Service Manual: HYDRAULIC BRAKE SYSTEM

SPECIFICATIONS > FASTENER SPECIFICATIONS

Application	Specification	
	Metric	English
Brake Hose Bracket Bolt	10 N.m	89 lb in
Brake Hose Fitting Bolt - Front	40 N.m	30 lb ft
Brake Hose Fitting Bolt - Rear	40 N.m	30 lb ft
Brake Pedal Assembly Nut	25 N.m	18 lb ft
Brake Pipe Fitting	18 N.m	13 lb ft
Brake Pipe Fitting - Brake Pressure Modulator Valve Inlet	32 N.m	24 lb ft
Brake Pipe Fitting - Master Cylinder Outlet	30 N.m	22 lb ft
Master Cylinder Nut	23 N.m	17 lb ft
Master Cylinder Reservoir Bolt	8 N.m	71 lb in
Power Brake Booster Pump Assembly Bolt	25 N.m	18 lb ft
Power Brake Booster Pump Nut	22 N.m	16 lb ft
Power Vacuum Brake Booster Nut	25 N.m	18 lb ft

SPECIFICATIONS > APPROXIMATE FLUID CAPACITIES

Application	Specification	
	Metric	US English
Hydraulic Brake System	0.86 L	1.82 pt

SPECIFICATIONS > BRAKE COMPONENT SPECIFICATIONS

Application	Specification	
	Metric	English
Brake Caliper Bleeder Valve - JL9, J55 Rear	11 N.m	97 lb in
Brake Caliper Bleeder Valve - J55 Front, J6G	17-20 N.m	13-15 lb ft

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SPECIFICATIONS > BRAKE SYSTEM SPECIFICATIONS

Application	Specification	
	Metric	English
Brake Pedal Travel • Maximum specification with 445 N (100 lbs) of force applied to the pedal with the ignition OFF and the booster power reserve depleted.	69.85 mm	2.75 in

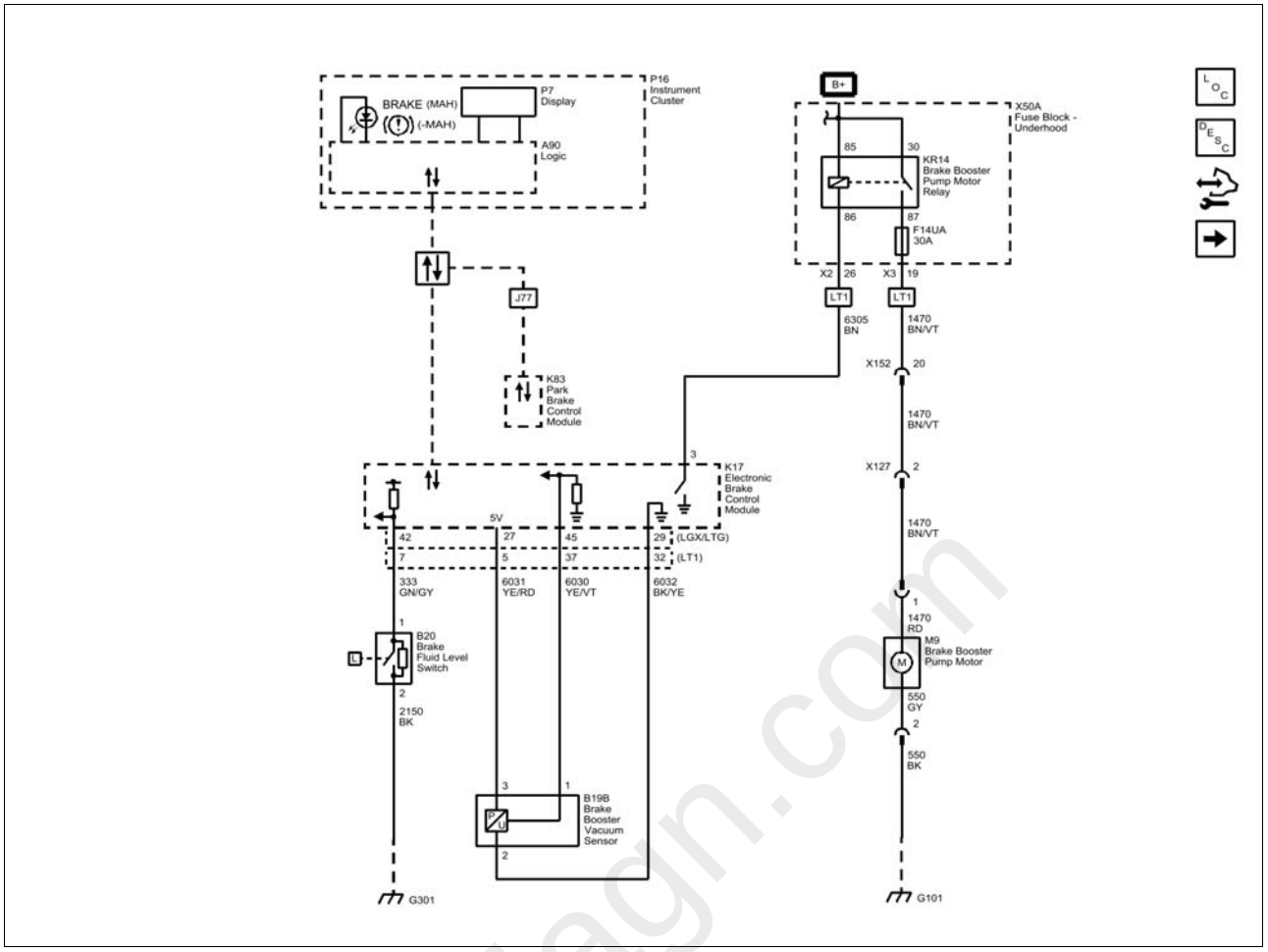
SPECIFICATIONS > ADHESIVES, FLUIDS, LUBRICANTS, AND SEALERS

Application	Type of Material	GM Part Number	
		United States	Canada
Hydraulic Brake System	DOT 3 Motor Vehicle Brake Fluid	19299818	19299819

SCHEMATIC WIRING DIAGRAMS > HYDRAULIC BRAKE WIRING SCHEMATICS > HYDRAULIC BRAKE

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Fig 1: Hydraulic Brake



Courtesy of GENERAL MOTORS COMPANY

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > DTC DESCRIPTOR

DTC C0126

Brake Fluid Level Sensor Circuit

For symptom byte information refer to Symptom Byte List .

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	C0267 00	C0126 05	C0126 05	-
Ground	-	C0126 05	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The brake fluid level switch monitors the level of the brake fluid in the brake fluid reservoir. When the brake fluid level switch input closed, the electronic brake control module will set the DTC.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CONDITIONS FOR RUNNING THE DTC

Ignition ON/Vehicle in Service Mode/Vehicle in Service Mode.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CONDITIONS FOR SETTING THE DTC

- Low brake fluid level is detected for 5 s.
- An open is detected on the ground circuit.
- An open or short to voltage is detected on the signal circuit.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

- The electronic brake control module disables the traction control and stability control for the duration of the ignition cycle.
- The traction control/stability control-active indicator turns ON.
- The brake warning indicator turns ON.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CONDITIONS FOR CLEARING THE DTC

The condition for setting the DTC is no longer present.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Hydraulic Brake System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CIRCUIT/SYSTEM VERIFICATION

1. Verify that the brake fluid level is above the minimum level.
    1. **If low**

       Refer to Brake Fluid Loss .
    1. **If above minimum level**
2. Refer to Circuit/System Testing.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > CIRCUIT/SYSTEM TESTING

1. Ignition OFF/Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B20 Brake Fluid Level Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF/Vehicle OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, repair the open/high resistance in the ground connection.
    1. **If less than 10 Ω**
3. Ignition ON/Vehicle in Service Mode.
4. Verify the scan tool Brake Fluid Level Sensor parameter is OK.
    1. **If the parameter is not OK**
        1. Ignition OFF/Vehicle OFF/Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for infinite resistance between the signal circuit terminal 1 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            2. If infinite resistance, replace the K17 Electronic Brake Control Module.
    1. **If the parameter is OK**
5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
6. Verify the scan tool Brake Fluid Level Sensor parameter is Low.
    1. **If the parameter is not Low**
        1. Ignition OFF/Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V.
        3. Test for less than 2 Ω in the signal circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If the parameter is Low**
7. Test or replace the B20 Brake Fluid Level Switch.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0126: BRAKE FLUID LEVEL SENSOR CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for electronic brake control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > DTC DESCRIPTOR

DTC C0267

Low Brake Fluid Indicated

For symptom byte information refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	C0267 00	C0126 05	C0126 05	-
Ground	-	C0126 05	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CIRCUIT/SYSTEM DESCRIPTION

The brake fluid level switch monitors the level of the brake fluid in the brake fluid reservoir. When the brake fluid level switch input closed, the electronic brake control module will set the DTC.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CONDITIONS FOR RUNNING THE DTC

Ignition ON/Vehicle in Service Mode.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CONDITIONS FOR SETTING THE DTC

Low brake fluid level is detected for 8 s.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > ACTION TAKEN WHEN THE DTC SETS

- The electronic brake control module disables the traction control and stability control for the duration of the ignition cycle.
- The traction control/stability control-active indicator turns ON.
- The brake warning indicator turns ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CONDITIONS FOR CLEARING THE DTC

The condition for setting the DTC is no longer present.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Brake Warning System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs

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- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CIRCUIT/SYSTEM VERIFICATION

1. Verify that the brake is above minimum level.
    1. **If low**

       Refer to Brake Fluid Loss .
    1. **If above minimum level**

       Refer to Circuit/System Testing.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > CIRCUIT/SYSTEM TESTING

1. Ignition OFF/Vehicle OFF and all vehicle systems OFF, disconnect the harness connector at the B20 Brake Fluid Level Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF/Vehicle OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, repair the open/high resistance in the ground connection.
    1. **If less than 10 Ω**
3. Ignition ON/Vehicle in Service Mode.
4. Verify the scan tool Brake Fluid Level Sensor parameter is OK.
    1. **If the parameter is not OK**
        1. Ignition OFF/Vehicle OFF/Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for infinite resistance between the signal circuit terminal 1 and ground.

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1. If less than infinite resistance, repair the short to ground on the circuit.
2. If infinite resistance, replace the K17 Electronic Brake Control Module.

1. **If the parameter is OK**

5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
6. Verify the scan tool Brake Fluid Level Sensor parameter is Low.
    1. **If the parameter is not Low**
        1. Ignition OFF/Vehicle OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V.
        3. Test for less than 2 Ω in the signal circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If the parameter is Low**
7. Test or replace the B20 Brake Fluid Level Switch.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0267: LOW BRAKE FLUID INDICATED > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

Control Module References for electronic brake control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > DTC DESCRIPTOR

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DTC C027B

Brake Booster Electric Vacuum Pump

For symptom byte information refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Vacuum Pump Relay B+	2	2	-	-
Vacuum Pump Relay Control	C027B 00	C027B 00	1	-
Vacuum Pump Relay Ground	-	2	-	-
Brake Booster Pump Motor Control	2	2	1	-
Brake Booster Pump Motor Ground	-	2	-	-
1. Brake Booster Pump Motor Always ON 2. Brake Booster Pump Motor Always OFF				

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CIRCUIT/SYSTEM DESCRIPTION

The brake booster vacuum sensor measures the vacuum in the brake booster assembly. The electronic brake control module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor supplies a voltage signal in relation to the pressure in the brake booster to the electronic brake control module. When the vacuum within the system becomes weak, the electronic brake control module turns ON the brake booster pump motor by providing ground to the brake booster pump motor relay. The relay activates and supplies battery voltage to the brake booster pump motor.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CONDITIONS FOR SETTING THE DTC

A short to ground or open/high resistance is detected on the control circuit.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > ACTION TAKEN WHEN THE DTC SETS

The DTC is stored in memory.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CONDITIONS FOR CLEARING THE DTC

The condition for setting the DTC is no longer present.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

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Description and Operation

Brake Assist System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CIRCUIT/SYSTEM VERIFICATION

1. Ignition ON.
2. Verify the M9 Brake Booster Pump Motor turns ON and OFF when commanding the Brake Booster Electric Vacuum Pump On and Off with a scan tool.

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1. **If the M9 Brake Booster Pump Motor does not turn ON and OFF**

   Refer to Circuit/System Testing.

1. **If the M9 Brake Booster Pump Motor turn ON and OFF**

3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > CIRCUIT/SYSTEM TESTING

1. Ignition OFF, disconnect the KR14 Brake Booster Pump Motor Relay, ignition ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.
    1. **If the test lamp does not illuminate and the circuit fuse is good**
        1. Ignition OFF, remove the test lamp.
        2. Test for less than 2 Ω in the B+ circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.
    1. **If the test lamp does not illuminate and the circuit fuse is open**
        1. Ignition OFF, remove the test lamp.
        2. Test for infinite resistance between the B+ circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance,
        3. Disconnect the M9 Brake Booster Pump Motor.
        4. Test for greater than 10 Ω between the control circuit terminal 87 and ground.
            1. If less than 10 Ω, repair the short to ground on the circuit.
            2. If greater than 10 Ω, test or replace the M9 Brake Booster Pump Motor.
    1. **If the test lamp illuminates**
3. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
4. Test for less than 10 Ω between the ground circuit terminal 86 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.

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1. If 2 Ω or greater, repair the open/high resistance in the circuit.
2. If less than 2 Ω, repair the open/high resistance in the ground connection.

1. **If less than 10 Ω**

5. Connect a test lamp between the control circuit terminal 85 and the ground circuit terminal 86.
6. Verify the test lamp turns ON and OFF when commanding the Brake Booster Pump Motor On and Off with a scan tool.
    1. **If the test lamp is always OFF**
        1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
        2. Test for infinite resistance between the control circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the control circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If the test lamp is always ON**
        1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for less than 1 V between the control circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V, replace the K17 Electronic Brake Control Module.
    1. **If the test lamp turns ON and OFF**
7. Verify a test lamp does not illuminate between the control circuit terminal 87 and ground.
    1. **If the test lamp illuminates**

        Repair the short to voltage on the circuit.

    1. **If the test lamp does not illuminate**
8. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the M9 Brake Booster Pump Motor. It may take up to 2 minutes for all vehicle systems to power down.
9. Test for less than 10 Ω between the M9 Brake Booster Pump Motor ground circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF.

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2. Test for less than 2 Ω in the ground circuit end to end.
    1. If 2 Ω or greater, repair the open/high resistance in the circuit.
    2. If less than 2 Ω, repair the open/high resistance in the ground connection.

1. **If less than 10 Ω**

10. Connect the harness connector at the M9 Brake Booster Pump Motor.
11. Ignition ON, connect a 30 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.
12. Verify the M9 Brake Booster Pump Motor is activated.
    1. **If the M9 Brake Booster Pump Motor does not activate**
        1. Ignition OFF, remove the jumper wire.
        2. Test for less than 2 Ω in the control circuit terminal 87 end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the M9 Brake Booster Pump Motor.

    1. **If the M9 Brake Booster Pump Motor activates**
13. Test or replace the KR14 Brake Booster Pump Motor Relay.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > COMPONENT TESTING

Relay Test

1. Ignition OFF, remove the KR14 Brake Booster Pump Motor Relay.
2. Test for 70-150 Ω between terminals 85 and 86.
    1. **If less than 70 Ω or greater than 150 Ω**

        Replace the KR14 Brake Booster Pump Motor Relay.

    1. **If between 70-150 Ω**
3. Test for infinite resistance between the terminals listed below:
    1. 30 and 86
    2. 30 and 87
    3. 30 and 85
    4. 85 and 87

    1. **If less than infinite resistance**

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Replace the KR14 Brake Booster Pump Motor Relay.

1. **If infinite resistance**

4. Install a 30 A fused jumper wire between relay terminal 85 and 12 V. Install a jumper wire between relay terminal 86 and ground.
5. Test for less than 10 Ω between terminals 30 and 87.
    1. **If 10 Ω or greater**

        Replace the KR14 Brake Booster Pump Motor Relay.

    1. **If less than 10 Ω**
6. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C027B: BRAKE BOOSTER ELECTRIC VACUUM PUMP > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Power Brake Booster Pump Replacement
- Control Module References for electronic brake control module replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > DTC DESCRIPTOR

DTC C0299

Brake Booster Large Vacuum Leak Detected

For symptom byte information refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > CIRCUIT/SYSTEM DESCRIPTION

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The brake booster vacuum sensor measures the vacuum in the brake booster assembly. The electronic brake control module (EBCM) supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor supplies a voltage signal in relation to the pressure in the brake booster to the electronic brake control module.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > CONDITIONS FOR RUNNING THE DTC

- Engine running for a minimum of three minutes.
- Brake switch is off.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > CONDITIONS FOR SETTING THE DTC

The EBCM detected a too low vacuum in the brake booster assembly.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > ACTION TAKEN WHEN THE DTC SETS

The brake warning indicator turns ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > CONDITIONS FOR CLEARING THE DTC

- A current DTC clears when the diagnostic runs and passes.
- The electronic brake control module will turn OFF the indicator in the next ignition cycle.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Brake Assist System Description and Operation

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Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > CIRCUIT/SYSTEM TESTING

1. Ignition ON.
2. Verify that DTC C025E is not set.
    1. **If the DTC is set**

       Refer to DTC C025E .

    1. **If the DTC is not set**
3. Verify that the brake booster vacuum system has no damage, leakage or incorrect installation.
    1. **If damage, leakage or incorrect installation is found**

       Refer to Brake Assist System Diagnosis .

