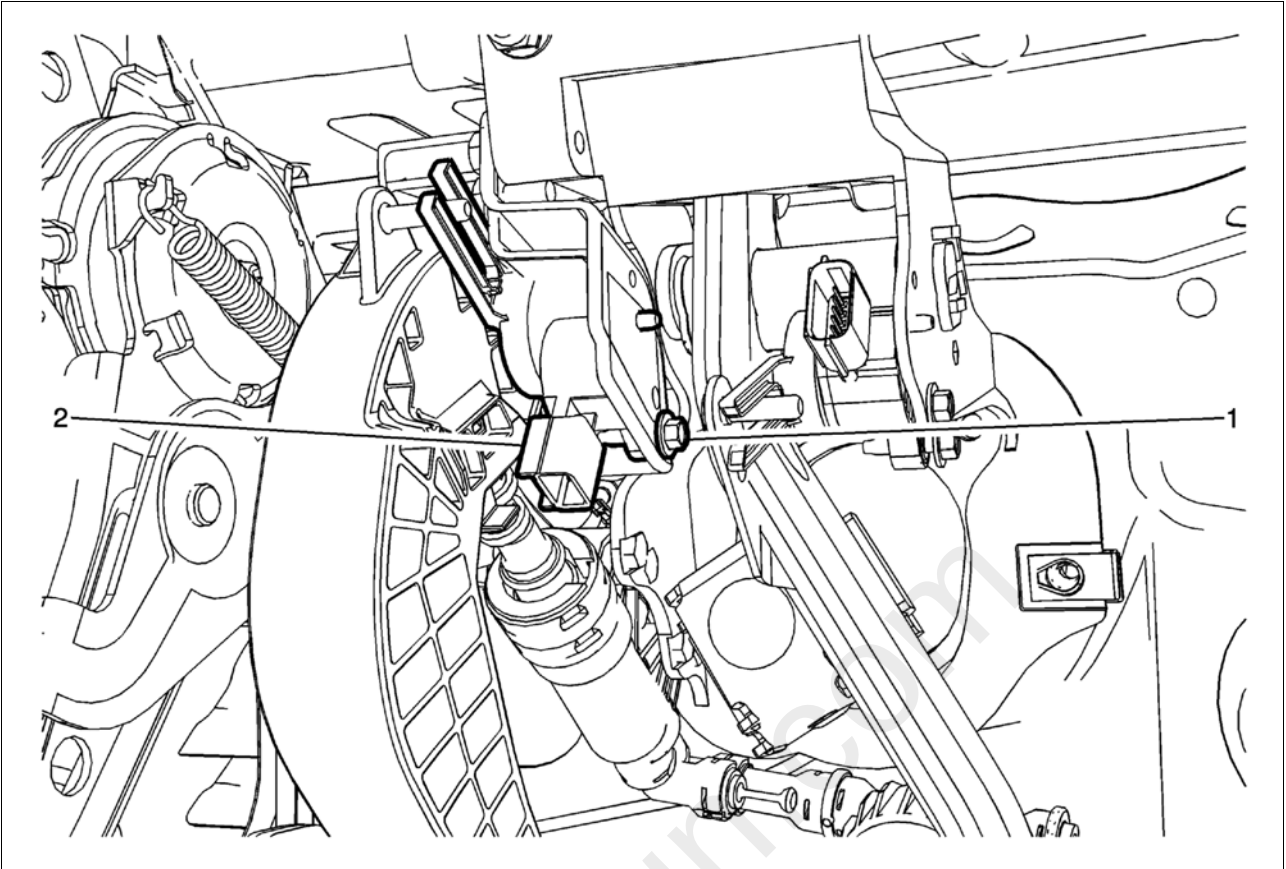
 NOTE:

Ensure the vehicle surroundings are appropriately protected in case of fluid spills from the reservoir. The first few pumps of the clutch pedal may have to be done by hand. The clutch pedal pressure should return after clutch is cycled several times.

8. Pump the clutch several times until pressure/feel is normal.
9. Ensure fluid is still at the full mark, add fluid if necessary. Adhesives, Fluids, Lubricants, and Sealers
10. Repeat steps 1 through 9 to ensure system is properly bled.
11. Reinstall the brake fluid reservoir cap.
12. Pump the brake pedal to ensure there is no air in the braking system.
13. If a NEW transmission has been installed, check the transmission fluid level. Transmission Fluid Level Inspection (MM6) Transmission Fluid Level Inspection (M13 Without Y4Q)
14. Check shifting for ease of movement with vehicle stationary, with engine running and with clutch disengaged.
15. Road test the vehicle to ensure proper operation. Undertake road test using varying RPM ranges and frequent gear changes, bring vehicle to operating temperature during this process. Ensure the brake and clutch system is operating correctly.

REPAIR INSTRUCTIONS > CLUTCH PEDAL POSITION SENSOR REPLACEMENT

Fig 1: Clutch Pedal Position Switch



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
1	Clutch Pedal Position Switch Fastener <i>CAUTION:</i> <i>Refer to Fastener Caution .</i> Tighten 2.5 N.m (22 lb in)
2	Clutch Pedal Position Switch Procedure Disconnect the clutch pedal position switch electrical connector. Perform the clutch pedal position learn procedure. Clutch Pedal Position Sensor Learn

REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LGX ENGINE)

Special Tools

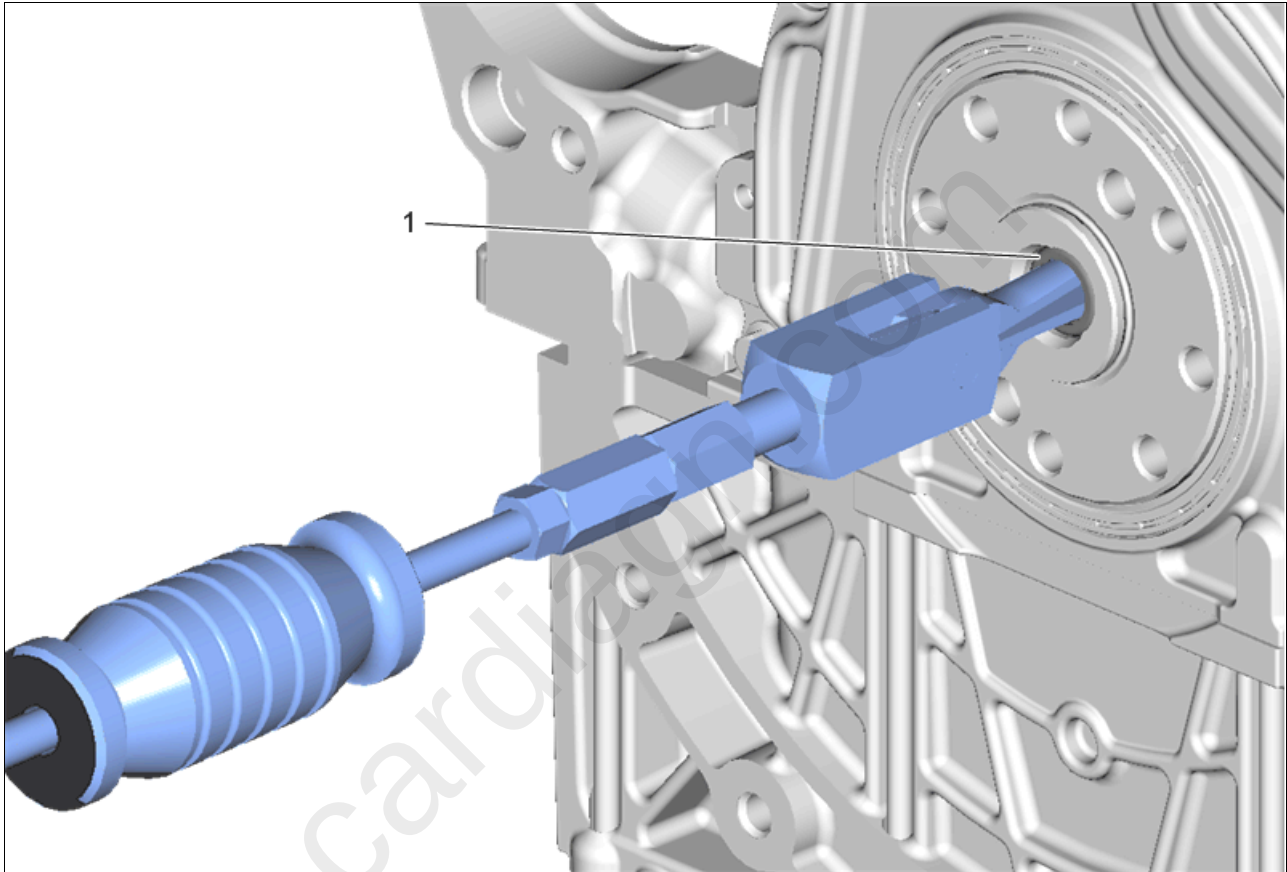
DT-43276 Clutch Pilot Bearing Remover

EN-38836 Pilot Bushing Installer/Clutch

For equivalent regional tools, refer to Special Tools .

REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LGX ENGINE) > REMOVAL PROCEDURE

Fig 1: Clutch Pilot Bearing



Courtesy of GENERAL MOTORS COMPANY

1. Remove the transmission. Transmission Replacement (M13 with LGX Engine)
2. Remove the clutch assembly. Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission)

 NOTE:

*When using the **DT-43276** , always secure the **DT-43276-1** tool body using a wrench. Do not allow the **DT-43276-1** tool to rotate. Failing to do so causes damage to the **DT-43276-1** tool body.*

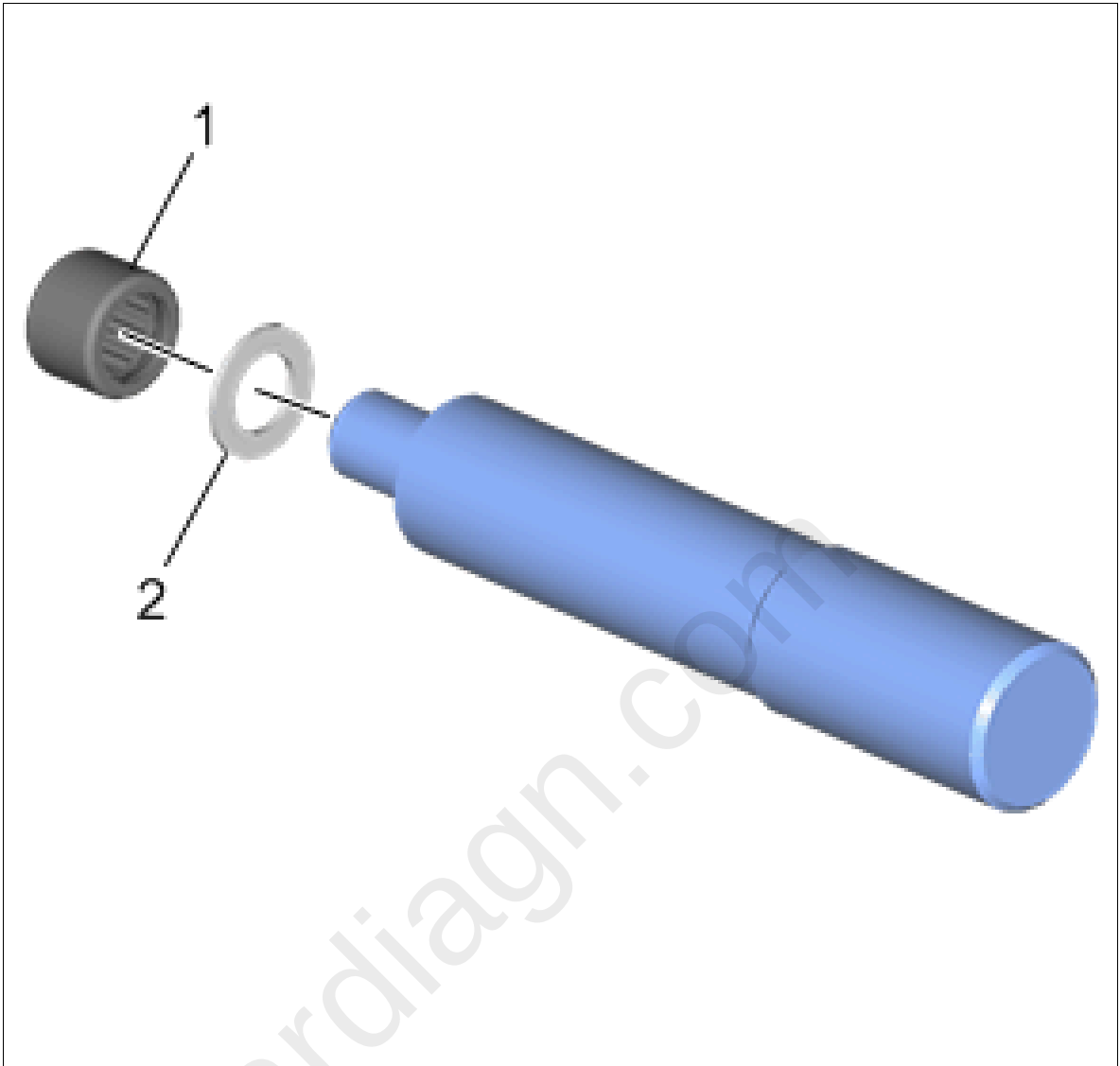
3. Remove the clutch bearing using the **DT-43276** .