    1. **If the inspection is OK**
4. Test or replace the B19B Brake Booster Vacuum Sensor.
5. Verify the DTC does not set while operating the vehicle under the Conditions for Running the DTC.
    1. **If the DTC sets**

       Replace the K17 Electronic Brake Control Module.

    1. **If the DTC does not set**
6. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0299: BRAKE BOOSTER LARGE VACUUM LEAK DETECTED > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

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- Power Brake Booster Vacuum Hose Replacement (LTG) Power Brake Booster Vacuum Hose Replacement (LGX) for brake booster vacuum sensor replacement
- Control Module References for electronic brake control module replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > DTC DESCRIPTOR

DTC C0914

Control Module Voltage Output 1 Circuit

For symptom byte information refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	C0914 00	C025E 04	C0914 00	-
Signal	C025E 04	C025E 04	C025E 04	C025E 5A
Low Reference	-	C025E 04	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The brake booster vacuum sensor monitors the pressure in the brake booster. The electronic brake control module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor supplies a voltage signal in relation to the pressure in the brake booster to the electronic brake control module.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > CONDITIONS FOR RUNNING THE DTC

Ignition ON

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > CONDITIONS FOR SETTING THE DTC

The electronic brake control module has detected a short to ground or short to voltage in the Brake Booster Vacuum Sensor 5V reference circuit.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

- The ABS indicator turns ON.
- The red brake indicator turns ON.
- The traction/stability control indicator turns ON.
- The Service Brake Assist message is displayed on the driver information center.
- The electronic brake control module disables the ABS, the traction control system and the electronic stability control for the duration of the drive cycle.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > CONDITIONS FOR CLEARING THE DTC

- The condition for setting the DTC is no longer present.
- The history DTC will clear after 40 consecutive fault-free drive cycles have occurred.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Brake Assist System Description and Operation

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Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE VOLTAGE OUTPUT 1 CIRCUIT > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B19B Brake Booster Vacuum Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for less than 2 Ω in the low reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 3 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If greater than 5.2 V**

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1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
2. Test for less than 1 V between the 5 V reference circuit and ground.
    1. If 1 V or greater, repair the short to voltage on the circuit.
    2. If less than 1 V, replace the K17 Electronic Brake Control Module.

1. **If between 4.8-5.2 V**

5. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
6. Test for less than 1 V between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and ground.
    1. **If greater than 1 V**

       Repair the short to voltage on the circuit.

    1. **If less than 1 V**
7. Ignition OFF.
8. Test for infinite resistance between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and ground.
    1. **If less than infinite resistance**

       Repair the short to ground on the circuit.

    1. **If infinite resistance**
9. Test for less than 2 Ω between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and the K17 Electronic Brake Control Module signal circuit terminal 37.
    1. **If 2 Ω or greater**

       Repair the open/high resistance in the circuit.

    1. **If less than 2 Ω**
10. Replace the B19B Brake Booster Vacuum Sensor.
11. Verify the DTC does not set while operating the vehicle under Conditions for Running the DTC.
    1. **If the DTC sets**

       Replace the K17 Electronic Brake Control Module.

    1. **If the DTC does not set**
12. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C0914: CONTROL MODULE

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VOLTAGE OUTPUT 1 CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Power Brake Booster Vacuum Hose Replacement (LTG) Power Brake Booster Vacuum Hose Replacement (LGX) for power brake booster vacuum sensor replacement
- Control Module References for control module replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > DTC DESCRIPTORS

DTC C025E

Brake Booster Vacuum Circuit

For symptom byte information refer to Symptom Byte List .

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
5 V Reference	C0914.00	C025E 04	C0914.00	-
Signal	C025E 04	C025E 04	C025E 04	C025E 5A
Low Reference	-	C025E 04	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > CIRCUIT/SYSTEM DESCRIPTION

The brake booster vacuum sensor monitors the pressure in the brake booster. The electronic brake control module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor supplies a voltage signal in relation to the pressure in the brake booster to the electronic brake control module.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > CONDITIONS FOR RUNNING THE DTC

Ignition ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > CONDITIONS FOR SETTING THE DTC

C025E 04

- A short to ground, short to voltage or open/high resistance is detected on the signal circuit.
- An open/high resistance is detected on the 5 V reference circuit.
- An open/high resistance is detected on the low reference circuit.

C025E 5A

The vacuum sensor signal is not plausible.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > ACTION TAKEN WHEN THE DTC SETS

The brake warning indicator turns ON.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > CONDITIONS FOR CLEARING THE DTC

- A current DTC clears when the diagnostic runs and passes.
- The electronic control module will turn OFF the indicator in the next ignition cycle.

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

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Brake Assist System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Control Module References for scan tool information

DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B19B Brake Booster Vacuum Sensor. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the low reference circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for less than 2 Ω in the low reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If less than 10 Ω**
3. Ignition ON.
4. Test for 4.8-5.2 V between the 5 V reference circuit terminal 3 and ground.
    1. **If less than 4.8 V**
        1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for infinite resistance between the 5 V reference circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            1. If infinite resistance
        3. Test for less than 2 Ω in the 5 V reference circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.

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1. **If greater than 5.2 V**
    1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
    2. Test for less than 1 V between the 5 V reference circuit and ground.
        1. If 1 V or greater, repair the short to voltage on the circuit.
        2. If less than 1 V, replace the K17 Electronic Brake Control Module.
1. **If between 4.8-5.2 V**

5. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
6. Test for less than 1 V between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and ground.
    1. **If greater than 1 V**

        Repair the short to voltage on the circuit.
    1. **If less than 1 V**
7. Ignition OFF.
8. Test for infinite resistance between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and ground.
    1. **If less than infinite resistance**

        Repair the short to ground on the circuit.
    1. **If infinite resistance**
9. Test for less than 2 Ω between the B19B Brake Booster Vacuum Sensor signal circuit terminal 1 and the K17 Electronic Brake Control Module signal circuit terminal 4.
    1. **If 2 Ω or greater**

        Repair the open/high resistance in the circuit.
    1. **If less than 2 Ω**
10. Replace the B19B Brake Booster Vacuum Sensor.
11. Verify the DTC does not set while operating the vehicle under Conditions for Running the DTC.
    1. **If the DTC sets**

        Replace the K17 Electronic Brake Control Module.
    1. **If the DTC does not set**
12. All OK.

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DIAGNOSTIC INFORMATION AND PROCEDURES > DTC C025E: BRAKE BOOSTER VACUUM CIRCUIT > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Power Brake Booster Vacuum Hose Replacement (LTG) Power Brake Booster Vacuum Hose Replacement (LGX) for Power Brake Booster Vacuum Sensor Replacement
- Control Module References for electronic brake control module replacement, programming and setup

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - HYDRAULIC BRAKES

> *NOTE:*
>
> *The following steps must be completed before using the symptom tables.*

1. Perform the Brake System Vehicle Road Test before using the hydraulic brake symptom tables in order to duplicate the customer's concern.
2. Review the system operation in order to familiarize yourself with the system functions. Refer to the following:
    1. Brake Warning System Description and Operation
    2. Hydraulic Brake System Description and Operation
    3. Brake Booster Vacuum Assist Description and Operation
    4. Brake Assist System Description and Operation
    5. ABS Description and Operation

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DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - HYDRAULIC BRAKES > VISUAL/PHYSICAL INSPECTION

- Inspect for aftermarket devices which could affect the operation of the hydraulic brake system. Refer to Checking Aftermarket Accessories .
- Inspect the easily accessible or visible system components, for obvious damage or conditions, which could cause the symptom.

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - HYDRAULIC BRAKES > INTERMITTENT

Faulty electrical connections or wiring may be the cause of intermittent conditions. Refer to Testing for Intermittent Conditions and Poor Connections .

DIAGNOSTIC INFORMATION AND PROCEDURES > SYMPTOMS - HYDRAULIC BRAKES > SYMPTOM LIST

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

- Brake Warning Indicator Malfunction
- Brake Booster Pump Motor Malfunction
- Brake Pulsation
- Brake System Noise
- Braking Action Uneven - Pulls to One Side
- Braking Action Uneven - Front to Rear
- Brake Pedal Excessive Travel
- Brake Pedal Excessive Effort
- Brakes Drag
- Brake System Slow Release
- Brake Fluid Loss

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Vacuum Pump Relay B+	2	2	-	-
Vacuum Pump Relay Control	2	2	1	-

Vacuum Pump Relay Ground	-	2	-	-
Brake Booster Vacuum Sensor 5V Reference	C1100 00	C1100 00	C1100 00, C1100 01	-
Brake Booster Vacuum Sensor Signal	C1100 00, C1100 02	C1100 00	C1100 00, C1100 01	C1100 09, C1100 5A
Brake Booster Vacuum Sensor Low Reference	-	C1100 00	-	-
Brake Booster Pump Motor Control	2	2	1	-
Brake Booster Pump Motor Ground	-	2	-	-
1. Brake Booster Pump Motor Always ON 2. Brake Booster Pump Motor Always OFF				

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > CIRCUIT/SYSTEM DESCRIPTION

The brake booster vacuum sensor measures the vacuum in the brake booster assembly. The electronic brake control module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor supplies a voltage signal in relation to the pressure in the brake booster to the electronic brake control module. When the vacuum within the system becomes weak, the electronic brake control module turns ON the brake booster pump motor by providing ground to the brake booster pump motor relay. The relay activates and supplies battery voltage to the brake booster pump motor.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Brake Booster Vacuum Assist Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections

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- Wiring Repairs

Scan Tool Reference

Control Module References

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > CIRCUIT/SYSTEM VERIFICATION

1. Verify the M9 Brake Booster Pump Motor turns ON and OFF when commanding the Brake Booster Electric Vacuum Pump On and Off with a scan tool.
    1. **If the M9 Brake Booster Pump Motor does not turn ON and OFF**

       Refer to Circuit/System Testing.

    1. **If the M9 Brake Booster Pump Motor turn ON and OFF**
2. Verify that the brake booster vacuum system has no damage, leakage or incorrect installation.
    1. **If damage, leakage or incorrect installation is found**

       Refer to Brake Assist System Diagnosis .

    1. **If the inspection is OK**
3. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > CIRCUIT/SYSTEM TESTING

1. Ignition OFF, disconnect the KR14 Brake Booster Pump Motor Relay, ignition ON.
2. Verify a test lamp illuminates between the B+ circuit terminal 30 and ground.
    1. **If the test lamp does not illuminate and the circuit fuse is good**
        1. Ignition OFF, remove the test lamp.
        2. Test for less than 2 Ω in the B+ circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, verify the fuse is not open and there is voltage at the fuse.
    1. **If the test lamp does not illuminate and the circuit fuse is open**
        1. Ignition OFF, remove the test lamp.
        2. Test for infinite resistance between the B+ circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.

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1. If infinite resistance,

3. Disconnect the M9 Brake Booster Pump Motor.
4. Test for greater than 10 Ω between the control circuit terminal 87 and ground.
    1. If less than 10 Ω, repair the short to ground on the circuit.
    2. If greater than 10 Ω, test or replace the M9 Brake Booster Pump Motor.

1. **If the test lamp illuminates**

3. Ignition OFF and all vehicle systems OFF. It may take up to 2 min for all vehicle systems to power down.
4. Test for less than 10 Ω between the ground circuit terminal 86 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, repair the open/high resistance in the ground connection.

    1. **If less than 10 Ω**

5. Connect a test lamp between the control circuit terminal 85 and the ground circuit terminal 86.
6. Verify the test lamp turns ON and OFF when commanding the Brake Booster Pump Motor On and Off with a scan tool.
    1. **If the test lamp is always OFF**
        1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
        2. Test for infinite resistance between the control circuit and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.

            1. If infinite resistance
        3. Test for less than 2 Ω in the control circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.

    1. **If the test lamp is always ON**
        1. Ignition OFF, remove the test lamp, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for less than 1 V between the control circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.

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1. If less than 1 V, replace the K17 Electronic Brake Control Module.

1. **If the test lamp turns ON and OFF**

7. Verify a test lamp does not illuminate between the control circuit terminal 87 and ground.

    1. **If the test lamp illuminates**

        Repair the short to voltage on the circuit.

    1. **If the test lamp does not illuminate**

8. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the M9 Brake Booster Pump Motor. It may take up to 2 minutes for all vehicle systems to power down.
9. Test for less than 10 Ω between the M9 Brake Booster Pump Motor ground circuit terminal 2 and ground.

    1. **If 10 Ω or greater**

        1. Ignition OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.

            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, repair the open/high resistance in the ground connection.

    1. **If less than 10 Ω**

10. Connect the harness connector at the M9 Brake Booster Pump Motor.
11. Ignition ON, connect a 30 A fused jumper wire between the B+ circuit terminal 30 and the control circuit terminal 87.
12. Verify the M9 Brake Booster Pump Motor is activated.

    1. **If the M9 Brake Booster Pump Motor does not activate**

        1. Ignition OFF, remove the jumper wire.
        2. Test for less than 2 Ω in the control circuit terminal 87 end to end.

            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, test or replace the M9 Brake Booster Pump Motor.

    1. **If the M9 Brake Booster Pump Motor activates**

13. Test or replace the KR14 Brake Booster Pump Motor Relay.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > COMPONENT TESTING

Relay Test

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1. Ignition OFF, remove the KR14 Brake Booster Pump Motor Relay.
2. Test for 70-150 Ω between terminals 85 and 86.
    1. **If less than 70 Ω or greater than 150 Ω**

       Replace the KR14 Brake Booster Pump Motor Relay.

    1. **If between 70-150 Ω**
3. Test for infinite resistance between the terminals listed below:
    1. 30 and 86
    2. 30 and 87
    3. 30 and 85
    4. 85 and 87
    1. **If less than infinite resistance**

       Replace the KR14 Brake Booster Pump Motor Relay.

    1. **If infinite resistance**
4. Install a 30 A fused jumper wire between relay terminal 85 and 12 V. Install a jumper wire between relay terminal 86 and ground.
5. Test for less than 10 Ω between terminals 30 and 87.
    1. **If 10 Ω or greater**

       Replace the KR14 Brake Booster Pump Motor Relay.

    1. **If less than 10 Ω**
6. All OK.

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE BOOSTER PUMP MOTOR MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Power Brake Booster Pump Replacement
- Control Module References for electronic brake control module replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > DIAGNOSTIC INSTRUCTIONS

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.

- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > DIAGNOSTIC FAULT INFORMATION

Circuit	Short to Ground	Open/High Resistance	Short to Voltage	Signal Performance
Signal	C0267 00	C0267 05	C0267 05	-
Ground	-	C0267 05	-	-

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > CIRCUIT/SYSTEM DESCRIPTION

The electronic brake control module monitors the brake fluid level in the brake fluid reservoir. When the fluid within the brake fluid reservoir is below the MIN level, contacts within the brake fluid level switch closes causing the voltage within the signal circuit to drop. The electronic brake control module will detect the voltage drop and will send a serial data message to the instrument cluster commanding the brake warning indicator to illuminate.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > REFERENCE INFORMATION

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

COMPONENT CONNECTOR END VIEWS - INDEX

Description and Operation

Brake Warning System Description and Operation

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > CIRCUIT/SYSTEM VERIFICATION

1. Verify that the brake fluid level is above the minimum level.
    1. **If low**

       Refer to Brake Fluid Loss .
    1. **If above minimum level**
2. Ignition ON.
3. Verify the scan tool Brake Fluid Level Sensor parameter is OK.
    1. **If the parameter is Low**

       Refer to Circuit/System Testing
    1. **If the parameter is Ok**
4. Verify the brake warning indicator turns ON and OFF when commanding the Instrument Cluster All Indicators On and Off with a scan tool.
    1. **If the brake warning indicator does not turn ON and OFF**

       Replace the P16 Instrument Cluster.
    1. **If the brake warning indicator turns ON and OFF**
5. All OK.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > CIRCUIT/SYSTEM TESTING

1. Ignition OFF and all vehicle systems OFF, disconnect the harness connector at the B20 Brake Fluid Level Switch. It may take up to 2 min for all vehicle systems to power down.
2. Test for less than 10 Ω between the ground circuit terminal 2 and ground.
    1. **If 10 Ω or greater**
        1. Ignition OFF.
        2. Test for less than 2 Ω in the ground circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, repair the open/high resistance in the ground connection.
    1. **If less than 10 Ω**

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3. Ignition ON.
4. Verify the scan tool Brake Fluid Level Sensor parameter is OK.
    1. **If the parameter is not OK**
        1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module.
        2. Test for infinite resistance between the signal circuit terminal 1 and ground.
            1. If less than infinite resistance, repair the short to ground on the circuit.
            2. If infinite resistance, replace the K17 Electronic Brake Control Module.
    1. **If the parameter is OK**
5. Install a 3 A fused jumper wire between the signal circuit terminal 1 and ground.
6. Verify the scan tool Brake Fluid Level Sensor parameter is Low.
    1. **If the parameter is OK**
        1. Ignition OFF, disconnect the harness connector at the K17 Electronic Brake Control Module, ignition ON.
        2. Test for less than 1 V between the signal circuit and ground.
            1. If 1 V or greater, repair the short to voltage on the circuit.
            1. If less than 1 V.
        3. Test for less than 2 Ω in the signal circuit end to end.
            1. If 2 Ω or greater, repair the open/high resistance in the circuit.
            2. If less than 2 Ω, replace the K17 Electronic Brake Control Module.
    1. **If the parameter is Low**
7. Test or replace the B20 Brake Fluid Level Switch.

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE WARNING INDICATOR MALFUNCTION > REPAIR INSTRUCTIONS

Perform the Diagnostic Repair Verification after completing the repair.

- Brake Fluid Level Indicator Switch Replacement
- Control Module References for electronic brake control module and Instrument Cluster replacement, programming and setup.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PULSATION

Step	Action	Yes	No
DEFINITION: Fluctuation or pulsation is felt through the brake pedal, steering wheel, seat, floor, and/or in the vehicle ONLY when braking.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the disc brake system for the following conditions. 1. Excessive thickness variation of rotor friction surfaces 2. Excessive assembled lateral runout (LRO) of rotor friction surfaces 3. Hard spots, heat checks, bluing discoloration of rotor friction surfaces; possibly due to brake drag 4. Excessive corrosion of rotor friction surfaces; including red, gray or black oxidation 5. Loose, damaged or missing caliper or lining hardware 6. Bent or damaged caliper or mounting component 7. Excessive LRO of wheel hub/axle flange; due to damage and/or loose or excessively worn bearings 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 3**	Go to Diagnostic Starting Point - Vehicle
3	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM NOISE

Step	Action	Yes	No
DEFINITION: Vehicle exhibits abnormal noise when braking; vehicle may exhibit abnormal noise during motion just after brake pedal release.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the disc brake system for the following conditions. 1. Lining wear indicator contact with rotor 2. Debris trapped between rotor and splash shield or backing plate; and/or debris trapped between rotor and linings 3. Contaminated linings 4. Aftermarket linings 5. Glazed linings 6. Distorted, cracked or damaged linings 7. Excessively worn linings 8. Damaged or excessively worn caliper hardware and/or lining hardware 9. Incorrectly installed, loose or missing caliper hardware and/or lining hardware 10. Lack of lubrication or excessive corrosion on metal to metal contact surfaces 11. Bent or damaged splash shield or backing plate 12. Hard spots, heat checks, blueing discoloration of rotor friction surfaces 13. Glazed rotor friction surfaces 14. Bent or damaged caliper or mounting component 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 9**	Go to **Step 3**

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3	1. Inspect the brake assist system for the following conditions. 1. Lack of lubrication or excessively worn pushrod or pedal pivots or pivot bushings 2. Bent or damaged pedal pushrod, pedal, or pedal bracket 3. Damaged or improperly operating vacuum booster and/or check valve, if equipped 4. Low power steering fluid level, if equipped with hydraulic boost 5. Improperly tensioned, excessively worn or damaged power steering belt, if equipped with hydraulic boost 6. Restricted return hose from hydraulic booster, if equipped 7. Improperly operating hydraulic booster, if equipped 8. Improperly functioning power steering system, if equipped with a hydraulic booster assembly 9. Contaminated power steering fluid, if equipped with hydraulic boost 2. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis . Did you find and correct a condition?	Go to **Step 9**	Go to **Step 4**
4	1. Inspect the hydraulic brake system for the following conditions. 1. Improper operation of caliper pistons 2. Contaminated brake fluid 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 9**	Go to **Step 5**
5	Is the vehicle equipped with a drum-in-rotor type of park brake system?	Go to **Step 6**	Go to **Step 9**

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6	Ensure the park brake shoes are not adjusted too tightly, possibly causing a noise under certain conditions. Are the park brake shoes adjusted too tightly?	Go to **Step 7**	Go to **Step 9**
7	1. Clean and inspect the park brake shoes for excessive wear and/or damage. 2. Inspect the drum portion of the rotors for excessive wear, blueing discoloration, heat spots, and excessive radial runout. 3. If any of these conditions are present, replace the affected components. 4. Adjust the park brake system. Did you find and correct a condition?	Go to **Step 9**	Go to **Step 8**
8	Inspect the park brake system for proper operation. Refer to Park Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 9**	Go to Diagnostic Starting Point - Vehicle
9	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKING ACTION UNEVEN - PULLS TO ONE SIDE > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table.

4

Suspension components that are not operating properly may cause a disturbance to the vehicle during application of the brake system.

5

Steering components that are not operating properly may cause a disturbance to the vehicle during application of the brake system.

Step	Action	Yes	No
DEFINITION: Vehicle pulls to one side only when braking.			

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1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the hydraulic brake system for the following conditions. 1. Kinked, pinched or damaged brake pipe or flexible brake hose 2. Sticking or improperly operating caliper piston 3. Brake fluid leak 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 6**	Go to **Step 3**
3	1. Inspect the disc brake system for the following conditions. 1. Contaminated linings 2. Glazed linings 3. Distorted, cracked or damaged linings on one side 4. Loose, damaged or missing caliper hardware and/or lining hardware 5. Incorrect linings on one side 6. Hard spots, heat checks, blueing discoloration of rotor friction surfaces; possibly due to brake drag 7. Glazed rotor friction surfaces 8. Bent or damaged caliper or mounting component 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 6**	Go to **Step 4**
4	1. Inspect the suspension system for the following conditions. 1. Incorrect tire pressures	Go to **Step 6**	Go to **Step 5**

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	2. Loose suspension component connections 3. Excessively worn or damaged suspension components 2. Adjust, repair or replace components as necessary. Refer to Diagnostic Starting Point - Vehicle . Did you find and correct a condition?		
5	1. Inspect the steering system for the following conditions. 1. Loose steering component connections 2. Excessively worn or damaged steering components 2. Adjust, repair or replace components as necessary. Refer to Diagnostic Starting Point - Vehicle . Did you find and correct a condition?	Go to **Step 6**	Go to Diagnostic Starting Point - Vehicle
6	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKING ACTION UNEVEN - FRONT TO REAR > TEST DESCRIPTIONS

The number below refers to the step number on the diagnostic table.

4

Suspension components that are not operating properly may cause a disturbance to the vehicle during application of the brake system.

Step	Action	Yes	No
DEFINITION: Braking action or stopping force sensitive or grabbing and/or more pronounced at the front or at the rear axle. Sensitive or grabbing brakes: Excessive brake jump-in force relative to brake pedal input.			

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1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the hydraulic brake system for the following conditions: 1. Improper operation of caliper pistons 2. Kinked, pinched or damaged brake pipe or flexible brake hose 3. Brake fluid leak 4. Improperly functioning proportion valve, if equipped 5. Improper operation of dynamic rear proportion (DRP) system, if equipped 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 6**	Go to **Step 3**
3	1. Inspect the disc brake system for the following conditions: 1. Contaminated linings 2. Glazed linings 3. Distorted, cracked or damaged linings 4. Excessively worn linings 5. Aftermarket linings 6. Damaged or excessively worn caliper hardware and/or lining hardware 7. Hard spots, heat checks, blueing discoloration of rotor friction surfaces 8. Glazed rotor friction surfaces 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 6**	Go to **Step 4**
4	1. Inspect the suspension system for the following conditions:	Go to **Step 6**	Go to **Step 5**

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	1. Loose suspension component connections 2. Excessively worn or damaged suspension components 2. Adjust, repair or replace components as necessary. Refer to Diagnostic Starting Point - Vehicle . Did you find and correct a condition?		
5	1. Inspect the brake assist system for the following conditions: 1. Binding, bent or damaged pedal pushrod, pedal, or pedal bracket 2. Damaged or improperly operating vacuum booster, if equipped 3. Damaged or improperly operating hydraulic booster, if equipped 2. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis . Did you find and correct a condition?	Go to **Step 6**	Go to Diagnostic Starting Point - Vehicle
6	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PEDAL EXCESSIVE TRAVEL

Step	Action	Yes	No
DEFINITION: Brake pedal travels further than expected to obtain firm pedal and/or firm pedal cannot be obtained, pedal fades away, or pedal is spongy.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle

2	Inspect the travel and feel of brake pedal applies. Perform the following: 1. Apply the brake pedal several times to fully deplete the power reserve. 2. With power reserve depleted, apply the brake pedal with light, steady pressure and hold for 15 seconds. Observe pedal travel and feel. 3. Apply the brake pedal with light, steady pressure, then without pumping the pedal, reduce pressure and reapply pressure several times. Observe pedal travel and feel for each apply. 4. Apply the brake pedal slowly, then release and apply the pedal quickly. Observe pedal travel and feel for each apply. Did you complete the brake pedal travel and feel inspections?	Go to **Step 3**	-
3	1. Inspect the hydraulic brake system for the conditions listed, based on the following symptoms observed during the pedal travel and feel inspections: 1. Pedal feel was spongy 1. Air in hydraulic system 2. External brake fluid leaks 3. Soft, weak or damaged hydraulic hoses; expanding under pressure 2. Pedal fell away and/or traveled to or almost to floor 1. External brake fluid leaks 2. Poor brake fluid quality; low boiling point 3. Internal brake fluid leaks; improperly functioning master cylinder 3. Pedal was somewhat firm then dropped slightly, or pedal rose with successive applies, or pedal travel was different between slow and quick applies	Go to **Step 8**	Go to **Step 4**

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	1. Internal brake fluid leaks; improperly functioning master cylinder 2. Poor brake fluid quality; low boiling point 4. Pedal returned to rest slowly after any of the applies 1. Internally damaged flexible brake hoses; hindering fluid return 2. Binding caliper pistons 3. Internal brake fluid leaks; improperly functioning master cylinder 2. Repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . 3. Re-inspect brake pedal apply travel and feel. Did you find and correct a condition?		
4	1. Inspect the disc brake system for the following conditions: 1. Cracked, excessively worn or damaged linings 2. Cracked, excessively worn or damaged rotors 3. Improperly operating, binding or damaged caliper hardware and/or lining hardware 4. Loose or missing caliper hardware and/or lining hardware 5. Excessive assembled lateral runout (LRO) of rotor friction surfaces 6. Bent or damaged caliper or mounting component 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . 3. Re-inspect brake pedal apply travel and feel. Did you find and correct a condition?	Go to **Step 8**	Go to **Step 5**

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5	Inspect for proper brake pedal travel. Refer to Brake Pedal Travel Measurement and Inspection . Is the brake pedal travel distance within the acceptable limits?	Go to **Step 7**	Go to **Step 6**
6	1. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components. 1. For the brake pedal pushrod component inspection, refer to Brake Pedal Pushrod Inspection . 2. Inspect the brake pedal bushings for binding, excessive wear and/or damage and inspect the brake pedal for a misaligned, bent, and/or damaged condition. 2. Replace the brake pedal system components that are worn, missing, misaligned, bent or damaged. Did you find and replace any worn, missing, misaligned, bent or damaged brake pedal system components?	Go to **Step 8**	Go to **Step 7**
7	1. Inspect the brake assist system for the following conditions: 1. Vacuum leaks and/or improperly operating check valve, if equipped with vacuum assist 2. Power steering fluid leaks, if equipped with hydraulic power assist 3. Damaged or improperly operating brake booster assembly 2. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis . Did you find and correct a condition?	Go to **Step 8**	Go to Diagnostic Starting Point - Vehicle
8	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PEDAL EXCESSIVE EFFORT

Step	Action	Yes	No
DEFINITION: Brake pedal requires an increased amount of input from the driver to obtain good braking action and/or stopping distance is increased.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the brake assist system for the following conditions: 1. Vacuum leaks, if equipped with vacuum power assist 2. Power steering fluid leaks, if equipped with hydraulic power assist 3. Lack of lubrication, binding or excessively worn pushrod or pedal pivots or pivot bushings 4. Bent or damaged pedal pushrod, pedal, or pedal bracket 5. Damaged or improperly operating brake booster assembly 2. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis . Did you find and correct a condition?	Go to **Step 5**	Go to **Step 3**
3	1. Inspect the hydraulic brake system for the following conditions: 1. Binding caliper pistons 2. Internally damaged flexible brake hoses; hindering fluid flow 3. External brake fluid leaks 4. Kinked or damaged flexible brake hoses and/or pipes 5. Internal brake fluid leaks; improperly operating master cylinder	Go to **Step 5**	Go to **Step 4**

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	6. Poor brake fluid quality; low boiling point 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?		
4	1. Inspect the disc brake system for the following conditions: 1. Excessively worn linings 2. Glazed linings 3. Cracked, distorted or damaged linings 4. Contaminated linings 5. Binding, damaged or excessively worn caliper hardware and/or lining hardware 6. Lack of lubrication or excessive corrosion on metal to metal contact surfaces 7. Excessively worn or corroded rotor friction surfaces 8. Glazed rotor friction surfaces 9. Hard spots, heat checks, blueing discoloration of rotor friction surfaces 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 5**	Go to Diagnostic Starting Point - Vehicle
5	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKES DRAG

Step	Action	Yes	No

DEFINITION: Brake system does not fully release or has delayed release; vehicle motion may be hindered by brake system without applying brakes.

1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	Is the vehicle equipped with an adjustable stop lamp switch and/or an adjustable cruise control release switch?	Go to **Step 3**	Go to **Step 4**
3	1. Inspect the stop lamp switch for proper adjustment to ensure that the brake pedal is fully releasing. 2. Inspect the cruise control release switch, if equipped, for proper adjustment to ensure that the brake pedal is fully releasing. Did you find and correct a condition?	Go to **Step 14**	Go to **Step 4**
4	Is the vehicle equipped with a drum-in-rotor type of park brake system?	Go to **Step 5**	Go to **Step 7**
5	Ensure the park brake shoes are not adjusted too tightly, possibly causing drag under certain conditions. Are the park brake shoes adjusted too tightly?	Go to **Step 6**	Go to **Step 7**
6	1. Clean and inspect the park brake shoes for excessive wear and/or damage. 2. Inspect the drum portion of the rotors for excessive wear, blueing discoloration and heat spots. 3. If any of these conditions are present, replace the affected components. 4. Adjust the park brake system. Did you find and correct a condition?	Go to **Step 14**	Go to **Step 7**
7	Inspect the park brake system for proper operation. Refer to Park Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 14**	Go to **Step 8**
8	1. Inspect the disc brake system for the following conditions: 1. Binding, incorrectly installed or missing caliper hardware and/or lining hardware- Ensure free movement of linings and of caliper, if equipped with sliding type caliper	Go to **Step 14**	Go to **Step 9**

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	2. Lack of lubrication or excessive corrosion on metal to metal contact surfaces 3. Distorted or damaged linings 4. Damaged or excessively worn caliper hardware and/or lining hardware 5. Bent or damaged caliper or mounting component 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?		
9	1. Separate the brake booster pushrod from the brake pedal. 2. Inspect the brake corners to determine if the brake drag condition is still present. Do the brake corners still exhibit the brake drag condition?	Go to **Step 11**	Go to **Step 10**
10	1. Inspect the pushrod for improper positioning and/or damage. Correctly position or replace the pushrod if necessary. 2. Inspect the brake pedal assembly for damage and replace if necessary. Did you complete the repair or replacement?	Go to **Step 14**	-
11	1. For vacuum boost systems, disconnect the vacuum check valve from the booster to relieve vacuum reserve. 2. Separate the master cylinder from the brake booster. Do not disconnect any brake pipes. 3. Inspect the brake corners to determine if the brake drag condition is still present. Do the brake corners still exhibit the brake drag condition?	Go to **Step 13**	Go to **Step 12**
12	Replace the brake booster assembly. Did you complete the replacement?	Go to **Step 14**	-
13	1. Inspect the hydraulic brake system for the following conditions.	Go to **Step 14**	Go to Diagnostic Starting Point - Vehicle

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	1. Improper operation of caliper pistons 2. Contaminated brake fluid 3. Internally damaged flexible brake hoses; hindering brake release 4. Damaged or improperly operating master cylinder 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?		
14	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM SLOW RELEASE

Step	Action	Yes	No
DEFINITION: Brake system releases and returns to rest slowly; vehicle motion is hindered by brake system briefly after release of brake pedal.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the hydraulic brake system for the following conditions: 1. Improper operation of caliper pistons 2. Internally damaged flexible brake hoses; hindering brake release 3. Contaminated brake fluid 4. Damaged or improperly operating master cylinder 2. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System	Go to **Step 5**	Go to **Step 3**

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	Diagnosis . Did you find and correct a condition?		
3	1. Inspect the brake assist system for the following conditions: 1. Binding, bent or damaged pedal pushrod, pedal, or pedal bracket 2. Damaged or improperly operating vacuum booster, if equipped 3. Restricted return hose from hydraulic booster, if equipped 4. Damaged or improperly operating hydraulic booster, if equipped 2. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis . Did you find and correct a condition?	Go to **Step 5**	Go to **Step 4**
4	1. Inspect the disc brake system for the following conditions: 1. Damaged or excessively worn caliper hardware and/or lining hardware 2. Distorted or damaged linings 3. Lack of lubrication or excessive corrosion on metal to metal contact surfaces 4. Bent or damaged caliper or mounting component 2. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 5**	Go to Diagnostic Starting Point - Vehicle
5	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle in order to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE FLUID LOSS

Step	Action	Yes	No
DEFINITION: Brake fluid level is low not related to lining wear.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	1. Inspect the following hydraulic brake system components for brake fluid leaks: 1. Flexible brake hose connections; threaded and bolted 2. Flexible brake hose crimp joints 3. Brake pipe fittings 4. Caliper piston seals 5. Wheel cylinder piston seals, if equipped 6. Master cylinder reservoir 7. Master cylinder reservoir low pressure hose, if equipped 8. Brake pressure modulator valve (BPMV) assembly, if equipped 2. Repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis . Did you find and correct a condition?	Go to **Step 8**	Go to **Step 3**
3	Is the vehicle equipped with a vacuum brake booster?	Go to **Step 4**	Go to **Step 6**
4	1. Disconnect the vacuum check valve from the booster to relieve vacuum reserve. 2. Separate the master cylinder from the vacuum brake booster. Do not disconnect any brake pipes. 3. Inspect the rear of the master cylinder for a brake fluid leak. 4. Inspect for brake fluid in the vacuum brake booster. Did you find a brake fluid leak?	Go to **Step 5**	Go to Diagnostic Starting Point - Vehicle

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5	Replace the brake master cylinder and the vacuum brake booster. Did you complete the replacement?	Go to **Step 8**	-
6	1. Wipe clean the external surface of the master cylinder to hydraulic brake booster area, if equipped. 2. Separate the master cylinder from the hydraulic brake booster, if equipped. Do not disconnect any brake pipes. 3. Inspect the rear of the master cylinder for a brake fluid leak. Did you find a brake fluid leak?	Go to **Step 7**	Go to Diagnostic Starting Point - Vehicle
7	Replace the brake master cylinder. Did you complete the replacement?	Go to **Step 8**	-
8	1. Install or connect components that were removed or disconnected during diagnosis. 2. Road test the vehicle to confirm proper operation. Refer to Brake System Vehicle Road Test . Is the condition still present?	Go to **Step 2**	System OK

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DIAGNOSTIC INFORMATION AND PROCEDURES > DISC BRAKE SYSTEM DIAGNOSIS > TEST DESCRIPTION

The numbers below refer to the step numbers on the diagnostic table:

9

Lubricant leaks from non-brake system components may come in contact with and contaminate brake system components.