1. Install the **DT-43276-1** into the clutch pilot bearing.
2. Using a wrench, secure the **DT-43276-1** .
3. Insert the **DT-43276-2** into the **DT-43276-1** .
4. Rotate the **DT-43276-2** clockwise into the **DT-43276-1** until the clutch pilot bearing is completely removed from the crankshaft.
5. Rotate the **DT-43276-2** counterclockwise to remove the **DT-43276-2** from the **DT-43276-1** .
6. Remove the **DT-43276-1** from the tool body.

**REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LGX ENGINE)
> INSTALLATION PROCEDURE**

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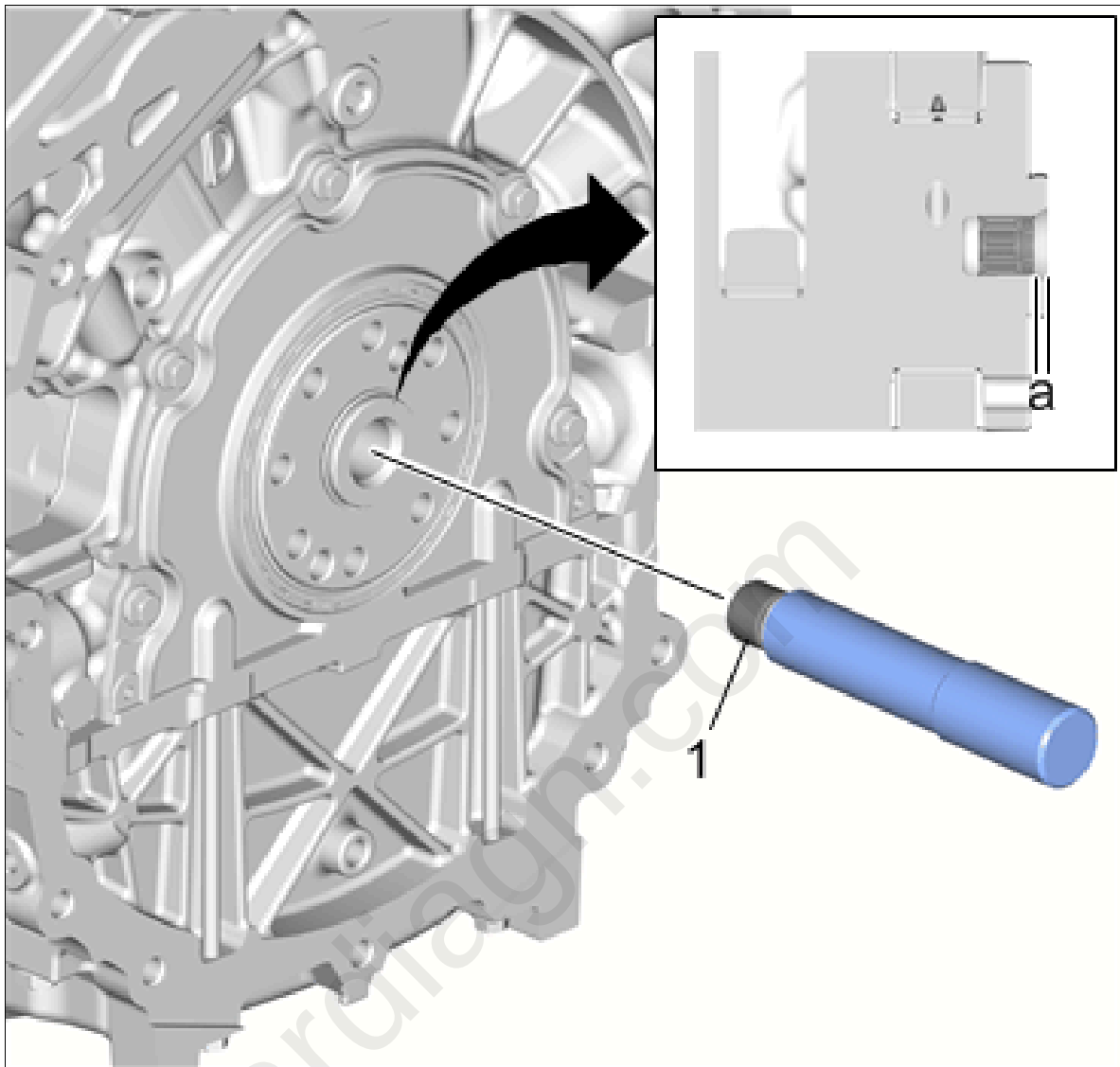
Fig 1: Pilot Bushing Installer/Clutch



Courtesy of GENERAL MOTORS COMPANY

1. Install a 5/8 inch washer (2) onto the **EN-38836** or equivalent. The washer serves as a stop against the crankshaft face and will assist in installing the bearing to the proper depth.
2. Install the new pilot bearing (1) onto the tool.

Fig 2: Pilot Bushing Installation Depth



Courtesy of GENERAL MOTORS COMPANY

3. Install a new pilot bearing into the crankshaft using the **EN-38836** .
4. Inspect the clutch pilot bearing for proper installation. A properly installed clutch pilot bearing will be installed until flush to the rear of the crankshaft.
5. Install the clutch assembly. Clutch Assembly Replacement (M13 Transmission) Clutch Assembly Replacement (MM6 Transmission)
6. Install the transmission. Transmission Replacement (M13 with LGX Engine)

REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LT1 ENGINE)

Special Tools

- **GE-2619-01** Slide Hammer

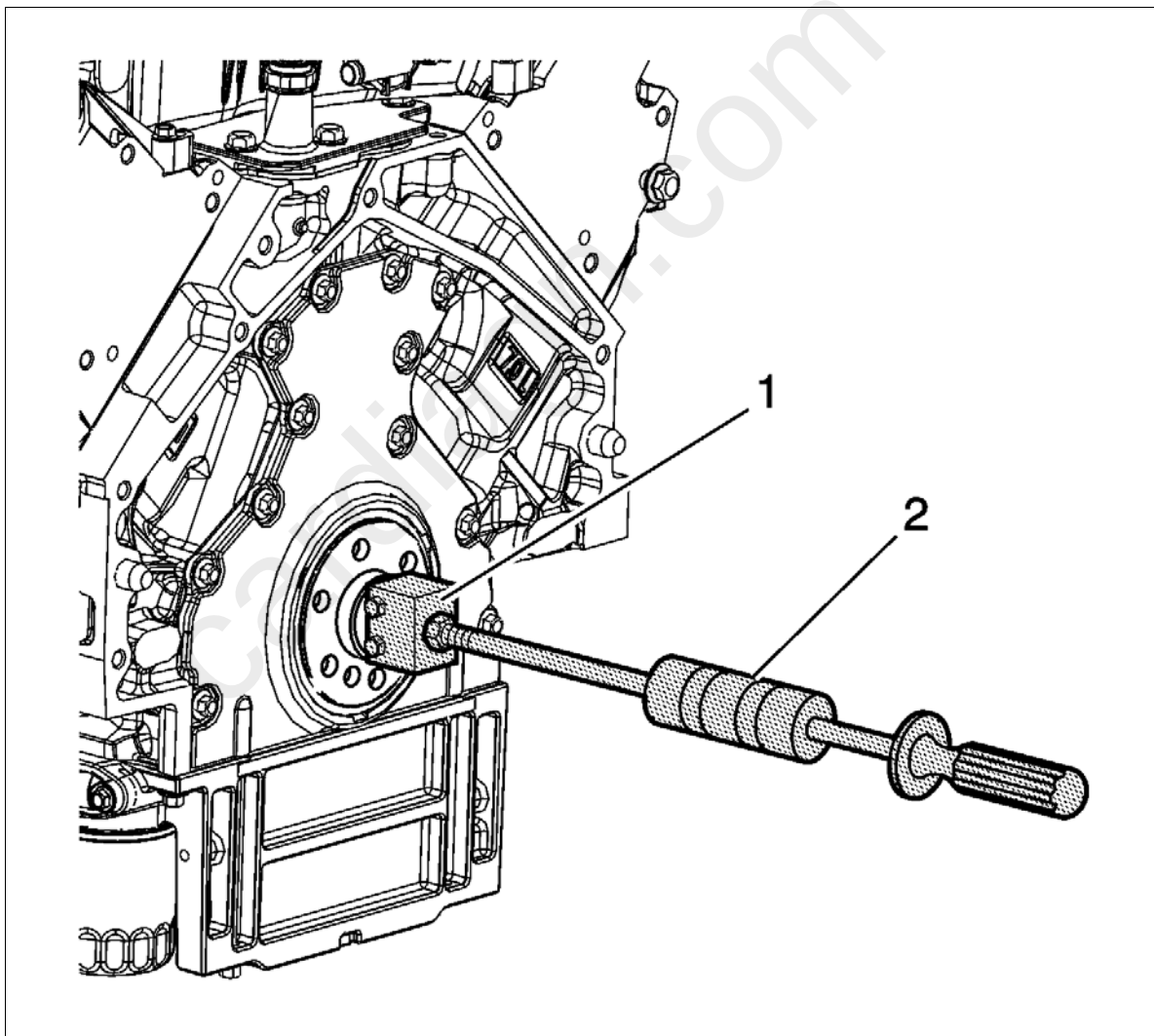
- **GE-8433** Two Jaw Puller
- **GE-23907** Slide Hammer with Bearing Adapter
- **GE-23907-1** Slide Hammer
- **EN-45949** Pilot Bearing and Flywheel Locator Installer

Equivalent regional tools:Special Tools .

REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LT1 ENGINE) > REMOVAL PROCEDURE

1. Remove the transmission from the vehicle. Transmission Replacement (MM6 with LT1 Engine)

Fig 1: Clutch Pilot Bearing Slide Hammer & Adapter



Courtesy of GENERAL MOTORS COMPANY

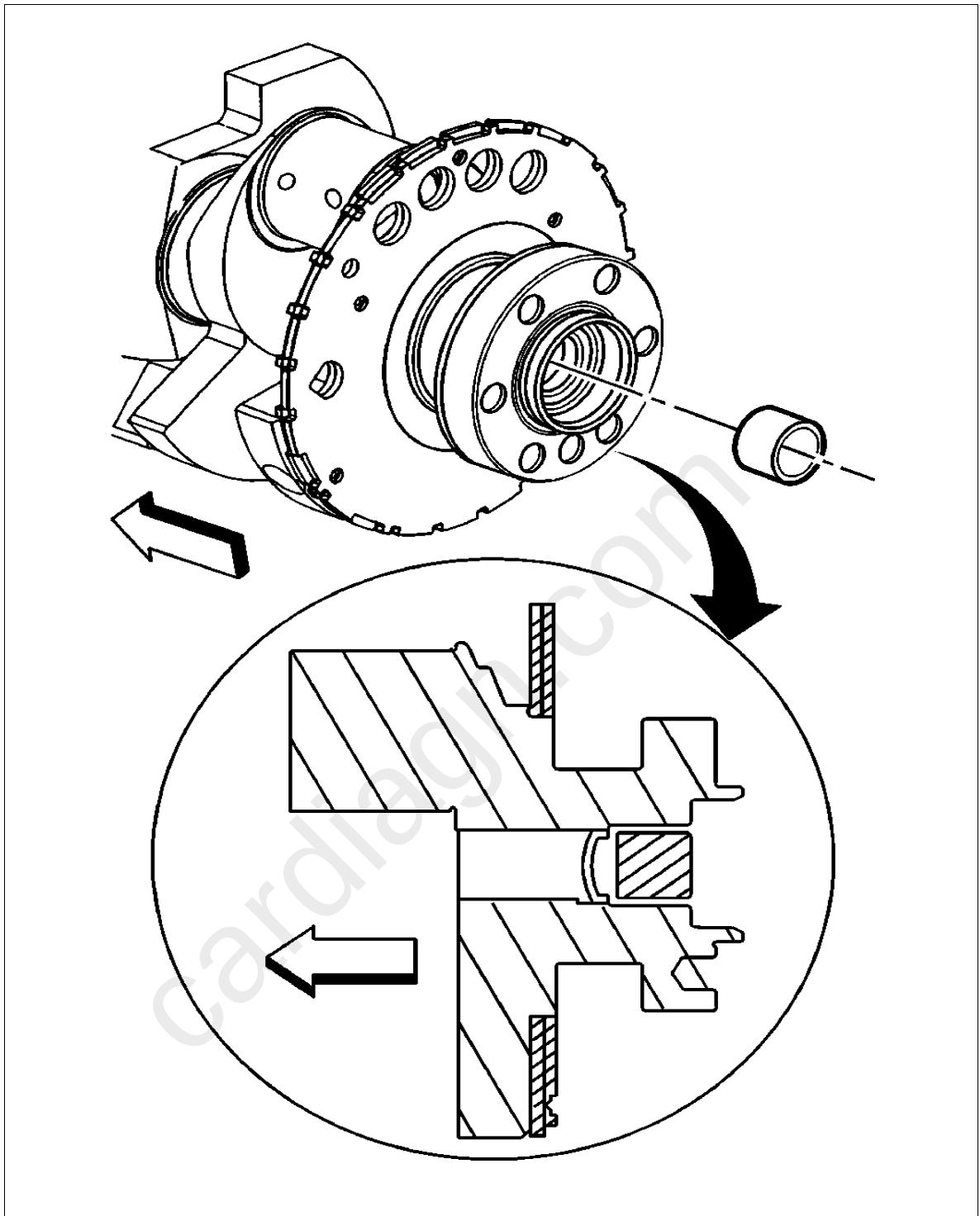
 **NOTE:**

GE-23907-1 slide hammer was part of the **GE-23907** slide hammer with bearing adapter set. The adapter is still available as **GE-23907** adapter.