10

Lubricant leaks from non-brake system components may come in contact with and contaminate brake system components.

12

Disc brake rotor shields/backing plates that come in contact with disc brake rotors may cause brake system noise.

15

Disc brake rotor thickness variation that exceeds the maximum acceptable level can cause brake pulsation.

19

Disc brake rotor thickness variation that exceeds the maximum acceptable level can cause brake pulsation.

22

Disc brake rotor assembled lateral runout (LRO) that exceeds the maximum acceptable level can lead to thickness variation.

Step	Action	Yes	No
DEFINITION: This diagnostic table is designed to diagnose ONLY the components of the DISC brake system in order to determine if the DISC brake system is operating properly. You will be directed by the appropriate Symptom table to go to other brake system diagnostic tables as appropriate.			
1	Were you sent here from a Brake Symptom table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	Visually inspect the disc brake pads for the following conditions: Refer to Front Disc Brake Pads Replacement (JL9)Front Disc Brake Pads Replacement (J55)Front Disc Brake Pads Replacement (J6G) . • Lining thickness below specifications • Uneven and/or abnormal wear- edge-to-edge and/or side-to-side • Looseness or damage-including pad hardware • Evidence of contamination from an external substance Did you find any conditions to indicate a concern with any of the front and/or rear disc brake pads?	Go to **Step 3**	Go to **Step 12**
3	Are any of the front and/or rear disc brake pads contaminated?	Go to **Step 8**	Go to **Step 4**
4	Are any of the front and/or rear disc brake pads worn unevenly?	Go to **Step 7**	Go to **Step 5**
5	Are any of the front and/or rear disc brake pads and/or pad hardware loose or damaged?	Go to **Step 7**	Go to **Step 6**
6	1. Remove and inspect the worn disc brake pads for glazing, looseness, heat spots or damage. 2. Replace the worn disc brake pads as a complete axle set. Refer to Front Disc Brake Pads Replacement (JL9)Front Disc Brake	Go to **Step 12**	-

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	Pads Replacement (J55)Front Disc Brake Pads Replacement (J6G) , and/or Rear Disc Brake Pads Replacement (J6G)Rear Disc Brake Pads Replacement (JL9, J55) . Did you complete the inspection and replacement?		
7	*CAUTION:* *Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.* *NOTE:* *Do NOT disconnect the hydraulic brake flex hoses from the calipers.* 1. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets or from the suspension knuckles and support the calipers. Refer to Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G) , and/or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55) . 2. Inspect the disc brake caliper mounting bracket or the suspension knuckles and the mounting/sliding hardware for the following conditions: Refer to Front Disc Brake Mounting and Hardware Inspection , and/or Rear Disc Brake Mounting and Hardware Inspection . 1. Binding or seized hardware 2. Worn, damaged or missing hardware components	Go to **Step 12**	-

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	3. Loose, bent, cracked, or damaged caliper mounting bracket or suspension knuckle 3. Replace components as required. Refer to the following procedures, as required: 1. Front Brake Caliper Bracket Replacement 2. Rear Brake Caliper Bracket Replacement 3. Front Brake Caliper Hardware Replacement (J55, J6G)Front Brake Caliper Hardware Replacement (JL9) 4. Rear Brake Caliper Hardware Replacement (J6G)Rear Brake Caliper Hardware Replacement (JL9, J55) 4. Replace the unevenly-worn, loose or damaged disc brake pads as a complete axle set. Refer to Front Disc Brake Pads Replacement (JL9)Front Disc Brake Pads Replacement (J55)Front Disc Brake Pads Replacement (J6G) , and/or Rear Disc Brake Pads Replacement (J6G)Rear Disc Brake Pads Replacement (JL9, J55) . Did you complete the inspection and replacement?		
8	1. Inspect the disc brake calipers, brake hoses and brake pipes for evidence of an external brake fluid leak. 2. Replace any components found to be leaking brake fluid. Refer to the following procedures as required: 1. Front Brake Caliper Overhaul (J55, J6G)Front Brake Caliper Overhaul (JL9) , or Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G) 2. Rear Brake Caliper Overhaul (J6G) , or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55) 3. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9)	Go to **Step 11**	Go to **Step 9**

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	4. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G) 5. Brake Pipe Replacement Did you find and correct the source of the leak causing contamination of the pads?		
9	1. Inspect the wheel drive shaft outer seals for damage and evidence of a grease leak. 2. Replace any wheel drive shaft seal that is found to be leaking grease which may be the source of the contamination to the pads. Did you find and correct the source of the leak causing contamination of the pads?	Go to **Step 11**	Go to **Step 10**
10	1. Inspect the automatic transmission cooling system lines, if equipped, for damage and evidence of an external fluid leak which may be the source of the contamination to the pads. 2. Inspect the power steering system hoses for damage and evidence of an external fluid leak which may be the source of the contamination to the pads. 3. Replace any components found to be leaking fluid which may be the source of the contamination to the pads. Did you find and correct the source of the leak causing contamination of the pads?	Go to **Step 11**	-
11	1. Clean the remaining disc brake system components to remove any traces of the contaminant. *CAUTION:* *Support the brake caliper with heavy mechanic wire, or equivalent, whenever it is separated from its mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn*	Go to **Step 12**	-

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may cause a brake fluid leak.

NOTE:

Do NOT disconnect the hydraulic brake flex hoses from the calipers.

2. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets or the suspension knuckles and support the calipers. Refer to Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G) , and/or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55) .
3. Inspect the disc brake caliper mounting/sliding hardware for the following conditions:

   Refer to Front Disc Brake Mounting and Hardware Inspection , and/or Rear Disc Brake Mounting and Hardware Inspection .

   1. Binding or seized hardware
   2. Distorted, worn, damaged or missing hardware components
4. Replace the caliper mounting/sliding hardware components as required. Refer to Front Brake Caliper Hardware Replacement (J55, J6G)Front Brake Caliper Hardware Replacement (JL9) , and/or Rear Brake Caliper Hardware Replacement (J6G)Rear Brake Caliper Hardware Replacement (JL9, J55) .
5. Replace the contaminated disc brake pads as a complete axle set. Refer to Front Disc Brake Pads Replacement (JL9)Front Disc Brake Pads Replacement (J55)Front Disc Brake Pads Replacement (J6G) , and/or Rear Disc Brake Pads Replacement (J6G)Rear Disc Brake Pads Replacement (JL9, J55) .

Did you complete the cleaning, inspection and replacement?

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12	Visually inspect each of the disc brake rotor shields/backing plates, if equipped, for evidence of contact with the brake rotors. Are any of the brake rotor shields/backing plates contacting the brake rotors?	Go to **Step 13**	Go to **Step 14**
13	Repair or replace the disc brake rotor shields/backing plates as required. Refer to Front Brake Shield Replacement . Did you complete the repair or replacement?	Go to **Step 14**	-
14	1. Check the thickness of each of the disc brake rotors. *NOTE:* *Make the following determination AND ANSWER the question INDIVIDUALLY for EACH rotor.* 2. Make a determination for each brake rotor if the rotor can be REFINISHED and REMAIN ABOVE the minimum requirements. Refer to Brake Rotor Thickness Measurement .Does the disc brake rotor meet the minimum requirements for REFINISHING?	Go to **Step 15**	Go to **Step 18**
15	*NOTE:* *Perform the following inspection AND ANSWER the question INDIVIDUALLY for EACH rotor.* Inspect each of the disc brake rotors for thickness variation that exceeds the maximum acceptable level. Refer to Brake Rotor Thickness Variation Measurement .Does the brake rotor exhibit thickness variation that exceeds the maximum acceptable level?	Go to **Step 17**	Go to **Step 16**
16	1. Inspect each of the disc brake rotors for the following surface and wear conditions: Refer to Brake Rotor Surface and Wear Inspection . 1. Heavy rust and/or pitting 2. Cracks and/or heat spots	Go to **Step 17**	Go to **Step 22**

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	3. Excessive blueing discoloration 4. Deep or excessive scoring beyond maximum acceptable level *NOTE:* *Make the following determination AND ANSWER the question INDIVIDUALLY for EACH rotor.* 2. Make a determination for each brake rotor if the rotor requires refinishing based upon the results of the inspection. If the brake rotor exhibits any of the conditions listed previously, it requires refinishing. Does the brake rotor require REFINISHING?		
17	1. Refinish the brake rotor. Refer to Brake Rotor Refinishing . 2. Inspect the brake rotor thickness. Refer to Brake Rotor Thickness Measurement . Were you able to REFINISH the brake rotor within the minimum requirements?	Go to **Step 22**	Go to **Step 21**
18	Is the brake rotor at or below the MINIMUM THICKNESS requirements?	Go to **Step 21**	Go to **Step 19**
19	*NOTE:* *Perform the following inspection AND ANSWER the question INDIVIDUALLY for EACH rotor.* Inspect each of the disc brake rotors for thickness variation that exceeds the maximum acceptable level. Refer to Brake Rotor Thickness Variation Measurement .Does the brake rotor exhibit thickness variation that exceeds the maximum acceptable level?	Go to **Step 21**	Go to **Step 20**
20	1. Inspect each of the disc brake rotors for the following surface and wear conditions: Refer to Brake Rotor Surface and Wear	Go to **Step 21**	Go to **Step 22**

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	Inspection . 1. Heavy rust and/or pitting 2. Cracks and/or heat spots 3. Excessive blueing discoloration 4. Deep or excessive scoring beyond maximum acceptable level *NOTE:* *Make the following determination AND ANSWER the question INDIVIDUALLY for EACH rotor.* 2. Make a determination for each brake rotor if the rotor requires replacement based upon the results of the inspection. If the brake rotor exhibits any of the conditions listed previously, it requires replacement. Does the brake rotor require REPLACEMENT?		
21	*NOTE:* *Whenever a brake rotor is replaced, the assembled lateral runout (LRO) of the rotor must be measured to ensure optimum performance of the disc brakes.* Replace the brake rotor. Refer to Front Brake Rotor Replacement (JL9)Front Brake Rotor Replacement (J55)Front Brake Rotor Replacement (J6G) , or Rear Brake Rotor Replacement (J6G)Rear Brake Rotor Replacement (JL9, J55) .Did you complete the replacement?	Go to **Step 24**	-
22	*NOTE:* *Perform the following inspection AND ANSWER the question INDIVIDUALLY for EACH rotor.*	Go to **Step 23**	Go to **Step 24**

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	Inspect each of the disc brake rotors for assembled lateral runout (LRO) that exceeds the maximum acceptable level. Refer to Brake Rotor Assembled Lateral Runout Measurement .Does the brake rotor exhibit assembled LRO that exceeds the maximum acceptable level?		
23	Correct the LRO for each brake rotor that was determined to have LRO exceeding the maximum acceptable level. Refer to Brake Rotor Assembled Lateral Runout Correction . Did you complete the operation?	Go to **Step 24**	-
24	Install or connect components that were removed or disconnected during diagnosis. Did you complete the operation?	Disc Brake System OK Return to Symptom Table	-

DIAGNOSTIC INFORMATION AND PROCEDURES > HYDRAULIC BRAKE SYSTEM DIAGNOSIS

Step	Action	Yes	No
DEFINITION: This diagnostic table is designed to diagnose ONLY the components of the HYDRAULIC brake system in order to determine if the Hydraulic brake system is operating properly. You will be directed by the appropriate Symptom Table to go to other brake system diagnostic tables as appropriate.			
1	Were you sent here from a Brake Symptom Table?	Go to **Step 2**	Go to Diagnostic Starting Point - Vehicle
2	Inspect and adjust the brake fluid level in the brake master cylinder. Master Cylinder Reservoir Filling . Was the brake fluid level low?	Go to **Step 3**	Go to **Step 4**
3	1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination: 1. Fluid separation, indicating two types of fluid are present 1. Swirled appearance-oil-based substance 2. Layered appearance-silicone-based substance 2. Fluid discoloration 1. Cloudy appearance-moisture	Go to **Step 5**	Go to **Step 6**

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	2. Dark appearance/suspended particles in fluid-dirt, rust, corrosion, brake dust 2. Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. Do any of the above conditions exist?		
4	1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination: 1. Fluid separation, indicating two types of fluid are present 1. Swirled appearance-oil-based substance 2. Layered appearance-silicone-based substance 2. Fluid discoloration 1. Cloudy appearance-moisture 2. Dark appearance/ suspended particles in fluid-dirt, rust, corrosion, brake dust 2. Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. Do any of the above conditions exist?	Go to **Step 5**	Go to **Step 12**
5	1. Flush the hydraulic brake system. Hydraulic Brake System Flushing . 2. If the brake fluid WAS contaminated with an oil-based or a silicone-based fluid, indicated by fluid separation and/or a swollen master cylinder reservoir cap diaphragm and/or swollen reservoir-to-master cylinder grommets, perform the following steps. 1. Remove ALL of the following components listed. Each component contains internal rubber seals/linings which have been contaminated. 2. Clean out the hydraulic brake pipes using	Go to **Step 9**	-

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denatured alcohol, or equivalent.

3. Dry the brake pipes using non-lubricated, filtered air.

4. Repair or replace ALL of the following components listed. Each component contains internal rubber seals/linings which have been contaminated.

    1. Master Cylinder Replacement

    2. Brake master cylinder reservoir: Clean the brake master cylinder reservoir using denatured alcohol, or equivalent, then dry the reservoir using non-lubricated, filtered air, or if necessary, replace the brake master cylinder reservoir.

    3. Replace the brake master cylinder reservoir cap diaphragm.

    4. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9)

    5. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G)

    6. Front Brake Caliper Overhaul (J55, J6G)Front Brake Caliper Overhaul (JL9) , or Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G)

    7. Rear Brake Caliper Overhaul (J6G) , or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55)

    8. Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement

3. If the brake fluid was NOT contaminated with an oil-based fluid, but WAS contaminated with water or dirt, rust, corrosion, and/or brake dust, replace the brake master cylinder reservoir cap diaphragm which may have allowed moisture or dirt to enter the system.

4. Refill and bleed the hydraulic brake system. Hydraulic Brake System Bleeding (Manual J55,

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	J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) . Did you complete the operation and any required repairs and/or replacements?		

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6	1. Inspect the following hydraulic brake system components for external fluid leaks; repair or replace any of the components found to be leaking brake fluid. 1. Master Cylinder Replacement 2. Brake master cylinder reservoir cap diaphragm 3. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9) 4. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G) 5. Brake Pipe Replacement 6. Front Brake Caliper Overhaul (J55, J6G)Front Brake Caliper Overhaul (JL9) , or Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G) 7. Rear Brake Caliper Overhaul (J6G) , or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55) 8. Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement 2. If you repaired or replaced any of the brake system components listed, bleed the hydraulic brake system. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) . While bleeding the hydraulic brake system, observe for the following conditions: 1. The presence of air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced 2. An unrestricted and even flow of brake fluid per axle during the bleeding procedure Did you find and correct a condition?	Go to **Step 7**	Go to **Step 12**
7	Was there air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced?	Go to **Step 19**	Go to **Step 8**

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8	Was the flow of brake fluid unrestricted and even per axle during the bleeding procedure?	Go to **Step 9**	Go to **Step 10**
9	Inspect the hydraulic function of the brake calipers for proper operation. Was the hydraulic function of the brake calipers operating properly?	Go to **Step 21**	Go to **Step 14**
10	Was the flow of brake fluid restricted or uneven through front axle hydraulic components during the bleeding procedure?	Go to **Step 13**	Go to **Step 11**
11	Was the flow of brake fluid restricted or uneven through rear axle hydraulic components during the bleeding procedure?	Go to **Step 17**	-
12	Inspect the hydraulic function of the brake calipers for proper operation. Was the hydraulic function of the brake calipers operating properly?	Go to **Step 15**	Go to **Step 13**
13	Determine if the brake caliper is restricting the flow of brake fluid and/or not operating properly: 1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP) . 2. Remove the tire and wheel assemblies. Tire and Wheel Removal and Installation . 3. Open the suspected caliper bleeder valve. 4. Using a large C-clamp, compress the caliper piston and observe for an unrestricted flow of brake fluid and for free movement of the caliper piston. 5. Close the caliper bleeder valve. Was the flow of brake fluid unrestricted and did the caliper piston move freely?	Go to **Step 17**	Go to **Step 14**
14	Repair or replace any brake caliper that was not operating properly. • Front Brake Caliper Overhaul (J55, J6G)Front Brake Caliper Overhaul (JL9) , or Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G) • Rear Brake Caliper Overhaul (J6G) , or Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55) Did you complete the repair and/or replacement?	Go to **Step 21**	-

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15	Bleed the hydraulic brake system to observe for the presence of air in the system and to observe for an unrestricted and even flow of brake fluid per axle during the bleeding procedure. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) . Was there air in the system?	Go to **Step 19**	Go to **Step 16**
16	Was the flow of brake fluid unrestricted and even per axle during the bleeding procedure?	Go to **Step 21**	Go to **Step 17**
17	1. Inspect the hydraulic brake pipes and flexible brake hoses for signs of a fluid restriction; such as being bent, kinked, pinched or damaged. Brake Pipe and Hose Inspection . 2. Replace any of the hydraulic brake pipes and/or flexible brake hoses found to be bent, kinked, pinched or damaged. 1. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9) 2. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G) 3. Brake Pipe Replacement 3. If none of the hydraulic brake pipes or flexible brake hoses were visibly bent, kinked, pinched or damaged, replace the hydraulic brake flex hose at the restricted location. Did you find and correct a condition?	Go to **Step 21**	Go to **Step 18**
18	Replace the brake pressure modulator valve (BPMV), in order to correct the hydraulic brake dynamic rear proportioning mechanical operation. Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement . Did you complete the replacement?	Go to **Step 21**	-
19	1. Inspect the hydraulic brake system components for brake fluid seepage at a seal and/or fitting location, which may have drawn air into the system. 2. Inspect the hydraulic brake system components for evidence of a recent repair, which may have introduced air into the system. 3. Repair or replace any of the components found to	Go to **Step 21**	Go to **Step 20**

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	be installed incorrectly or seeping brake fluid. Did you find and correct a condition?		
20	1. Inspect the brake master cylinder for internal fluid leaks. Brake System Internal Leak Test . 2. Replace the brake master cylinder if it is found to be leaking brake fluid internally. Master Cylinder Replacement . Did you find and correct a condition?	Go to **Step 21**	Return to Symptom Table
21	Install or connect components that were removed or disconnected during diagnosis. Did you complete the operation?	Hydraulic Brake System OK Return to Symptom Table	-

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE ASSIST SYSTEM DIAGNOSIS

Step	Action	Yes	No
DEFINITION: This diagnostic table is designed to diagnose ONLY the components of the brake ASSIST system in order to determine if the brake ASSIST system is operating properly. You will be directed by the appropriate Symptom table to go to other brake system diagnostic tables as appropriate.			
1	Were you sent here from a Brake Symptom table?	Go to **Step 3**	Go to **Step 2**
2	Were you sent here directly from an electrical diagnostic to investigate vacuum as a possible concern?	Go to **Step 5**	Go to Diagnostic Starting Point - Vehicle
3	Inspect for proper brake pedal travel. Brake Pedal Travel Measurement and Inspection . Is the brake pedal travel distance within the acceptable limits?	Go to **Step 5**	Go to **Step 4**
4	1. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components. 1. For the brake pedal pushrod component inspection, Brake Pedal Pushrod Inspection . 2. Inspect the brake pedal bushings for excessive wear and/or damage and inspect the brake pedal for a misaligned, bent and/or damaged condition.	Go to **Step 5**	Go to Hydraulic Brake System Diagnosis to check for internal and external fluid leaks and air in the hydraulic brake system

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	2. Replace the brake pedal system components that are worn, missing, misaligned, bent or damaged. Did you find and replace any worn, missing, misaligned, bent or damaged brake pedal system components?		
5	Check the engine vacuum source that supplies vacuum to the vacuum brake booster. Brake System Vacuum Source Test . Is the vacuum reading within the acceptable limits?	Go to **Step 6**	Go to Engine Controls Diagnostics Information to check for vacuum issues, including vacuum pump operation, if equipped
6	Does the condition occur during cold start-up conditions?	Go to **Step 7**	Go to **Step 8**
7	Check engine vacuum, and vacuum pump operation, if equipped, under the same cold start-up conditions. Refer to Engine Controls Diagnostics. Did you find and correct a condition?	Go to **Step 22**	Go to **Step 9**
8	During the vacuum source test, did the vacuum booster check valve operate properly?	Go to **Step 10**	Go to **Step 9**
9	Replace the vacuum booster check valve. Power Brake Booster Pressure Sensor Replacement Did you complete the replacement?	Go to **Step 10**	-
10	If equipped with a booster mounted separate vacuum sensor, inspect the vacuum sensor grommet for cracks, cuts, dry-rot, or damage. Does the vacuum sensor grommet exhibit any of the conditions listed?	Go to **Step 11**	Go to **Step 12**
11	Replace the vacuum sensor grommet. Did you complete the replacement?	Go to **Step 12**	-
12	1. If the vehicle is equipped with a vacuum sensor, install a scan tool. 2. Using the Data Display function, determine if brake booster vacuum sensor data is available within either the chassis brake controls area or the powertrain engine controls area. Is vacuum sensor data available through the scan tool?	Go to **Step 13**	Go to **Step 16**

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13	Perform the vacuum booster leak-down test using a scan tool: 1. Release the brake pedal. 2. Accelerate the engine to approximately 3000 RPM, then release the throttle. Wait 2-3 seconds and repeat once. 3. Turn the ignition OFF. 4. Turn the ignition ON. Do not start the engine. 5. Observe and record the vacuum sensor reading on the scan tool over a period of 60 seconds. *NOTE:* *Vacuum readings will decrease by approximately 2.7 kPa (0.8 Hg) for every 305 m (1000 ft) of elevation above sea level.* 6. Determine the rate of vacuum leak. **Specification** Maximum allowable vacuum leak rate: 10 kPa (3 in Hg) in 60 seconds Was the rate of vacuum leak within the specified allowable range?	Go to **Step 18**	Go to **Step 14**
14	1. Deplete the vacuum reserve by pressing the brake pedal several times, or by removing the vacuum booster check valve. 2. Separate the master cylinder from the vacuum brake booster. Do not disconnect any brake pipes. Master Cylinder Replacement . 3. If equipped with a vacuum seal on the rear of the master cylinder, inspect the seal for damage and correct positioning on the master cylinder. Replace the vacuum seal as necessary. 4. Carefully reinstall the master cylinder to the	Go to **Step 15**	-

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	brake booster. Master Cylinder Replacement . Did you complete the operation?		
15	Perform the vacuum booster leak-down test using a scan tool: 1. Release the brake pedal. 2. Accelerate the engine to approximately 3000 RPM, then release the throttle. Wait 2-3 seconds and repeat once. 3. Turn the ignition OFF. 4. Turn the ignition ON. Do not start the engine. 5. Observe and record the vacuum sensor reading on the scan tool over a period of 60 seconds. *NOTE:* *Vacuum readings will decrease by approximately 2.7 kPa (0.8 Hg) for every 305 m (1000 ft) of elevation above sea level.* 6. Determine the rate of vacuum leak. **Specification** Maximum allowable vacuum leak rate: 10 kPa (3 in Hg) in 60 seconds Was the rate of vacuum leak within the specified allowable range?	Go to **Step 22**	Go to **Step 21**
16	1. Separate the master cylinder from the vacuum brake booster. Do not disconnect any brake pipes. Before removing the master cylinder, first deplete the vacuum by removing the check valve or applying the brake pedal several times. Master Cylinder Replacement . 2. If equipped with a vacuum seal on the rear of the master cylinder, inspect the seal for damage and correct positioning on the	Go to **Step 17**	Go to **Step 18**

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	master cylinder. 3. If equipped with a vacuum seal that is part of the booster, inspect the seal for damage. Does the vacuum seal exhibit any of the conditions listed?		
17	1. If equipped with a vacuum seal on the rear of the master cylinder, replace the vacuum seal as necessary. Ensure the seal is positioned correctly during installation. 2. If equipped with a vacuum seal that requires replacement and which is part of the booster, the booster assembly must be replaced. 3. Carefully reinstall the master cylinder to the brake booster. Master Cylinder Replacement . Did you complete the replacement?	Go to **Step 18**	-
18	Perform the vacuum boost functional test: 1. If still separated, reinstall the master cylinder to the booster. Master Cylinder Replacement . 2. If the engine was started after reinstalling the master cylinder to the booster, perform the following: With the engine OFF, depress the brake pedal several times to deplete the vacuum reserve. 3. Depress and maintain moderate foot pressure on the brake pedal. 4. Start the engine and observe pedal operation. 5. Observe for audible vacuum leaks. The brake pedal should fall slightly, then hold. Is there an audible vacuum leak coming from the brake pedal area?	Go to **Step 21**	Go to **Step 19**
19	Did the brake pedal fall slightly after the engine was started, then hold?	Go to **Step 20**	Go to **Step 21**

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20	Perform the vacuum booster leak-down test: 1. Release the brake pedal. 2. Accelerate the engine to approximately 3000 RPM, then release the throttle. Wait 2-3 seconds and repeat once. 3. Turn the ignition OFF. 4. Wait 60 seconds. 5. Depress the brake pedal 2 times to check for vacuum booster available vacuum reserve. Observe pedal effort. 1. Both pedal applies should be assisted 2. The amount of assist could diminish slightly with the second apply Were both pedal applies power assisted?	Go to **Step 22**	Go to **Step 21**
21	Replace the vacuum brake booster. Power Brake Booster Replacement Did you complete the replacement?	Go to **Step 22**	-
22	Install or connect any components that were removed or disconnected during diagnosis. Did you complete the operation?	Brake Assist System OK Return to Symptom Table	-

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM VEHICLE ROAD TEST > PRELIMINARY INSPECTIONS

1. Visually inspect easily accessible brake system components for obvious damage and/or leaks which may indicate that the vehicle should not be driven until further inspections have been completed.
2. Inspect the brake master cylinder reservoir fluid level and adjust only if necessary for brake system road testing. Refer to Master Cylinder Reservoir Filling .
3. Inspect the tire inflation pressures and adjust as necessary.
4. Inspect the tire tread patterns to ensure that they are the same or very similar, especially per axle.
5. Ensure that the vehicle is not loaded unevenly prior to brake system road testing.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM VEHICLE ROAD

TEST > ROAD TESTING PROCEDURE

WARNING:

Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

1. Start the engine and allow it to idle.
2. Check to see if the brake system warning lamp remains illuminated.
3. If the brake system warning lamp remains illuminated, DO NOT proceed to test drive the vehicle until it is diagnosed and repaired. Refer to Symptoms - Hydraulic Brakes .
4. Select a smooth, dry, clean and level road or large lot that is as free of traffic and obstacles as possible for brake system low speed road testing.
5. With the transmission in PARK, lightly apply the brake pedal. Observe both the pedal feel and the pedal travel.
6. If the brake pedal apply felt spongy, or the pedal travel was excessive, DO NOT drive the vehicle until it is repaired.
7. If the brake pedal apply did not feel spongy and the pedal travel was not excessive, proceed to step 8.
8. Release and apply the brakes.
9. While continuing to apply the brakes, shift the transmission into DRIVE, release the brakes and allow the engine to idle the vehicle away from the stopped position. Observe for a slow release of the brake system.
10. With the aid of an assistant to observe the vehicle's performance from outside of the vehicle, drive the vehicle at a low speed and lightly apply the brakes while driving past the assistant. Have the assistant observe for brake system noise from the side of the vehicle closest to them, while you observe both the pedal effort and the pedal travel.
11. If the brake pedal apply effort was excessive, or the pedal travel was excessive, DO NOT continue to test drive the vehicle until it is repaired.
12. If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to step 13.
13. Drive the vehicle in the opposite direction, at the same low speed and lightly apply the brakes while driving past the assistant. Have the assistant observe for brake system noise from the side of the vehicle closest to him.
14. Drive the vehicle at a low speed and shift the transmission into NEUTRAL without applying the brakes. Observe for a rapid deceleration in vehicle speed, indicating possible brake drag.
15. Select a smooth, dry, clean and level road that is as free of heavy traffic as possible for brake system moderate speed road testing.

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16. Drive the vehicle at a moderate speed. Observe for a pull and/or incorrect tracking of the vehicle without the brakes applied.
17. While continuing to drive the vehicle at a moderate speed, perform several light applies of the brakes. Observe the pedal effort and the pedal travel, observe for brake system noise, pulsation and/or brake drag.
18. If the brake pedal apply effort was excessive, or the pedal travel was excessive, DO NOT continue to test drive the vehicle until it is repaired.
19. If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to step 20.
20. While continuing to drive the vehicle at a moderate speed, perform several moderate applies of the brakes. Observe the pedal effort and the pedal travel, observe for brake system pulsation and/or uneven braking action - either side to side, or front to rear.

    A small amount of vehicle front end dip is expected during a moderate apply of the brakes.
21. If the brake pedal apply effort was excessive, or the pedal travel was excessive, DO NOT continue to test drive the vehicle until it is repaired.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PEDAL TRAVEL MEASUREMENT AND INSPECTION

Special Tools

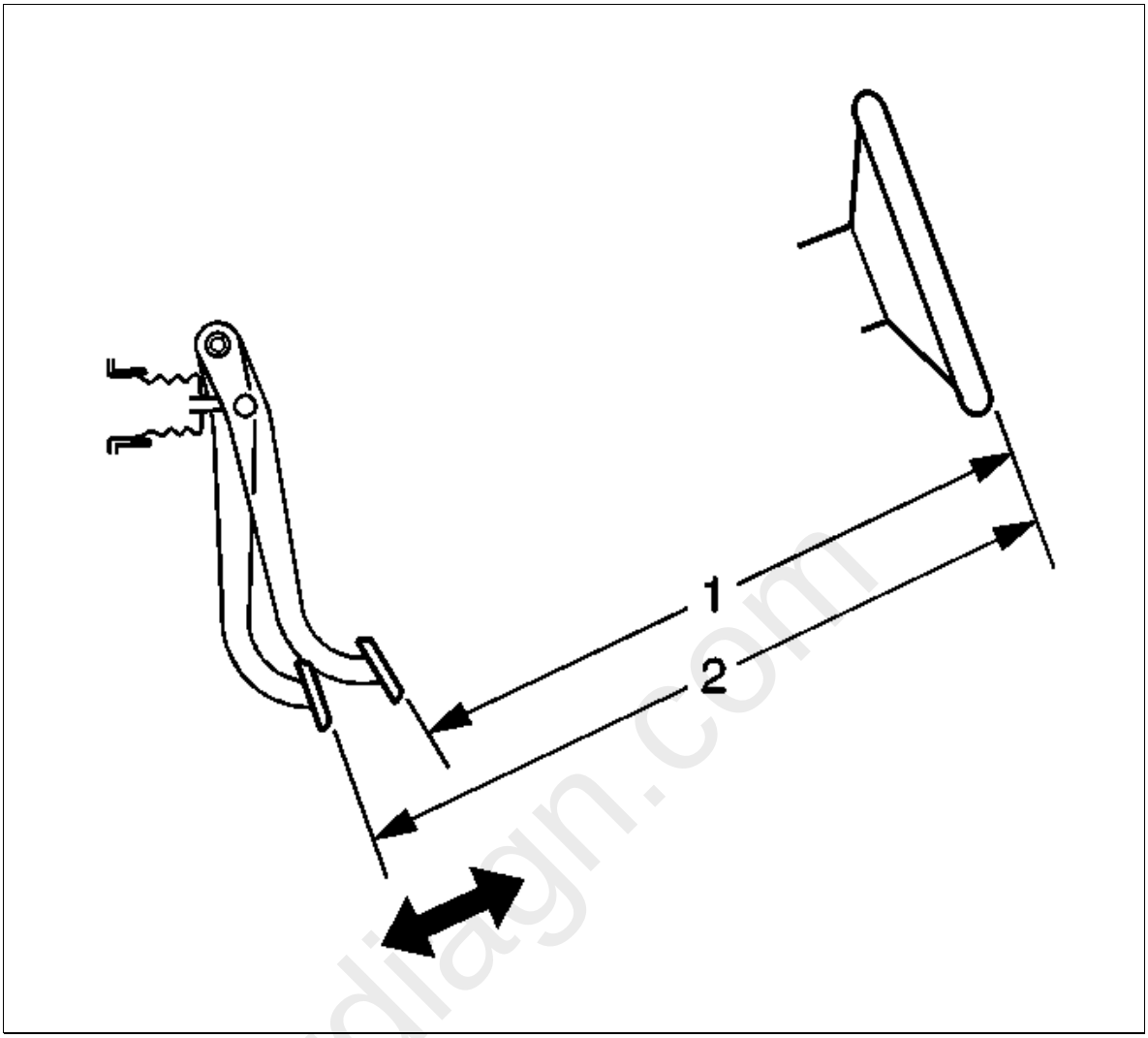
CH-28662 Brake Pedal Effort Gauge

For equivalent regional tools, refer to Special Tools .

1. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.
2. Install the **CH-28662** Brake Pedal Effort Gauge to the brake pedal.