2. Remove the clutch pilot bearing using the **GE-23907** adapter (1) and **GE-23907-1** slide hammer (2).
 1. Install the legs of the **GE-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 **GE-23907-1** slide hammer (2) to the **GE-23907** adapter (1).
 4. Remove the bearing from the rear of the crankshaft.
 5. Remove the special tools from the bearing.

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Fig 2: Locating Clutch Pilot Bearing

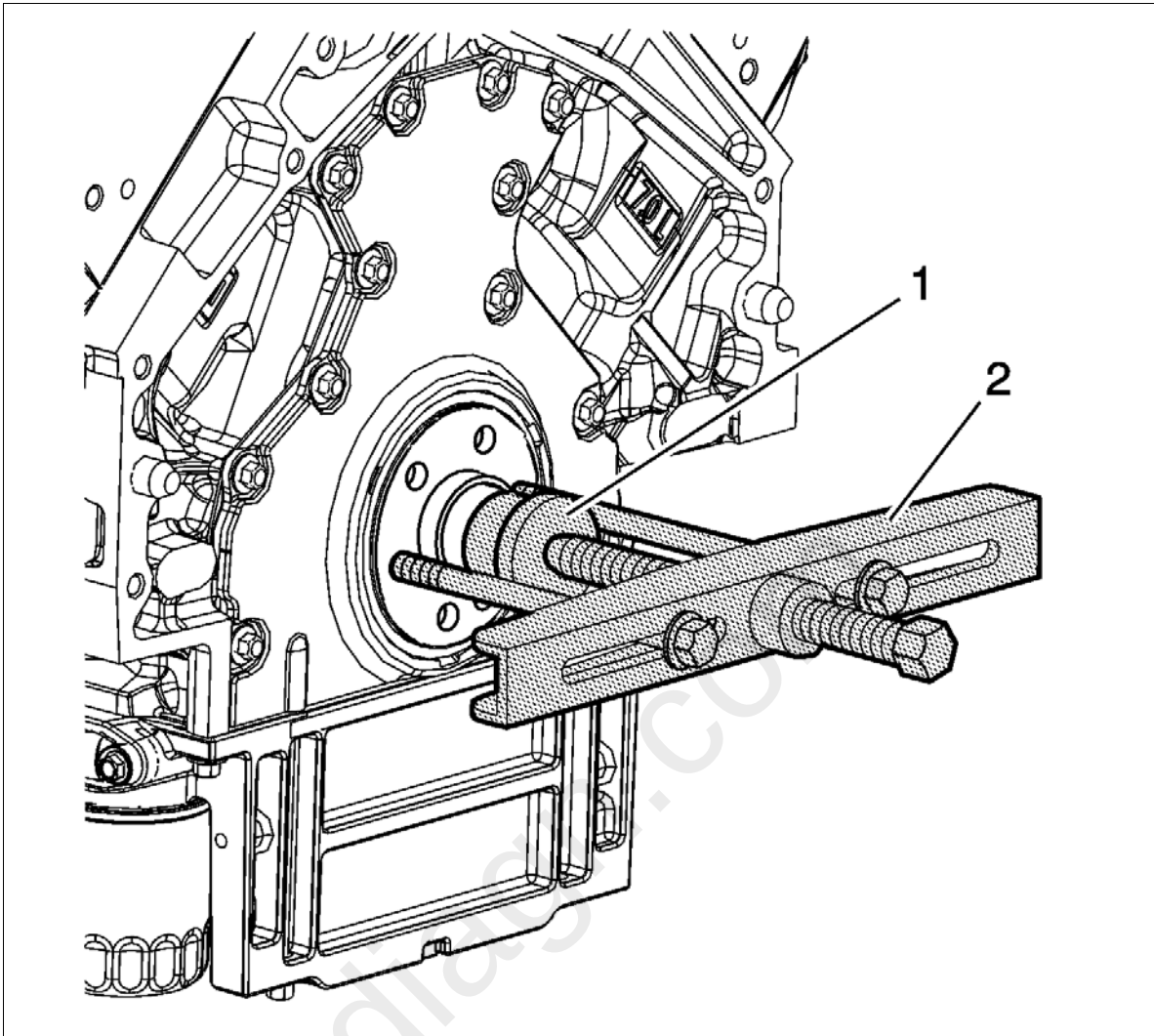


Courtesy of GENERAL MOTORS COMPANY

3. DISCARD the bearing.

**REPAIR INSTRUCTIONS > CLUTCH PILOT BEARING REPLACEMENT (LT1 ENGINE) >
INSTALLATION PROCEDURE**

Fig 1: Identifying Special Tools

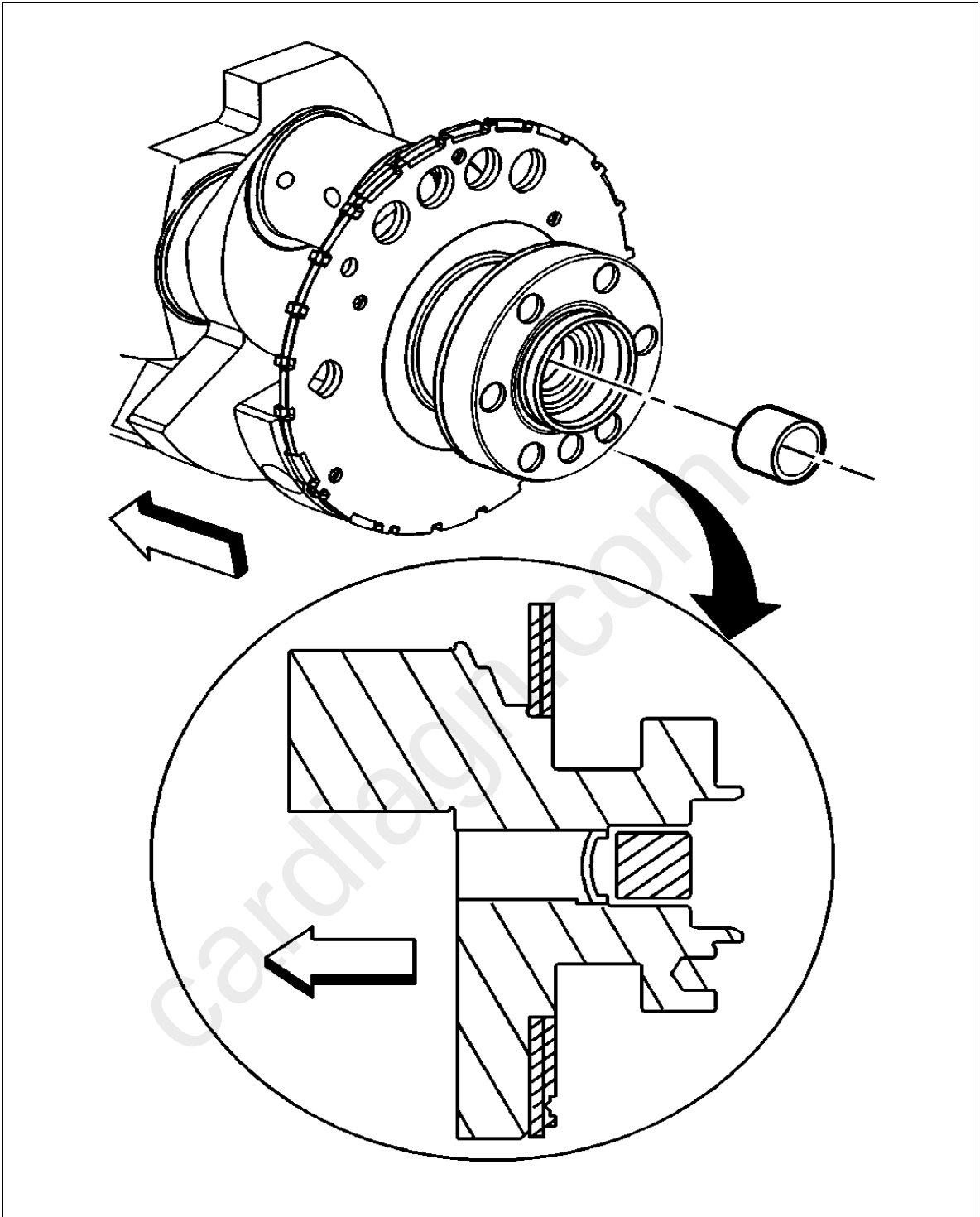


Courtesy of GENERAL MOTORS COMPANY

1. Position the NEW bearing to the rear of the crankshaft.
2. Assemble the **GE-8433** two jaw puller (2), the **EN-45949** pilot bearing and flywheel locator installer (1) and bolts to the rear of the crankshaft.

Tighten the bolts until snug.
3. Rotate the bolt of the **GE-8433** two jaw puller (2) until the bearing is seated in the bore of the crankshaft.
4. Remove the tools.

Fig 2: Locating Clutch Pilot Bearing



Courtesy of GENERAL MOTORS COMPANY

5. Inspect the clutch pilot bearing for proper installation.
6. Install the transmission to the vehicle. Transmission Replacement (MM6 with LT1 Engine)

TRANSMISSION)