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Fig 1: Measuring Brake Pedal Travel



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3. Measure and record the distance (1) from the brake pedal to the rim of the steering wheel; note the points of measurement.
4. Apply and maintain the brakes with 445 N (100 lb) of force to the brake pedal, as indicated on the brake pedal effort gauge.
5. While maintaining 445 N (100 lb) of force to the brake pedal, measure and record the distance (2) from the same point on the brake pedal to the same point on the rim of the steering wheel.
6. Release the brakes and repeat steps 4 and 5 to obtain a second measurement. After obtaining a second measurement, proceed to step 7.
7. Average the first and second measurements recorded during the two applies of the brakes.
8. Subtract the initial measurement, unapplied (1), from the averaged, applied measurement (2) to obtain the brake pedal travel distance.

Specification

Maximum brake pedal travel (measured with the ignition OFF, brake booster power assist

depleted, and the brakes cool): 63.5 mm (2.5 in).

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM VACUUM SOURCE TEST

> *NOTE:*
>
> 1. *Engine temperature, accessory load, and elevation level will affect engine vacuum.*
> 2. *Vacuum readings will decrease by approximately 2.7 kPa (0.8 in Hg) for every 305 m (1000 ft) of elevation above sea level.*

1. Disconnect the engine vacuum hose from the vacuum brake booster check valve.
2. Install a vacuum gauge to the engine vacuum hose.
3. Start the engine and allow the engine to idle until normal operating temperatures are reached.
4. With the vehicle in PARK, the engine idling, and the air conditioning (A/C) system OFF, check to see if the engine vacuum reading is within the specified normal engine vacuum range.

   Specification

   47-68 kPa (14-20 in Hg)
5. Turn the ignition OFF.
6. If the engine vacuum reading was within the specified normal range, proceed to step 10.
7. If the engine vacuum reading was NOT within the specified normal range, inspect the engine vacuum hose for the following conditions:
   1. Loose connection to the engine
   2. Collapse, deformation or contamination
   3. Cracks, cuts, dry-rot
8. If any of these conditions were found with the engine vacuum hose, replace the hose, then repeat steps 2-4.
9. If none of these conditions were found with the engine vacuum hose, then there is an engine vacuum source problem, check the engine vacuum system.
10. Remove the vacuum brake booster check valve from the booster.
11. Install the check valve to the engine vacuum hose.
12. Install the vacuum gauge to the check valve.
13. Start the engine and allow the engine to idle in PARK with the A/C system OFF, until normal operating temperatures are reached.

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14. Turn the ignition OFF.
15. Check to see if the engine vacuum reading is maintained within the specified normal engine vacuum range.

    Specification

    47-68 kPa (14-20 in Hg)

16. If the engine vacuum reading is maintained within the specified normal range, proceed to step 18.
17. If the engine vacuum reading is NOT maintained within the specified normal range, replace the brake booster check valve, then repeat steps 11-15.
18. Inspect the brake booster check valve grommet for the following conditions:
    1. Loose connection to the vacuum brake booster
    2. Deformation or contamination
    3. Cracks, cuts, dry-rot
19. If any of these conditions were found with the check valve grommet, replace the grommet.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM EXTERNAL LEAK INSPECTION

WARNING:

Refer to Brake Fluid Irritant Warning .

CAUTION:

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

1. In order to inspect for external brake fluid leaks, first check the fluid level in the master cylinder.

   While a slight brake fluid level drop can be considered a normal condition due to brake lining wear, a very low level may indicate a brake fluid leak in the hydraulic system.
2. If the fluid level is abnormally low, adjust the brake fluid level. Refer to Master Cylinder Reservoir Filling .
3. Start the engine and allow it to idle.
4. Apply constant, moderate foot pressure to the brake pedal.

   If the brake pedal gradually falls away while under foot pressure, there may be a brake fluid

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leak.

5. Turn OFF the ignition.
6. Visually inspect the following brake system components for brake fluid leaks, excessive corrosion, and damage. Give particular attention to all brake pipe and flexible hose connections to ensure that there are not any slight brake fluid leaks - even though the brake pedal may feel firm and hold steady:
    1. Master cylinder brake pipe fittings
    2. All brake pipe connections
    3. Brake pipes
    4. Brake hoses and connections
    5. Brake calipers and/or wheel cylinders, if equipped
7. While slight dampness around the master cylinder reservoir can be considered acceptable, brake fluid leaking from any of the brake system components requires immediate attention. If any of these components exhibit signs of brake fluid leakage, repair or replace those components. After the repair or replacement, reinspect the hydraulic brake system to assure proper function.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE SYSTEM INTERNAL LEAK TEST

WARNING:

Refer to Brake Fluid Irritant Warning .

CAUTION:

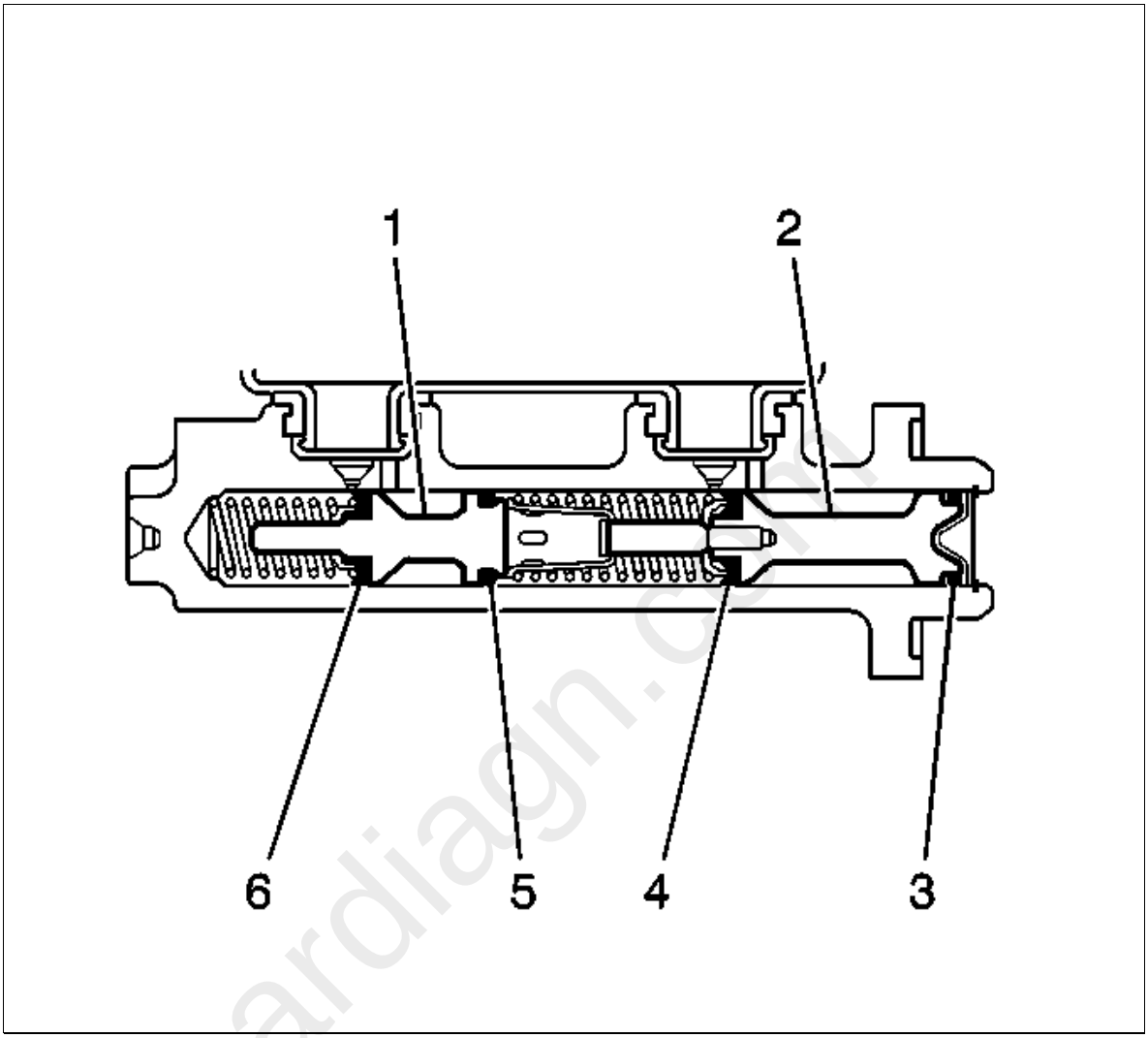
Refer to Brake Fluid Effects on Paint and Electrical Components Caution .

1. Start the engine and allow it to idle.
2. Apply light, steady pressure to the brake pedal. Observe both the brake pedal feel and travel.
3. Release the brakes and turn OFF the ignition.
4. If the brake pedal apply felt spongy, but the brake pedal travel was not excessive, perform the following steps:
    1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection .
    2. Pressure bleed the brake system in order to purge any air that may be trapped in the

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system. Refer to Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) .

Fig 1: Brake Master Cylinder (Cross Sectional View)



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5. If the brake pedal apply did not feel spongy, but the brake pedal travel was excessive, perform the following steps:
    1. Loosen the master cylinder-to-brake power booster mounting nuts.
    2. Carefully pull the master cylinder away from the brake power booster just enough to inspect the mounting surface of the master cylinder.
    3. Inspect the master cylinder mounting surface at the primary piston (2) for brake fluid leaks.
6. If the master cylinder exhibits any leakage around the primary piston (2), then the primary piston primary seal (4) and/or secondary seal (3) is leaking and the master cylinder requires overhaul or replacement.
7. If the master cylinder primary piston (2) does not exhibit any leakage, pressure bleed the brake

system. Refer to Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) .

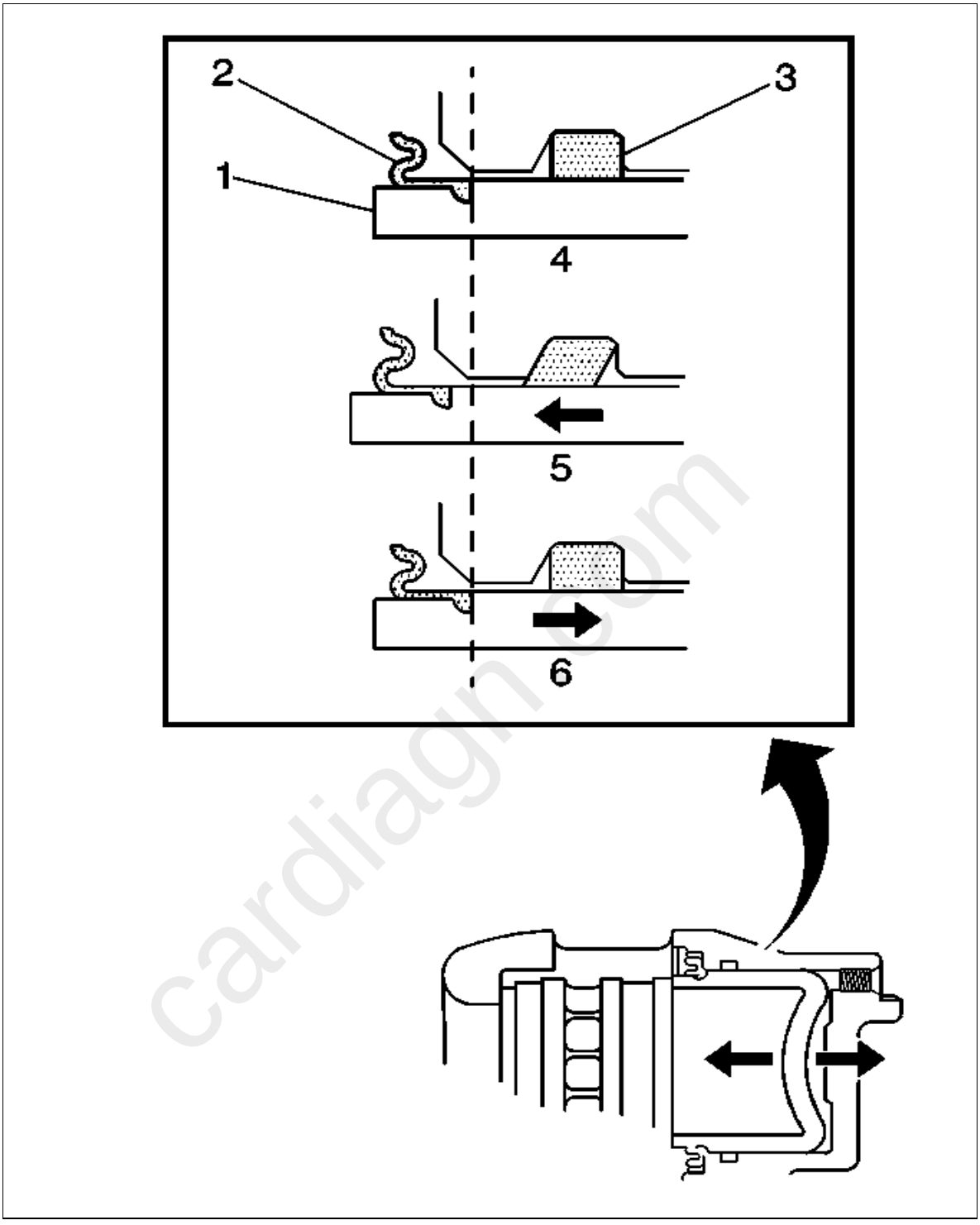
8. If the brake pedal apply did not feel spongy, and the brake pedal travel was initially steady and not excessive, but then gradually fell, then the master cylinder requires overhaul or replacement due to an internal leak past the secondary piston (1) from the secondary piston primary seal (6) or secondary seal (5).

9. If the brake pedal apply did not feel spongy, and the brake pedal travel was initially steady and not excessive, then fell slightly, then became steady again, then the brake pressure modulator valve (BPMV) may be leaking internally, and may require replacement.

DIAGNOSTIC INFORMATION AND PROCEDURES > HYDRAULIC BRAKE COMPONENT OPERATION VISUAL INSPECTION

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Fig 1: Brake Caliper/Pad Inspection Areas



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Refer to Brake Fluid Irritant Warning .

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> *CAUTION:*
>
> *Refer to Brake Fluid Effects on Paint and Electrical Components Caution .*

1. With the tire and wheel assemblies removed and the brake rotors retained by wheel lug nuts, visually inspect the caliper piston dust boot (2) sealing area to ensure that there are no brake fluid leaks.
2. If any evidence of a brake fluid leak is present, the brake caliper requires overhaul or replacement.
3. While the brake system is at rest (4), observe the position of the caliper piston (1) in relation to the caliper housing.
4. Have an assistant apply and release the brake pedal several times while you observe the operation of the hydraulic brake caliper.
    1. Observe the caliper piston (1) for unrestricted and even movement during each apply of the brake system (5).
    2. Observe the caliper piston (1) for an unrestricted and even return motion during each release of the brake system (6).
5. If the caliper piston (1) did not exhibit unrestricted and even movement during brake system apply and/or release, the piston square seal (3) may be worn or damaged and the caliper may require overhaul or replacement.

DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PIPE AND HOSE INSPECTION

> *WARNING:*
>
> *Refer to Brake Fluid Irritant Warning .*

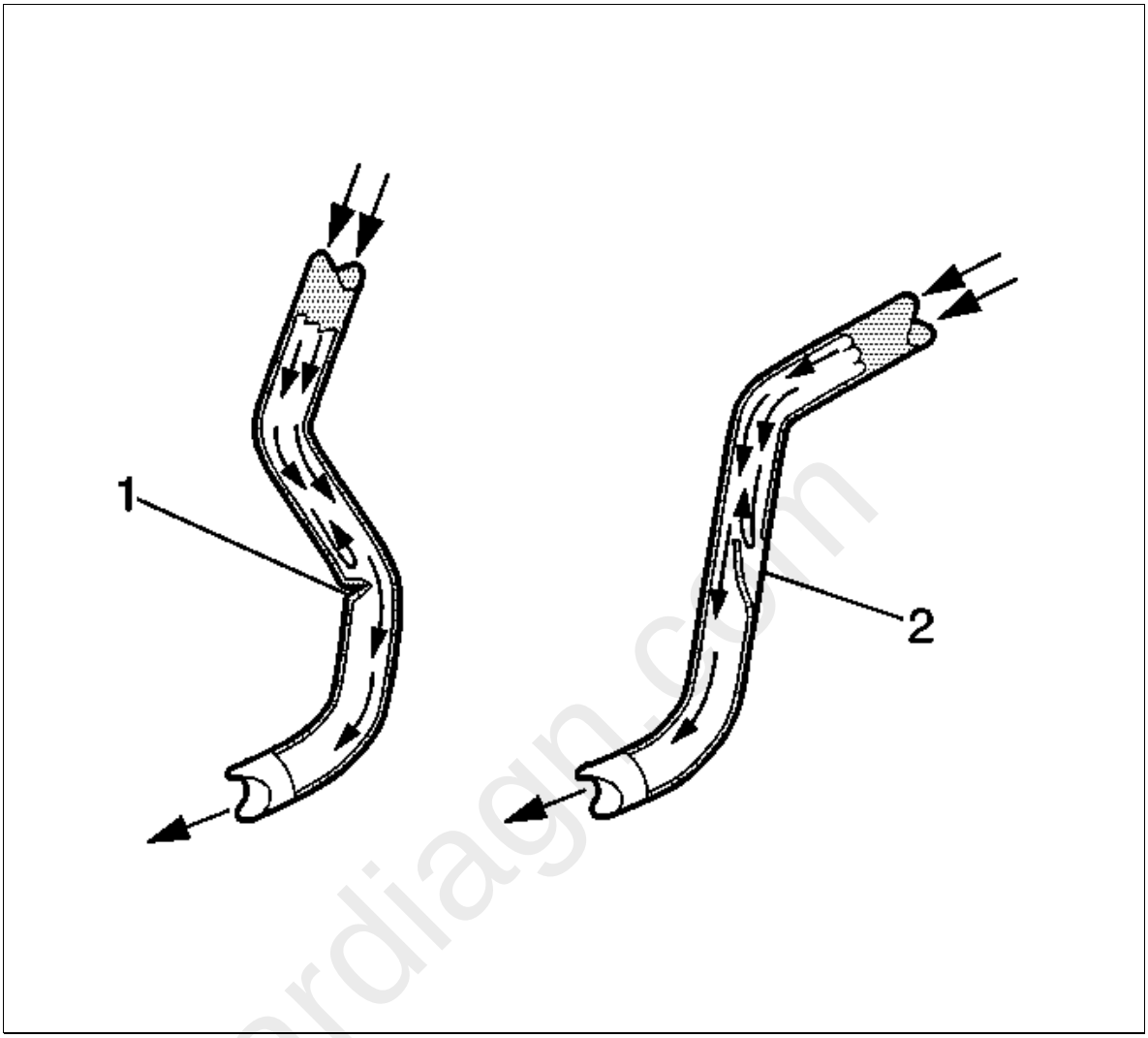
> *CAUTION:*
>
> *Refer to Brake Fluid Effects on Paint and Electrical Components Caution .*

1. Visually inspect all of the brake pipes for the following conditions:
    1. Kinks, improper routing, missing or damaged retainers
    2. Leaking fittings, excessive corrosion
2. If any of the brake pipes exhibited any of the conditions listed, then the identified pipe, or pipes, require replacement.