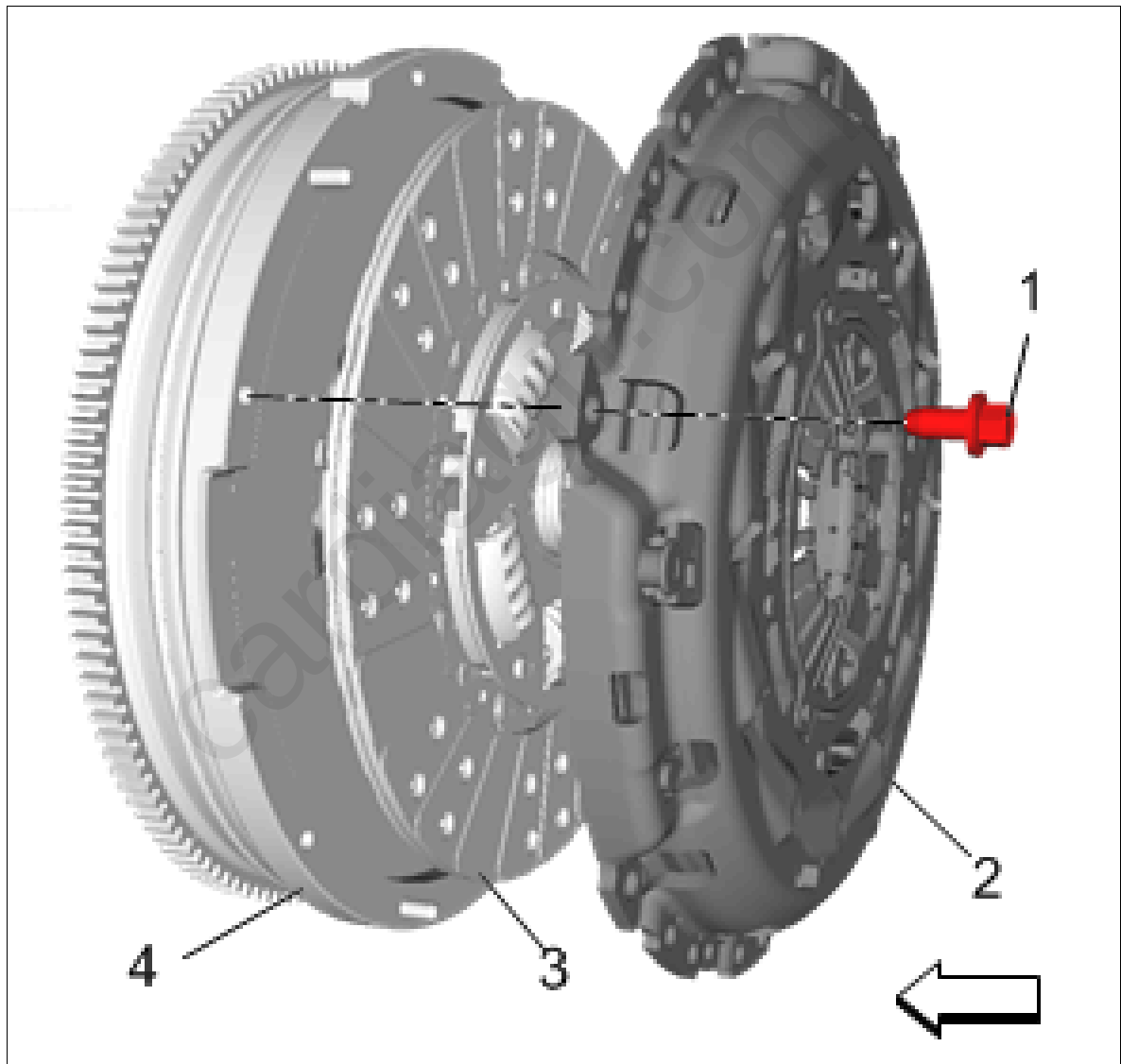
Special Tools

- **EN-50792** Flywheel Holding Tool

For equivalent regional tools, refer to Special Tools .

REPAIR INSTRUCTIONS > CLUTCH ASSEMBLY REPLACEMENT (M13 TRANSMISSION) > REMOVAL PROCEDURE

Fig 1: Clutch Assembly



Courtesy of GENERAL MOTORS COMPANY

1. Remove the manual transmission. Refer to Transmission Replacement (M13 with LGX Engine)Transmission Replacement (M13 with LTG Engine) .
2. Remove the starter. Refer to Starter Replacement (LT1)Starter Replacement (LGX)Starter

Replacement (LTG) .

3. Install the **EN-50792** tool.
4. Remove and DISCARD the six clutch pressure plate bolts (1).
5. Remove the clutch pressure plate (2) from the dowel pins on the flywheel.
6. Remove the driven disc (3).

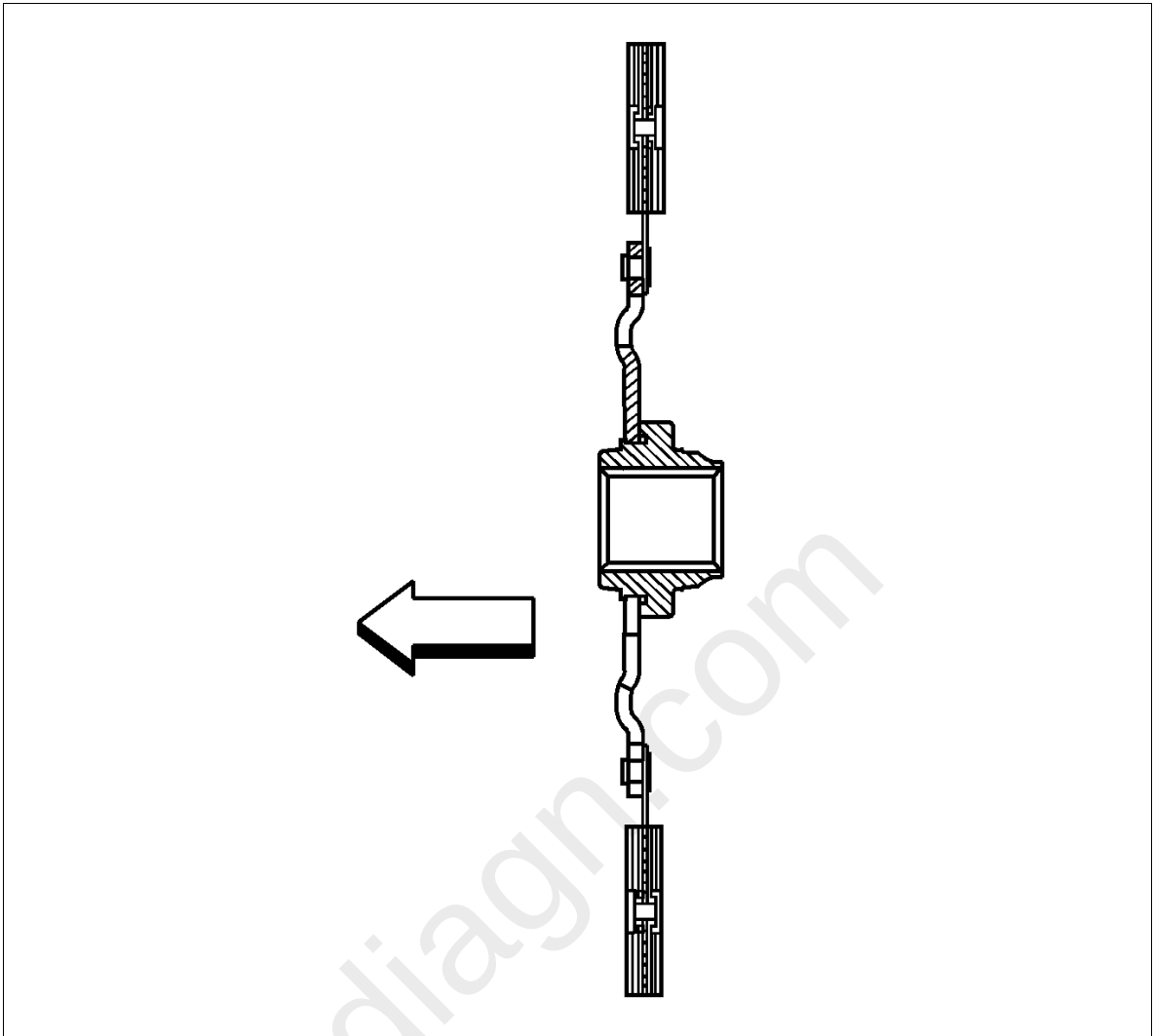
REPAIR INSTRUCTIONS > CLUTCH ASSEMBLY REPLACEMENT (M13 TRANSMISSION) > INSTALLATION PROCEDURE



NOTE:

When the clutch driven plate requires replacement, the engine flywheel must also be replaced along with the clutch pressure plate as an assembly.

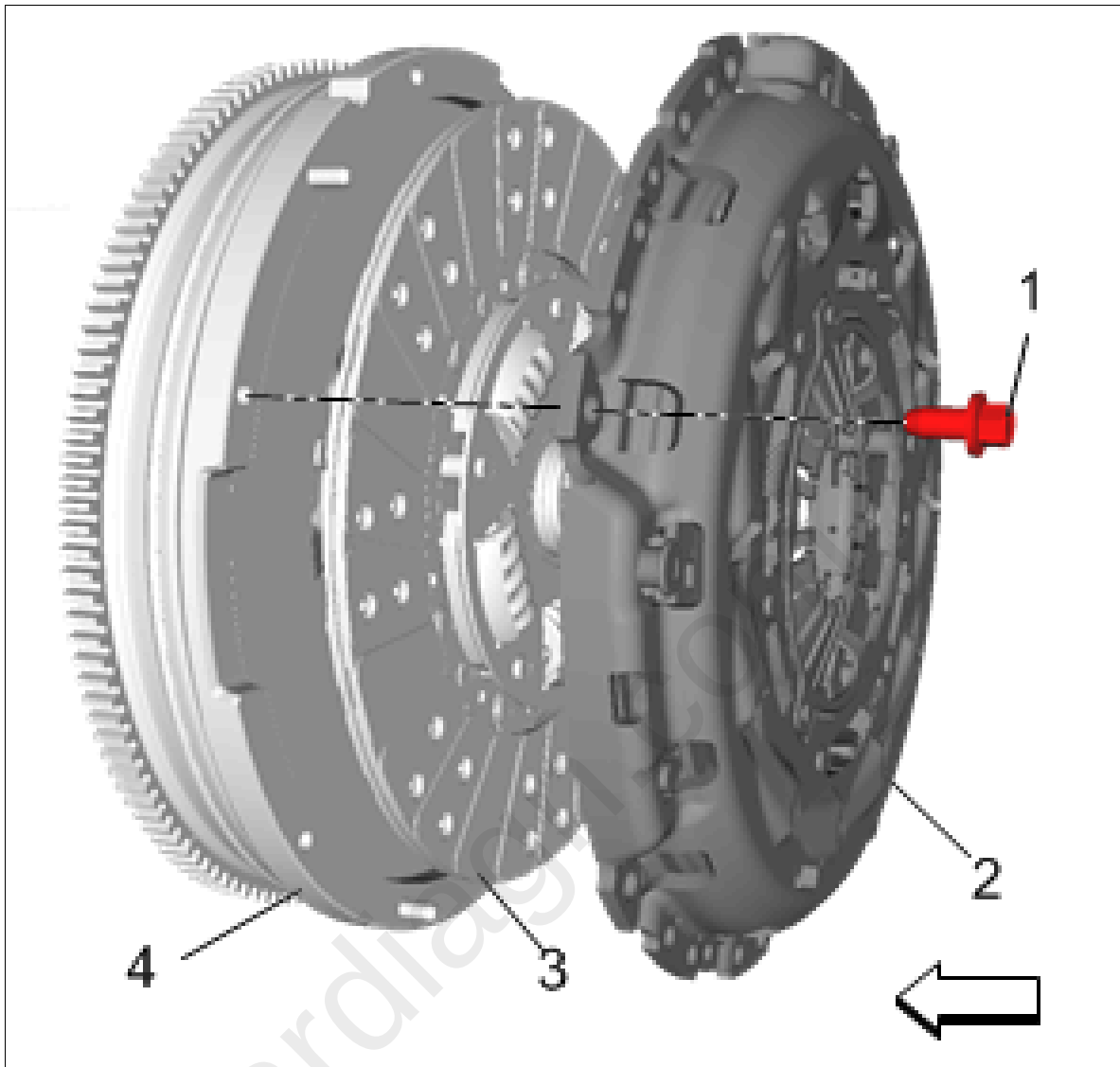
Fig 1: Drive Plate & Front Of Vehicle (Arrow)



Courtesy of GENERAL MOTORS COMPANY

1. The splined portion of the driven plate protrudes out of the plate more on one side than the other. The side that protrudes out more is the transmission side. The arrow in the graphic indicates the front of the vehicle, or flywheel side of the driven plate.

Fig 2: Clutch Assembly



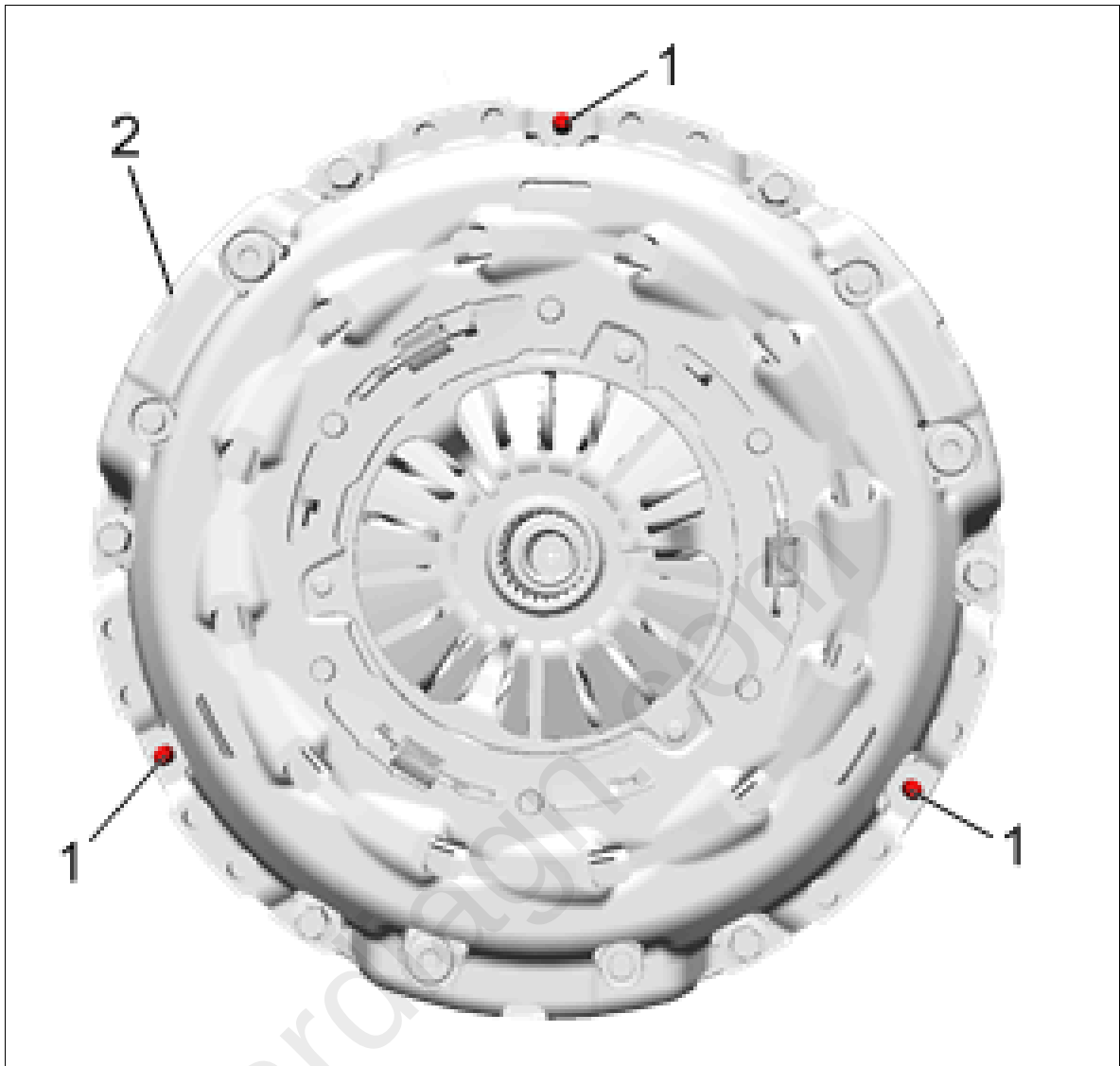
Courtesy of GENERAL MOTORS COMPANY

 NOTE:

*NEW bolts have an adhesive patch and **MUST** be tightened to final torque within five minutes of installation.*

2. Install the driven plate (3) to the flywheel.
3. Install the clutch pressure plate (2) to the dowel pins on the flywheel.
4. Install the NEW clutch pressure plate bolts finger tight.

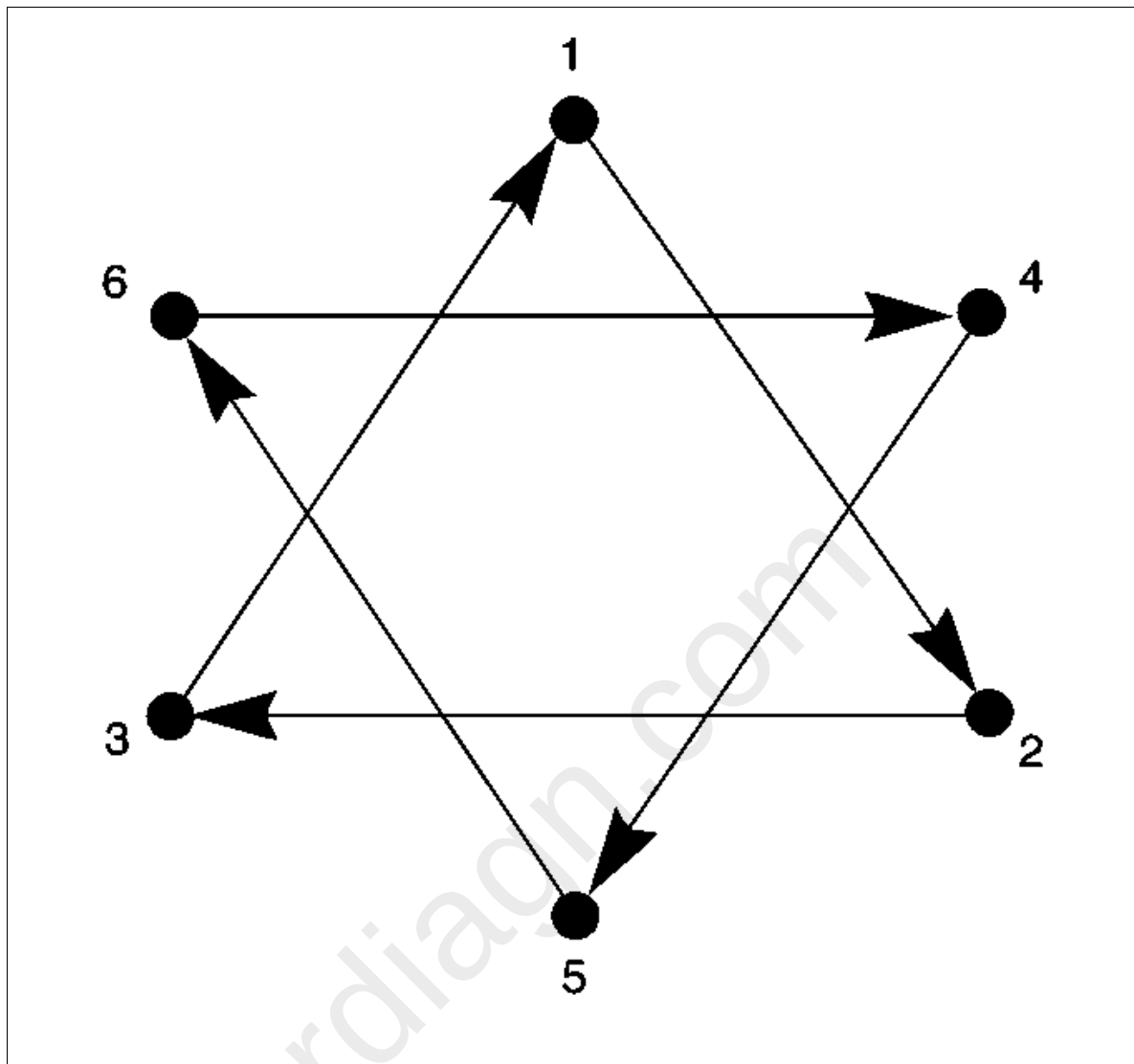
Fig 3: Dowel Pins



Courtesy of GENERAL MOTORS COMPANY

5. Ensure all three dowel pins (1) are visibly seated through the clutch cover dowel pin alignment holes as shown.
6. Use a commercially available universal clutch alignment tool to align the clutch driven plate to the center of the engine crankshaft.

Fig 4: Clutch Pressure Plate Bolts Tightening Sequence (4.8L, 5.3L, and 6.0L Engines)



Courtesy of GENERAL MOTORS COMPANY



CAUTION:

Refer to Fastener Caution .

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

1. Tighten all the clutch pressure plate bolts in sequence and evenly to 15 N.m (11 lb ft).
2. Tighten all the clutch pressure plate bolts in sequence and evenly to 30 N.m (22 lb ft).
3. Loosen bolts (1, 2, 3) 180 degrees. Re-torque bolts (1, 2, 3) in sequence and evenly 30 N.m (22 lb ft) plus 20 degrees.
4. Loosen bolts (4, 5, 6) 180 degrees. Re-torque bolts (4, 5, 6) in sequence and evenly 30 N.m (22 lb ft) plus 20 degrees.

8. Remove the commercially available clutch alignment tool.
9. Remove the **EN-50792** tool.
10. Install the starter. Refer to Starter Replacement (LT1)Starter Replacement (LGX)Starter Replacement (LTG) .
11. Install the manual transmission. Refer to Transmission Replacement (M13 with LGX Engine)Transmission Replacement (M13 with LTG Engine) .

REPAIR INSTRUCTIONS > CLUTCH ASSEMBLY REPLACEMENT (MM6 TRANSMISSION)

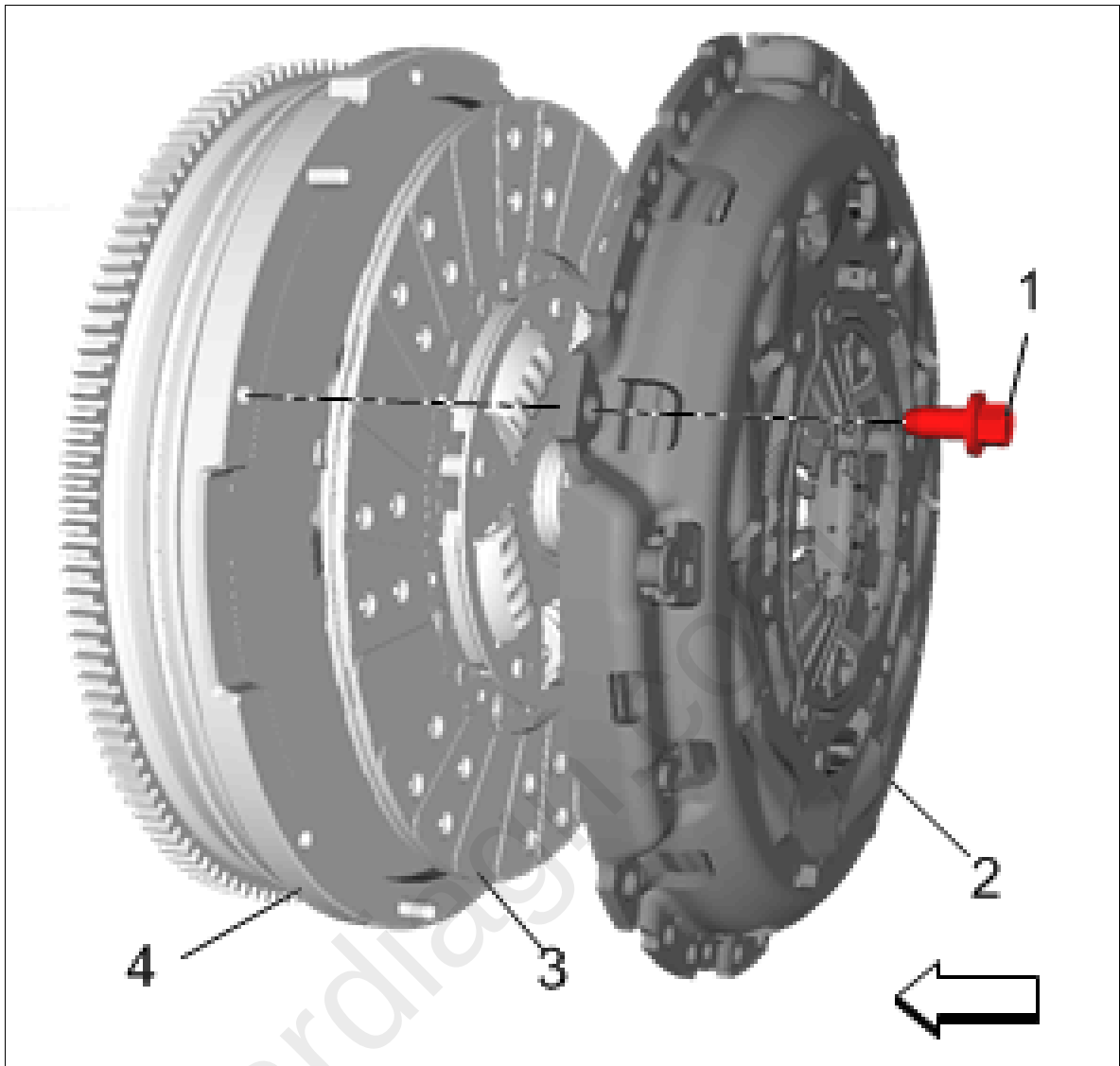
Special Tools

- **EN-50792** Flywheel Holding Tool

For equivalent regional tools, refer to Special Tools .