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3. Ensure that the vehicle axles are properly supported at ride height in order to maintain the proper relationship of the flexible brake hoses to the chassis.

Fig 1: Flexible Brake Hose Failure Conditions



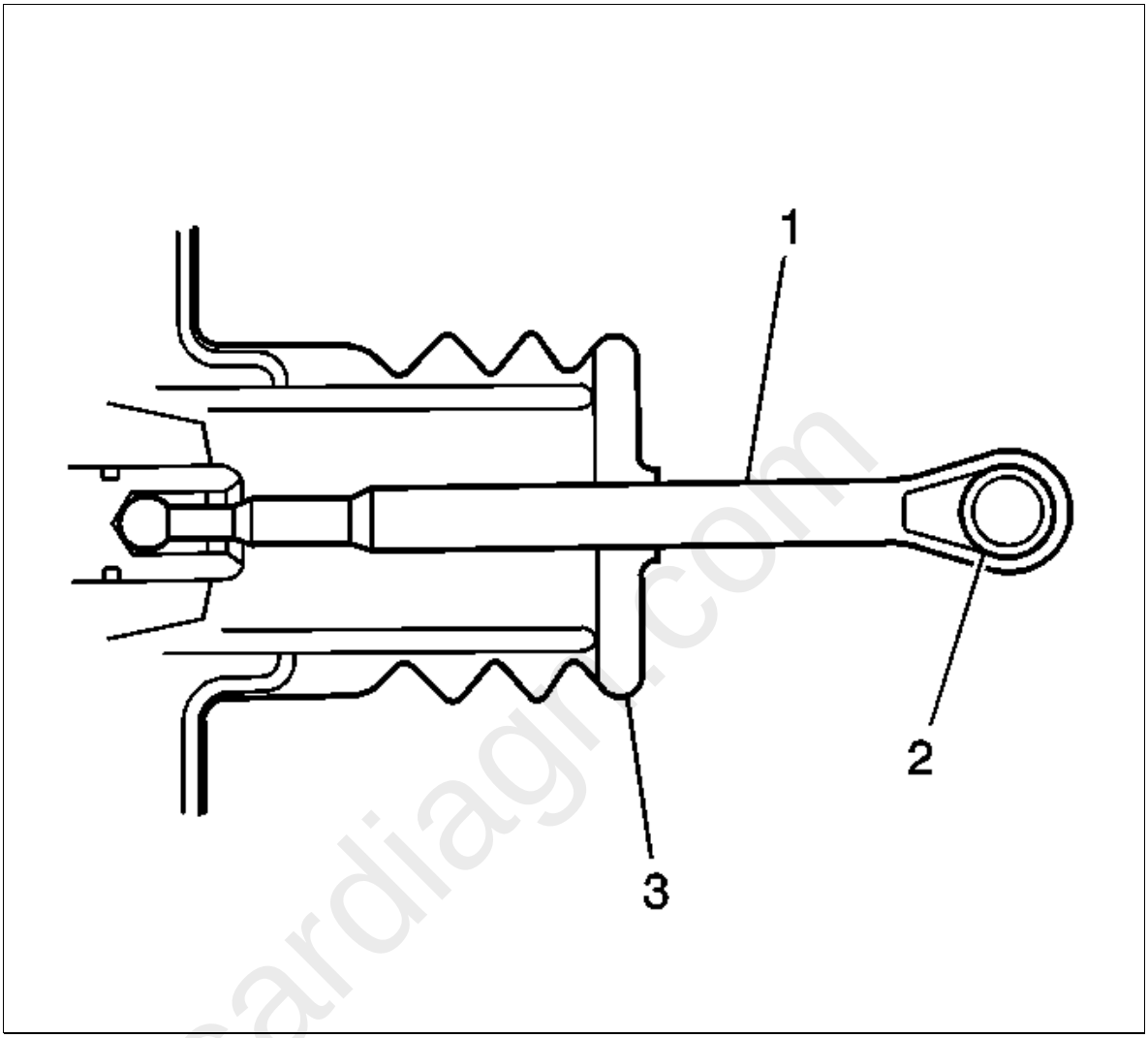
Courtesy of GENERAL MOTORS COMPANY

4. Visually inspect all of the flexible brake hoses for the following conditions:
    1. Kinks (1), improper routing, twists, chafing, missing or damaged retainers
    2. Leaking connections, cracking, dry-rot, blisters, bulges
5. If any of the flexible brake hoses exhibited any of the conditions listed, then the identified flexible brake hose, or hoses require replacement.
6. Squeeze the flexible brake hoses with firm finger pressure to check for soft spots (2), indicating an internal restriction. Check the entire length of each flexible brake hose.
7. If any of the flexible brake hoses were found to have soft spots (2), then the identified flexible brake hose, or hoses require replacement.

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DIAGNOSTIC INFORMATION AND PROCEDURES > BRAKE PEDAL PUSHROD INSPECTION

Fig 1: Brake Pedal Pushrod



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1. Disconnect the brake pedal pushrod (1) from the brake pedal.
2. Inspect the brake pedal pushrod eyelet bushing (2), if equipped, for cracks and/or excessive wear.
3. Reposition the pedal pushrod boot (3) toward the front of the vehicle to expose as much of the pedal pushrod (1) as possible.
4. Inspect the brake pedal pushrod (1) for straightness.
5. If the brake pedal pushrod eyelet bushing (2) exhibited cracks and/or excessive wear, then the bushing requires replacement.
6. If the brake pedal pushrod (1) is not straight, then the pushrod requires replacement.
7. Return the pedal pushrod boot (3) to its original position on the pedal pushrod (1).

8. Connect the brake pedal pushrod (1) to the brake pedal.

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE FLUID REPLACEMENT

WARNING:

Brake Fluid Irritant Warning

CAUTION:

Brake Fluid Effects on Paint and Electrical Components Caution

CAUTION:

Only use products that comply with GM specifications and check manufacturer information respectively. We recommend the use of GM genuine products. Instructions must be followed at all times. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.

1. With the engine OFF, apply and release the brake pedal several times until the pedal effort becomes firm to deplete the brake booster power reserve.
2. Clean the outer surface of the master cylinder brake fluid reservoir, on and around the reservoir cap, prior to removing the cap and diaphragm. Master Cylinder Reservoir Filling
3. Fill the master cylinder brake fluid reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container. Adhesives, Fluids, Lubricants, and Sealers
4. Maintain the brake fluid level in the master cylinder brake fluid reservoir to between the minimum and maximum-fill level during the brake fluid replacement procedure.
5. Following the hydraulic brake system bleeding procedure, bleed each of the hydraulic brake wheel circuits until clean, clear brake fluid is observed coming from each bleeder valve. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9)
6. Fill the master cylinder brake fluid reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container. Master Cylinder Reservoir Filling
7. Securely install the master cylinder brake fluid reservoir diaphragm and cap.
8. Slowly apply and release the brake pedal, observing the brake pedal feel.
9. If the brake pedal feels spongy, perform the following:

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1. Visually inspect the hydraulic brake system for external leaks. Brake System External Leak Inspection
2. Using a scan tool, perform the antilock brake system automated bleed procedure to remove any air that may have become trapped in the brake pressure modulator valve (BPMV). Antilock Brake System Automated Bleed

REPAIR INSTRUCTIONS > MASTER CYLINDER RESERVOIR FILLING

WARNING:

Refer to Brake Fluid Irritant Warning .

CAUTION:

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

1. Visually inspect the brake fluid level through the brake master cylinder reservoir.
2. If the brake fluid level is at or below the half-full point during routine fluid checks, the brake system should be inspected for wear and possible brake fluid leaks.
3. If the brake fluid level is at or below the half-full point during routine fluid checks, and an inspection of the brake system did not reveal wear or brake fluid leaks, the brake fluid may be topped-off up to the maximum-fill level.
4. If brake system service was just completed, the brake fluid may be topped-off up to the maximum-fill level.
5. If the brake fluid level is above the half-full point, adding brake fluid is not recommended under normal conditions.
6. If brake fluid is to be added to the master cylinder reservoir, clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Use only GM approved brake fluid from a clean, sealed brake fluid container.

REPAIR INSTRUCTIONS > MASTER CYLINDER RESERVOIR REPLACEMENT > REMOVAL PROCEDURE

WARNING:

Refer to Brake Fluid Irritant Warning .

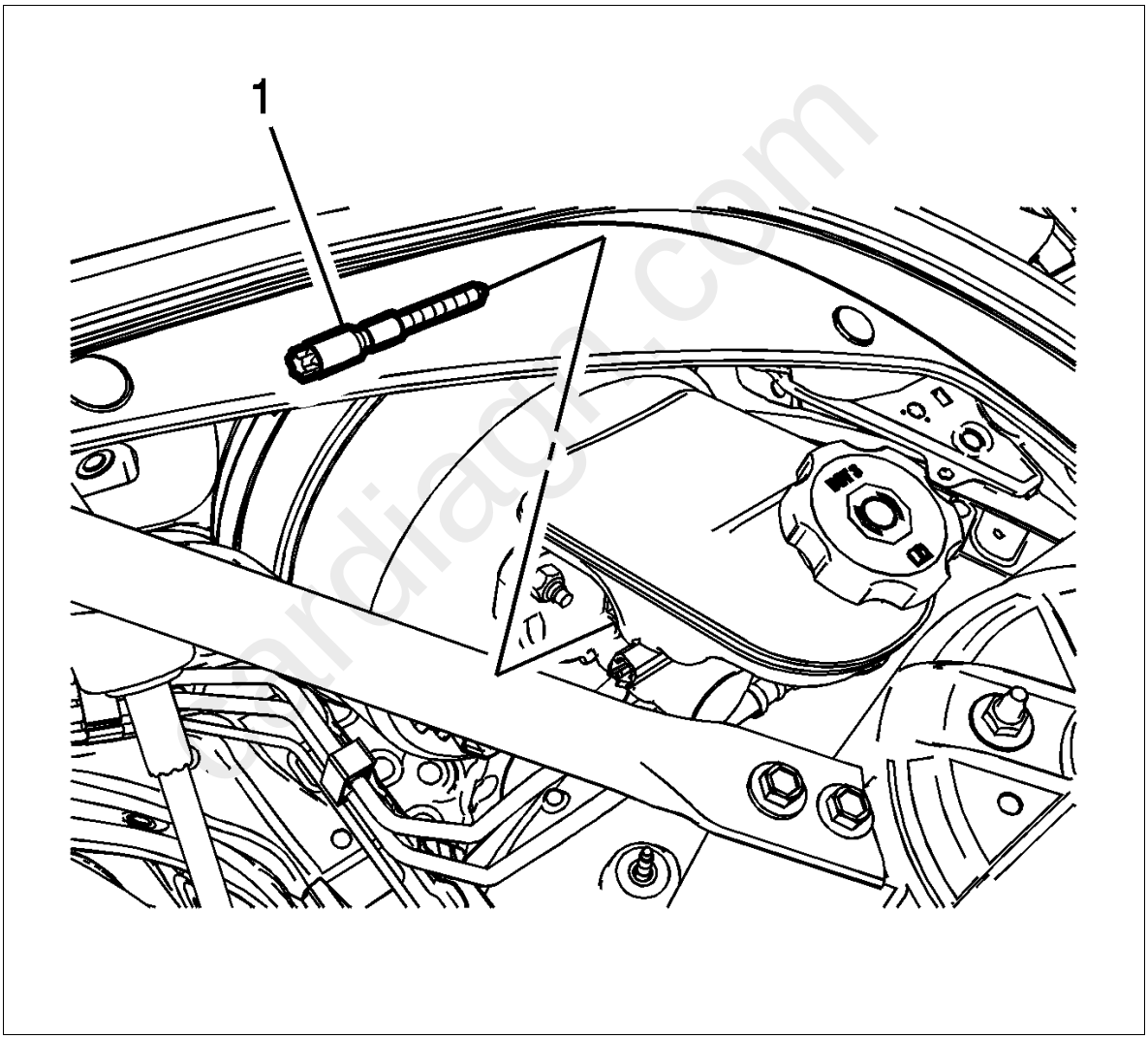
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CAUTION:

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

1. Using a suitable tool, remove and properly discard the brake fluid from the master cylinder reservoir.
2. Remove the brake fluid level indicator switch. Refer to Brake Fluid Level Indicator Switch Replacement .
3. If equipped, disconnect the clutch master cylinder feed hose.