REPAIR INSTRUCTIONS > CLUTCH ASSEMBLY REPLACEMENT (MM6 TRANSMISSION) > REMOVAL PROCEDURE

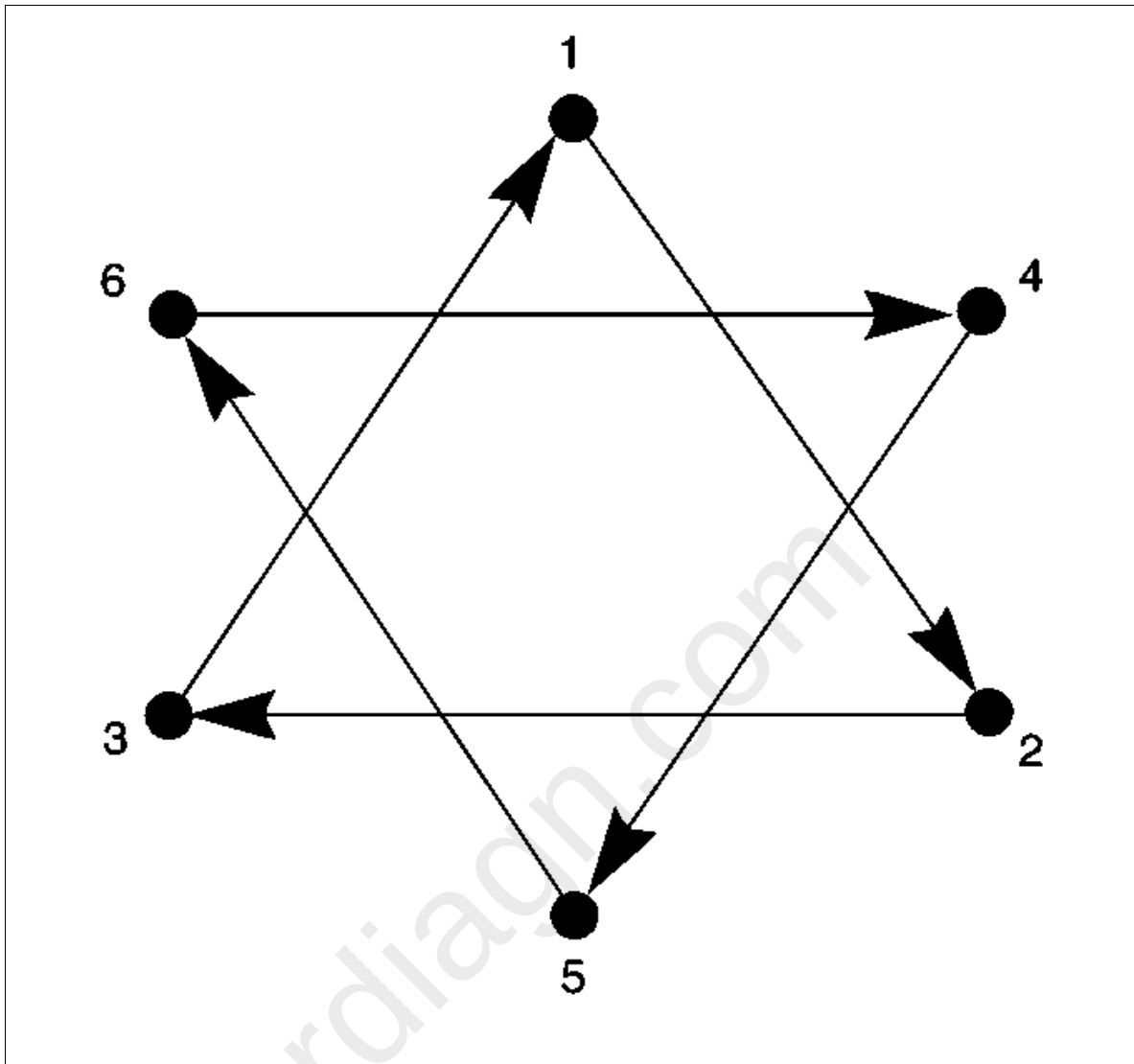
Fig 1: Clutch Assembly



Courtesy of GENERAL MOTORS COMPANY

1. Remove the manual transmission. Transmission Replacement (MM6 with LT1 Engine)
2. Remove the starter. Starter Replacement (LT1) Starter Replacement (LGX) Starter Replacement (LTG)
3. Install the **EN-50792** tool.

Fig 2: Clutch Pressure Plate Bolts Tightening Sequence (4.8L, 5.3L, and 6.0L Engines)



Courtesy of GENERAL MOTORS COMPANY

 NOTE:

If reusing the pressure plate assembly, place an alignment mark on the pressure plate and flywheel for proper alignment during installation.

 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 bolts are loose.
5. Remove and DISCARD the six clutch pressure plate bolts (1).
6. Remove the clutch pressure plate (2) from the dowel pins on the flywheel.
7. Remove the driven disc (3).

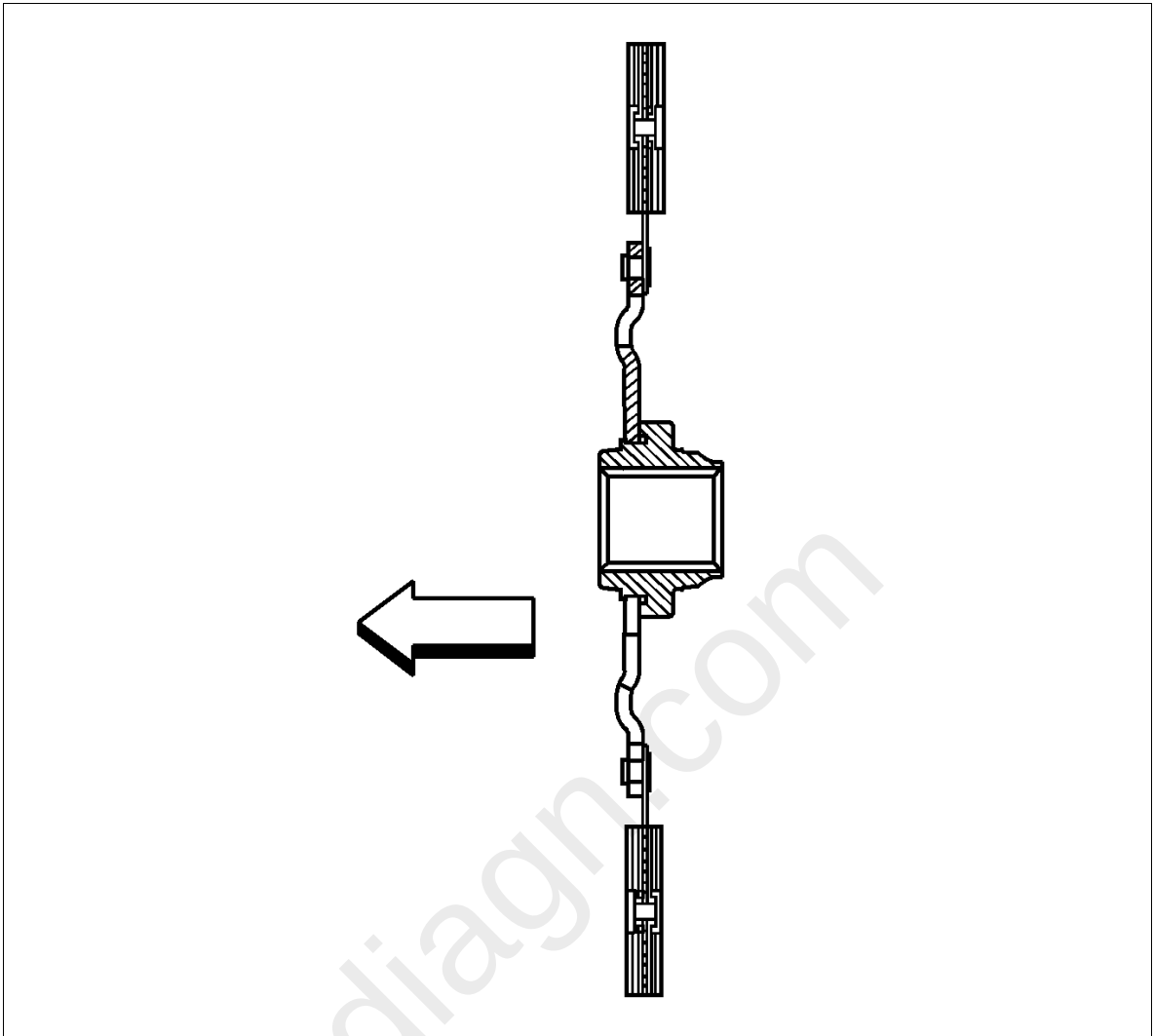
REPAIR INSTRUCTIONS > CLUTCH ASSEMBLY REPLACEMENT (MM6 TRANSMISSION) > INSTALLATION PROCEDURE



NOTE:

When the clutch driven plate requires replacement, the engine flywheel must also be replaced along with the clutch pressure plate as an assembly.

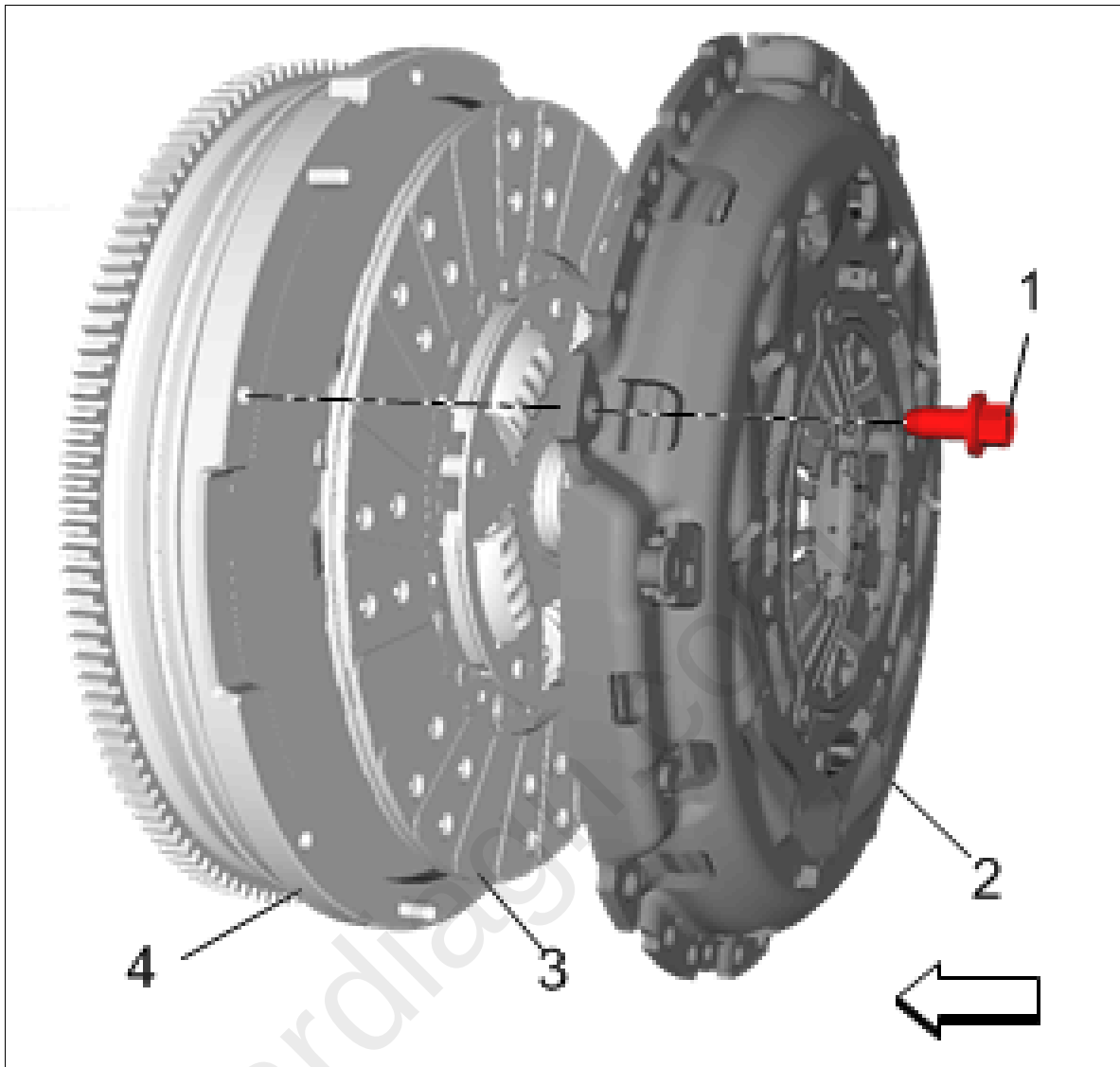
Fig 1: Drive Plate & Front Of Vehicle (Arrow)



Courtesy of GENERAL MOTORS COMPANY

1. The splined portion of the driven plate protrudes out of the plate more on one side than the other. The side that protrudes out more is the transmission side. The arrow in the graphic indicates the front of the vehicle, or flywheel side of the driven plate.

Fig 2: Clutch Assembly



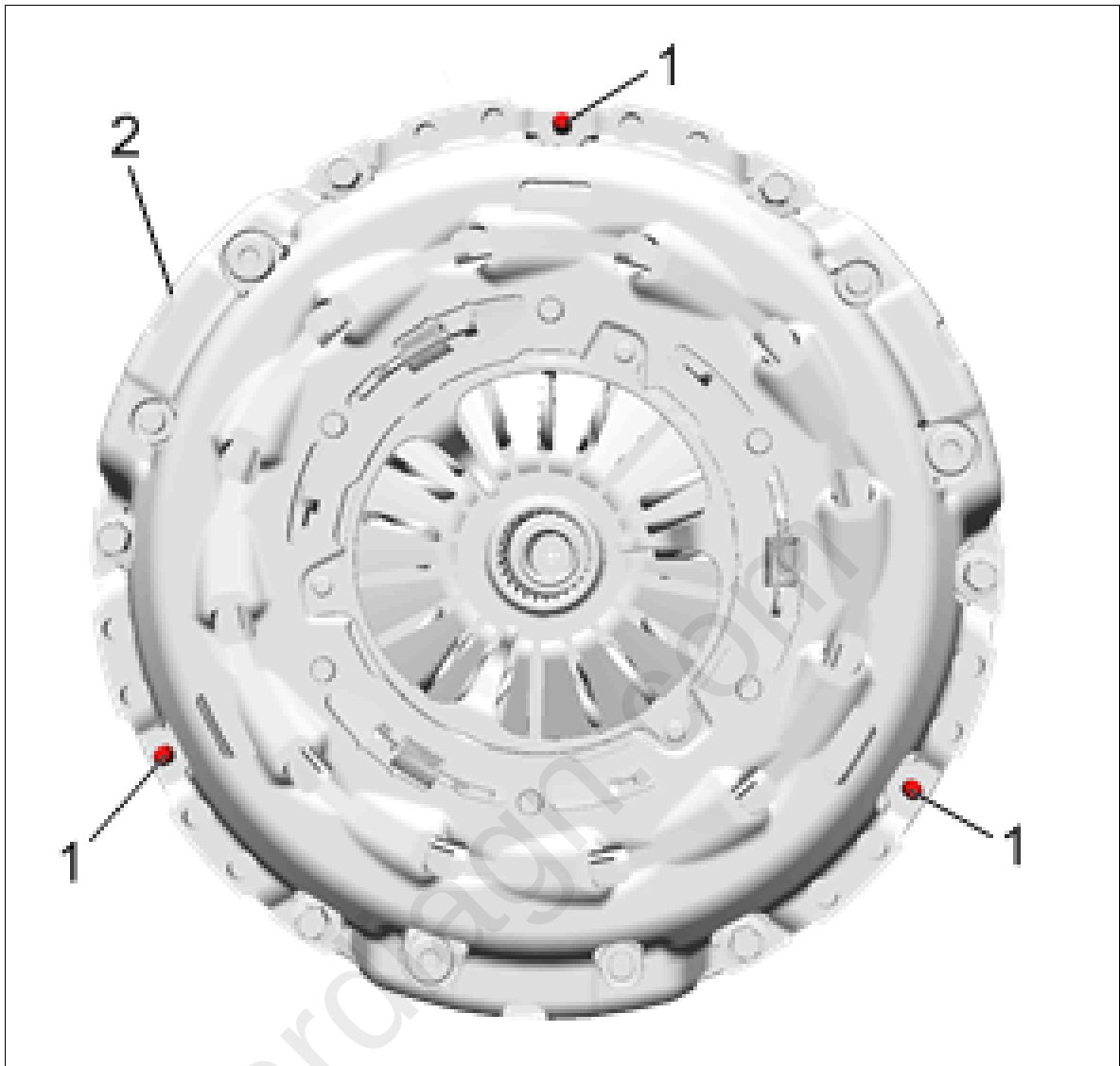
Courtesy of GENERAL MOTORS COMPANY

 NOTE:

If NEW bolts DO NOT have an adhesive patch, use Loctite 272™ thread sealant to make certain the bolts do not come loose. If the NEW bolts come with an adhesive patch they MUST be tightened to final torque within five minutes of installation.

2. Install the driven plate (3) to the flywheel.
3. Install the clutch pressure plate (2) to the dowel pins on the flywheel.
4. Install the NEW clutch pressure plate bolts finger tight.

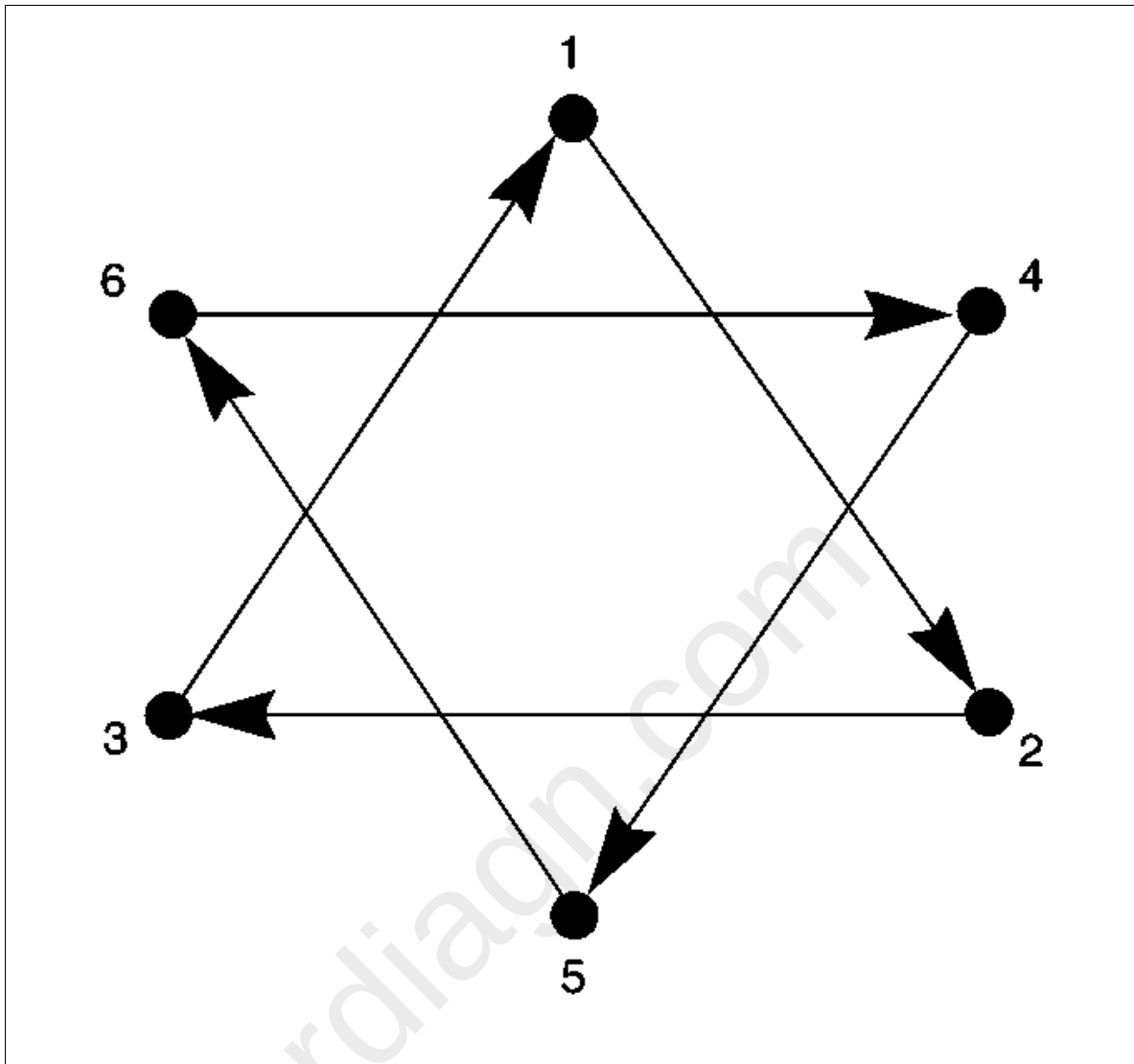
Fig 3: Dowel Pins



Courtesy of GENERAL MOTORS COMPANY

5. Ensure all three dowel pins (1) are visibly seated through the clutch cover dowel pin alignment holes as shown.
6. Use a commercially available universal clutch alignment tool to align the clutch driven plate to the center of the engine crankshaft.

Fig 4: Clutch Pressure Plate Bolts Tightening Sequence (4.8L, 5.3L, and 6.0L Engines)



Courtesy of GENERAL MOTORS COMPANY

 CAUTION:

Refer to Fastener Caution .

 IMPORTANT:

Bolts need to be tightened in the sequence shown, starting with the number one and following in numerical order.

7. Tighten the clutch pressure plate bolts using the following sequence:

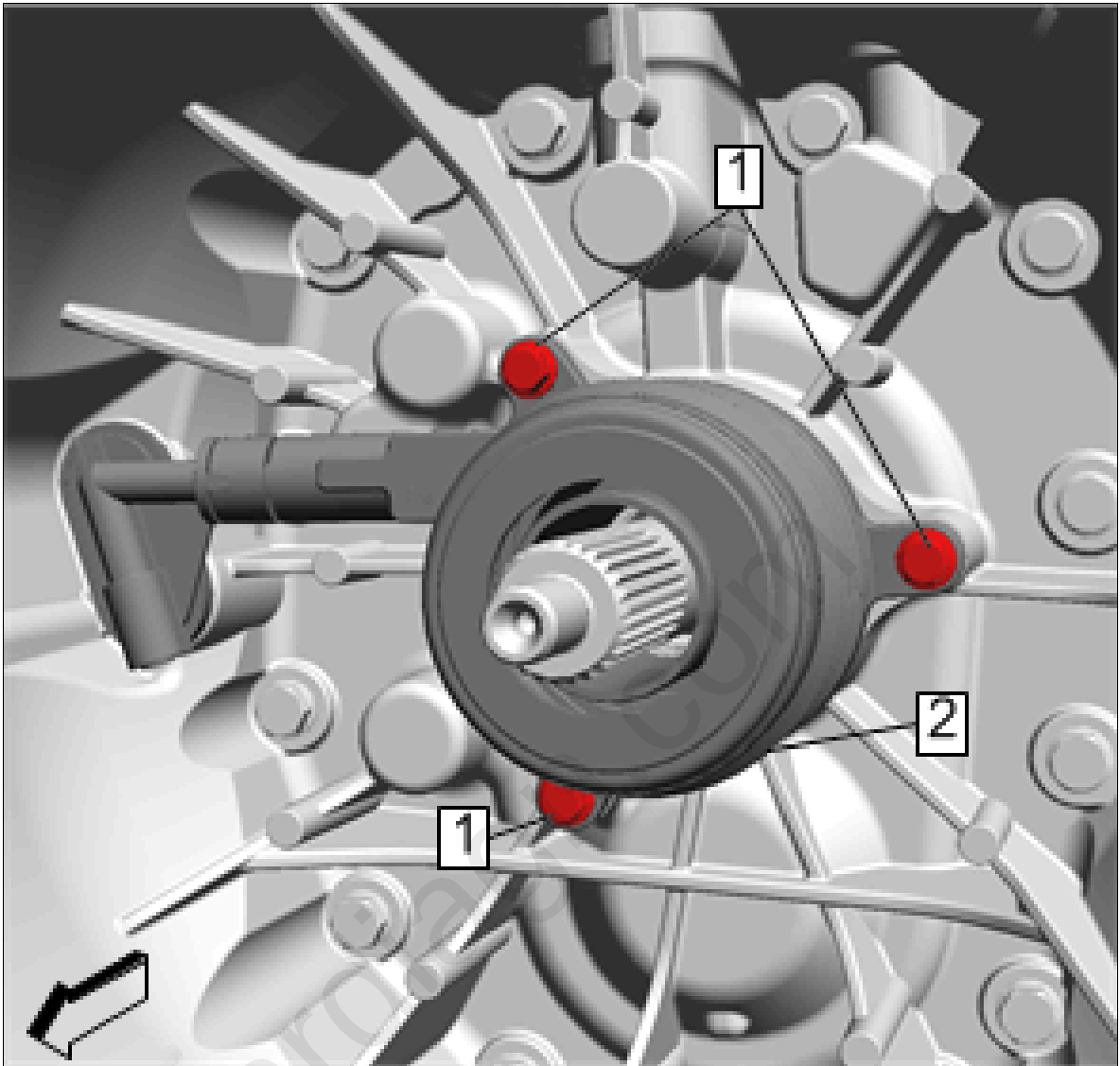
1. Tighten all the clutch pressure plate bolts in sequence and evenly to 15 N.m (11 lb ft).

2. Tighten all the clutch pressure plate bolts in sequence and evenly to 35 N.m (26 lb ft).
3. Tighten all the clutch pressure plate bolts in sequence and evenly to 70 N.m (52 lb ft).
8. Remove the commercially available clutch alignment tool.
9. Remove the **EN-50792** tool.
10. Install the starter. Starter Replacement (LT1)Starter Replacement (LGX)Starter Replacement (LTG)
11. Install the manual transmission. Transmission Replacement (MM6 with LT1 Engine)

REPAIR INSTRUCTIONS > CLUTCH CONCENTRIC ACTUATOR CYLINDER REPLACEMENT > REMOVAL PROCEDURE

1. Remove the manual transmission from the vehicle. Refer to Transmission Replacement (MM6 with LT1 Engine)Transmission Replacement (M13 with LGX Engine)Transmission Replacement (M13 with LTG Engine) .

Fig 1: Clutch Slave Cylinder

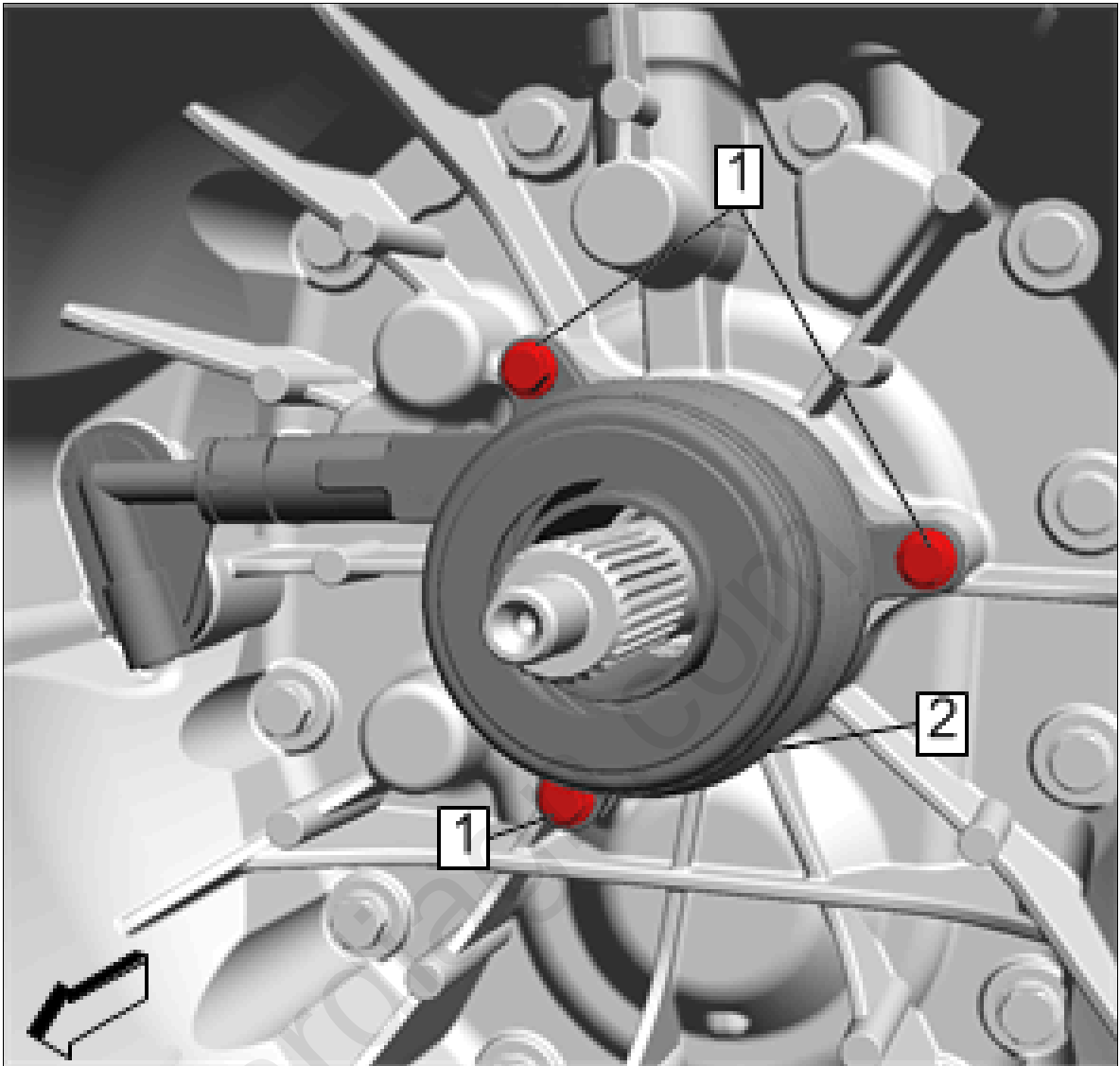


Courtesy of GENERAL MOTORS COMPANY

2. Remove the clutch slave cylinder bolts (1).
3. Remove the clutch slave cylinder (2) from the transmission.

**REPAIR INSTRUCTIONS > CLUTCH CONCENTRIC ACTUATOR CYLINDER
REPLACEMENT > INSTALLATION PROCEDURE**

Fig 1: Clutch Slave Cylinder



Courtesy of GENERAL MOTORS COMPANY



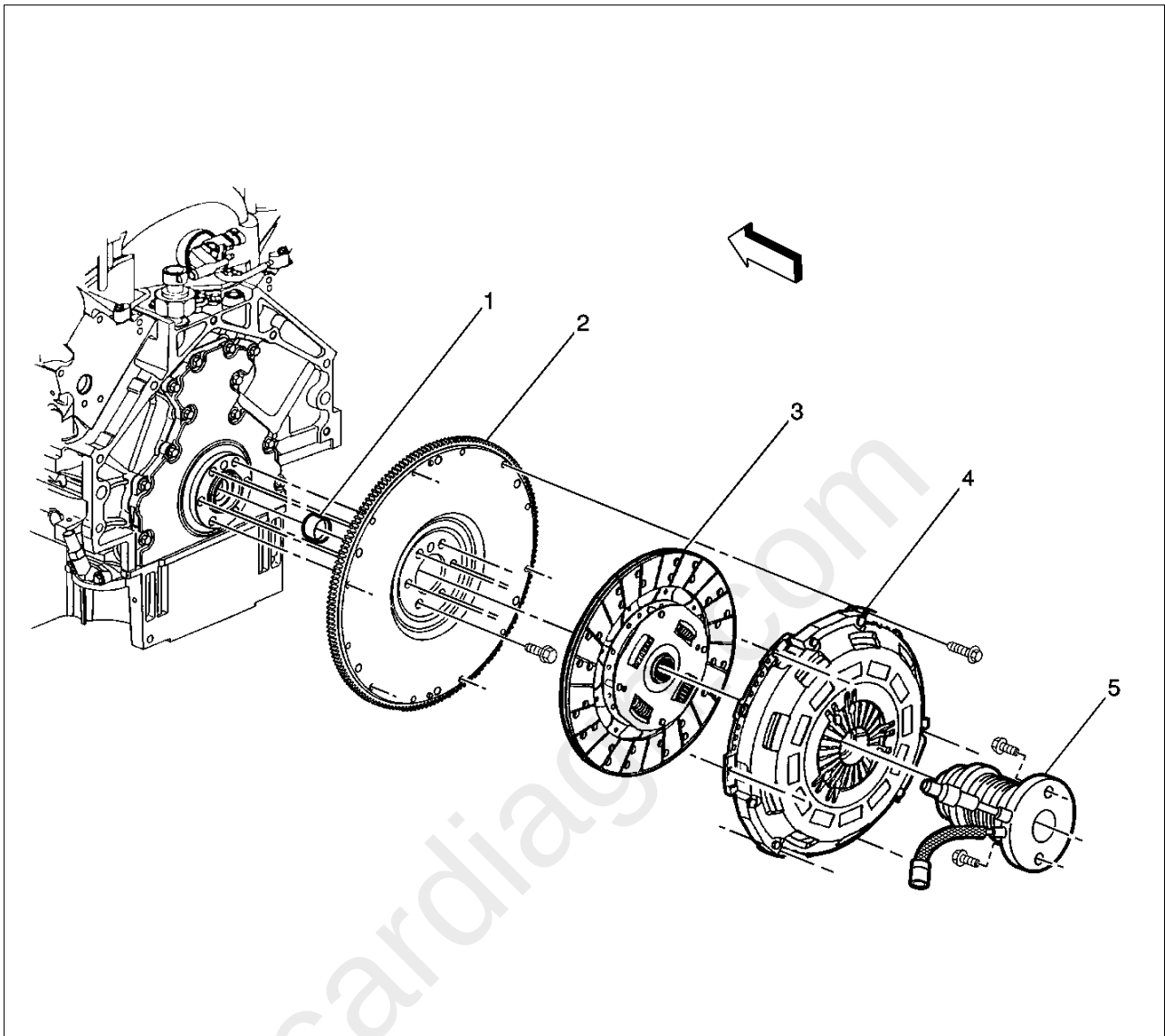
CAUTION:

Refer to Fastener Caution .

1. Position the clutch slave cylinder (2) on the transmission.
2. Install the clutch slave cylinder and bolts (1) and tighten to 9 N.m (80 lb in).
3. Install the manual transmission to the vehicle. Refer to Transmission Replacement (MM6 with LT1 Engine)Transmission Replacement (M13 with LGX Engine)Transmission Replacement (M13 with LTG Engine) .

OPERATION

Fig 1: Clutch System Exploded View



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 members in contact with each other

DESCRIPTION AND OPERATION > CLUTCH SYSTEM DESCRIPTION AND OPERATION > 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.

DESCRIPTION AND OPERATION > CLUTCH SYSTEM DESCRIPTION AND OPERATION > 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.

DESCRIPTION AND OPERATION > CLUTCH SYSTEM DESCRIPTION AND OPERATION > 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.

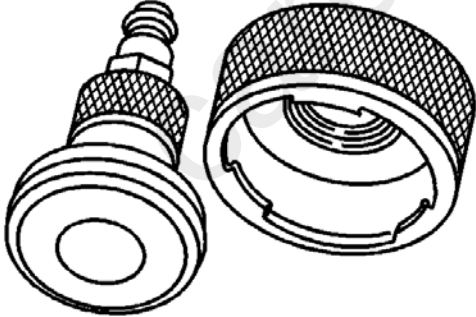
The clutch release bearing is moved by the actuator assembly to move the release levers which move the pressure plate to the rear, thus separating the clutch disc from the flywheel when the clutch pedal is depressed by the driver. As the clutch disc wears, the diaphragm spring fingers move forward forcing the

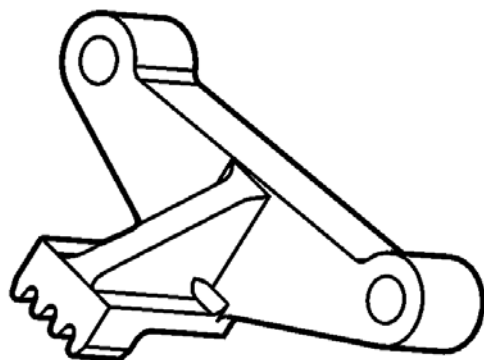
release bearing to move. This movement forces the actuator cylinder piston to move forward in its bore, consuming hydraulic fluid from the master cylinder reservoir, thereby providing the SELF-ADJUSTING feature of the hydraulic clutch linkage system.

DESCRIPTION AND OPERATION > CLUTCH SYSTEM DESCRIPTION AND OPERATION > HYDRAULIC CLUTCH DESCRIPTION

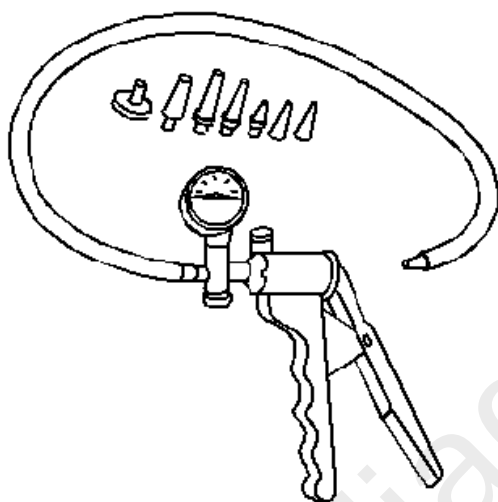
The clutch hydraulic system consists of a master cylinder and an actuator cylinder. When pressure is applied to the clutch pedal, pedal depressed, the pushrod contacts the plunger and pushes it down the bore of the master cylinder. In the first 0.8 mm (0.031 in) of movement, the compensation port seal 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
	CH-44894-A J-44894 Brake Pressure Bleeder Adapter



EN-50792
Flywheel Holding Tool



GE-23738-A
J-23738-A
Vacuum Pump