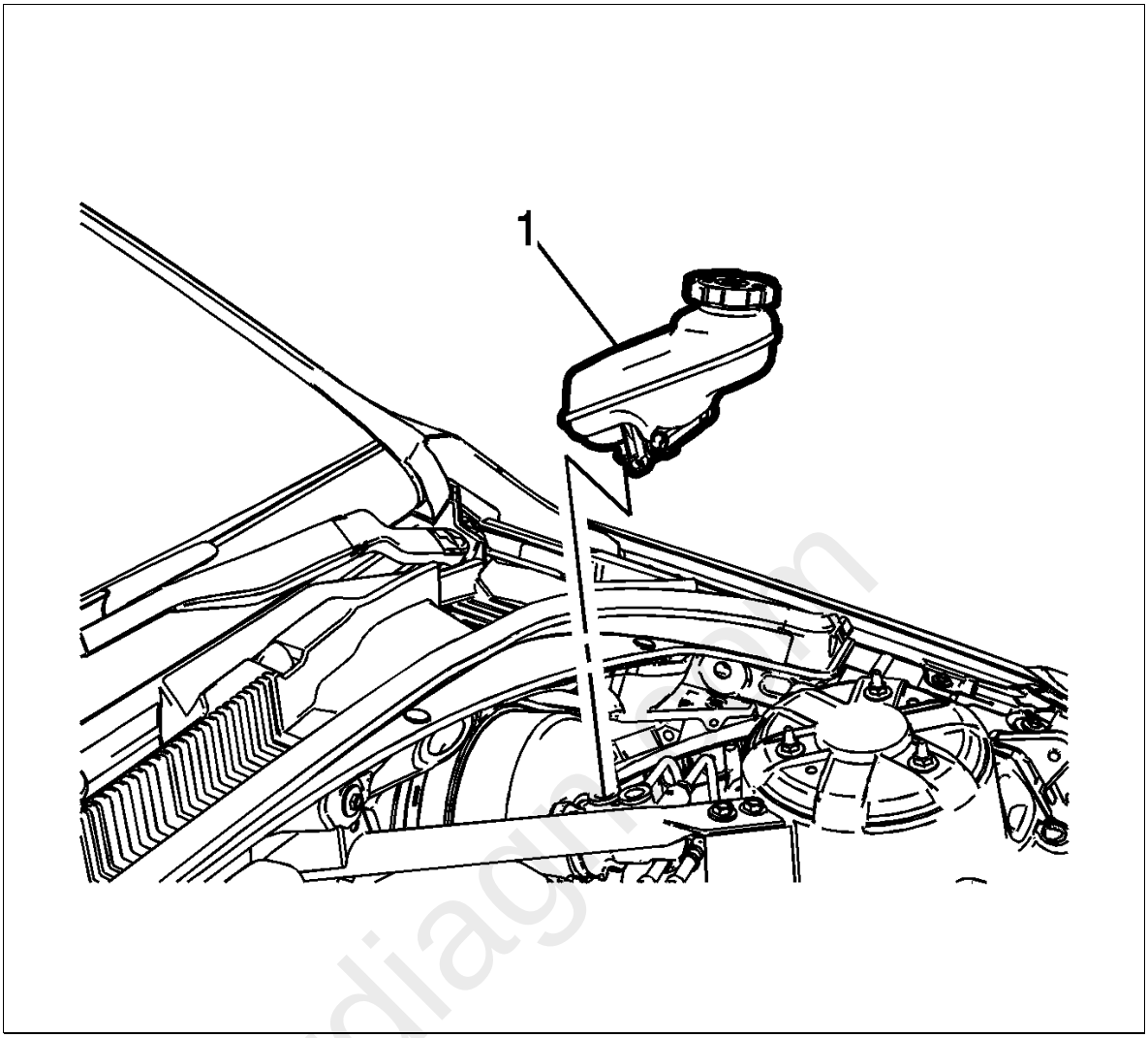
Fig 1: Master Cylinder Reservoir Bolt



Courtesy of GENERAL MOTORS COMPANY

4. Remove the master cylinder reservoir bolt (1).

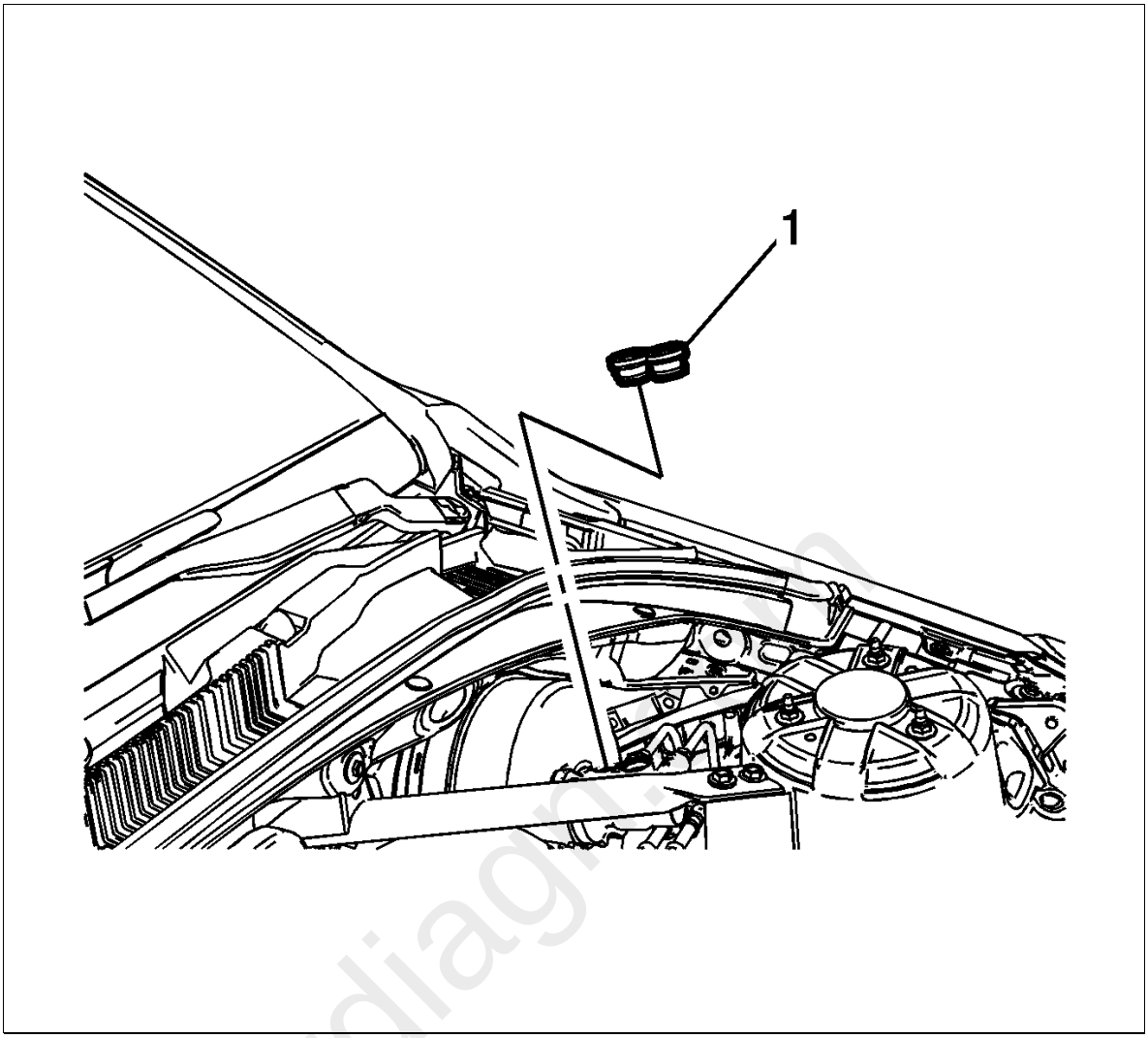
Fig 2: Master Cylinder Reservoir



Courtesy of GENERAL MOTORS COMPANY

5. Lift the master cylinder reservoir (1) upward to release the reservoir from the reservoir seals and the master cylinder.

Fig 3: Master Cylinder Reservoir Seals



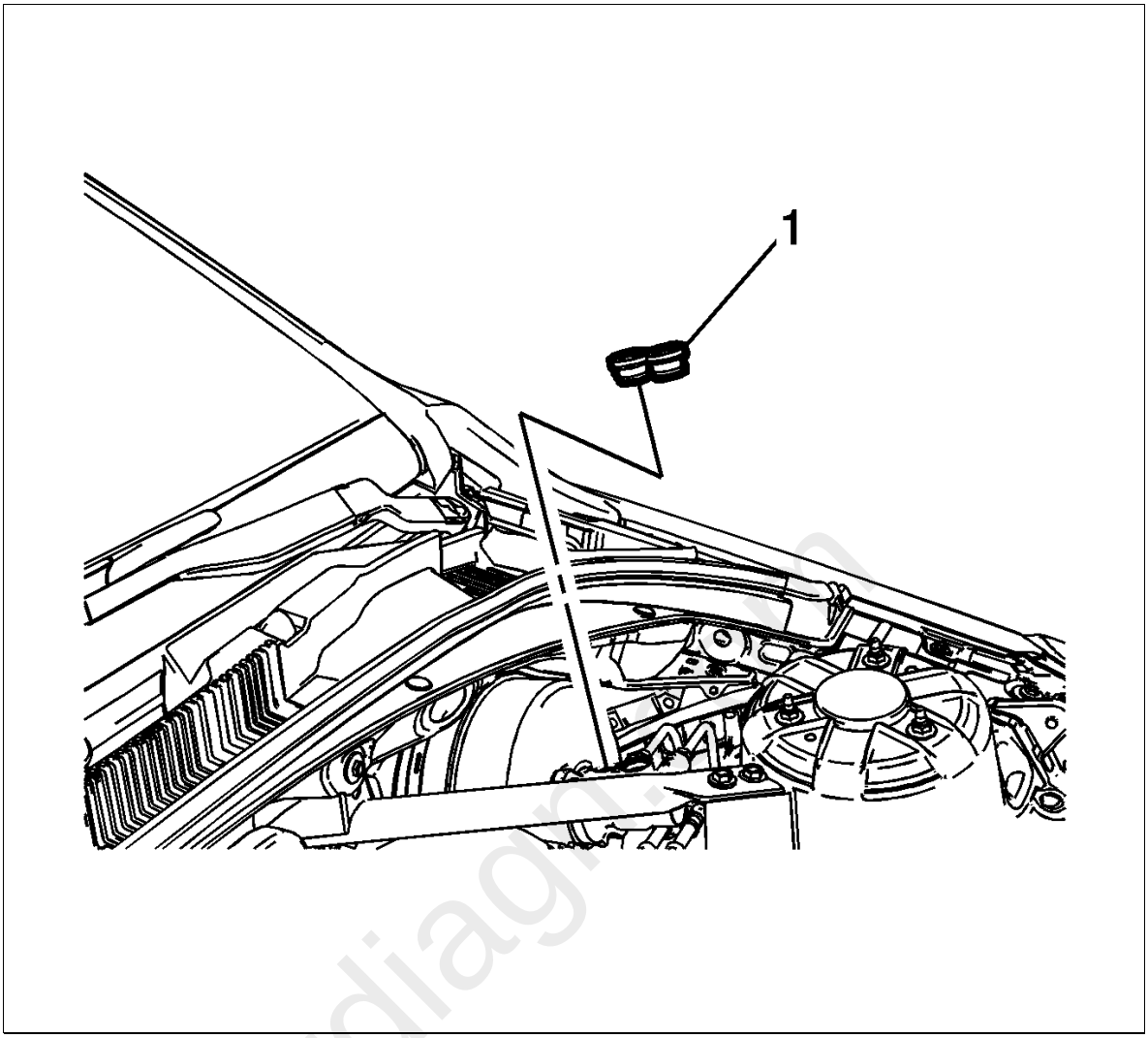
Courtesy of GENERAL MOTORS COMPANY

6. Remove the 2 master cylinder reservoir seals (1).

REPAIR INSTRUCTIONS > MASTER CYLINDER RESERVOIR REPLACEMENT > INSTALLATION PROCEDURE

1. Lubricate the master cylinder reservoir seals with GM approved brake fluid from a clean, sealed, brake fluid container.

Fig 1: Master Cylinder Reservoir Seals



Courtesy of GENERAL MOTORS COMPANY

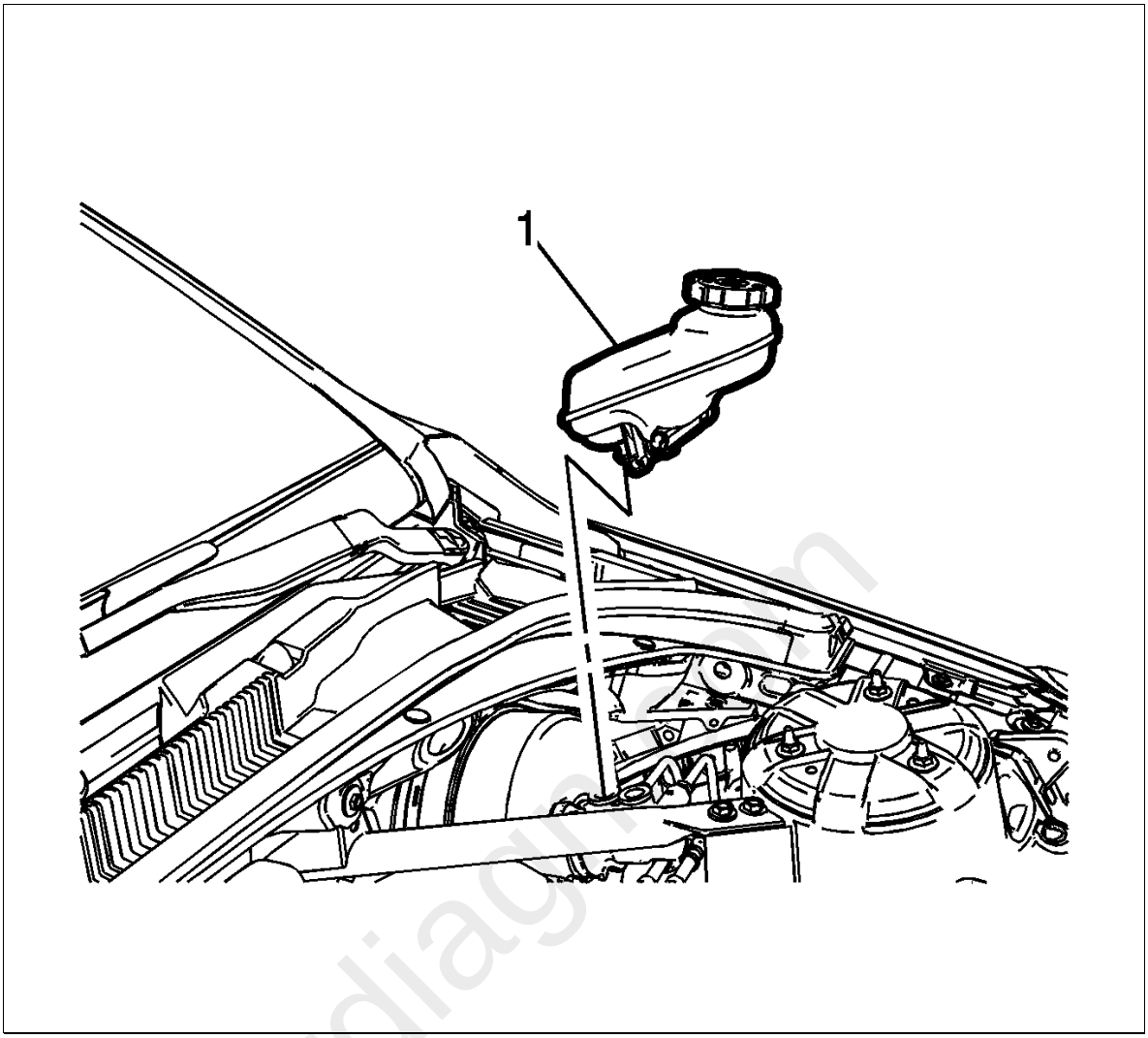
NOTE:

Ensure the reservoir seals are fully seated in the master cylinder.

2. Install the 2 master cylinder reservoir seals (1).

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Fig 2: Master Cylinder Reservoir



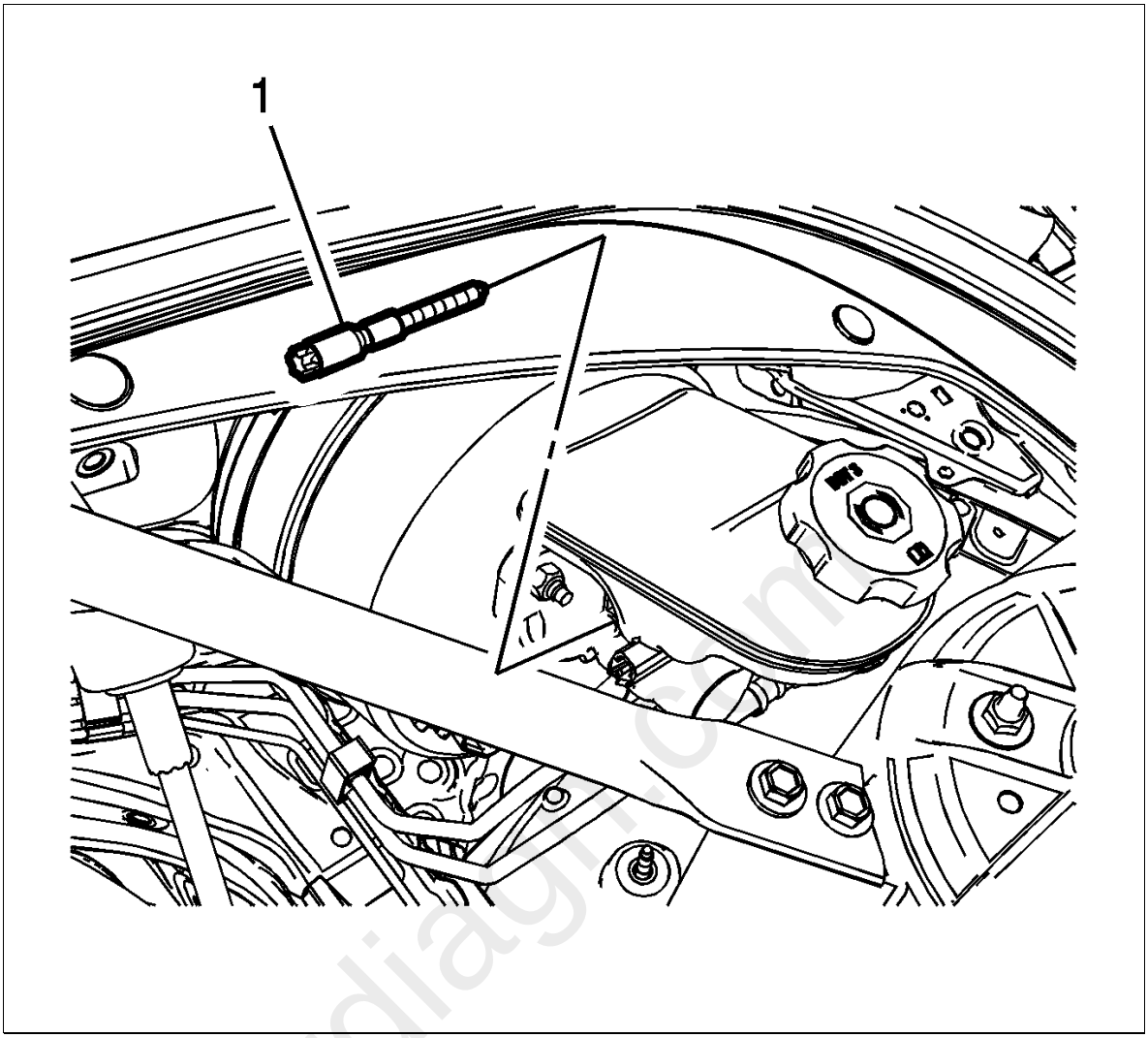
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Ensure the master cylinder reservoir is fully seated in the master cylinder.

3. Firmly and squarely press the master cylinder reservoir (1) into the master cylinder.

Fig 3: Master Cylinder Reservoir Bolt



Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

4. Install the master cylinder reservoir bolt (1) and tighten to 8 N.m (71 lb in).
5. If equipped, connect the clutch master cylinder feed hose.
6. Install the brake fluid level indicator switch. Refer to Brake Fluid Level Indicator Switch Replacement .
7. Fill the master cylinder reservoir. Refer to Master Cylinder Reservoir Filling .

REPAIR INSTRUCTIONS > MASTER CYLINDER REPLACEMENT > REMOVAL

PROCEDURE

WARNING:

Refer to Brake Fluid Irritant Warning .

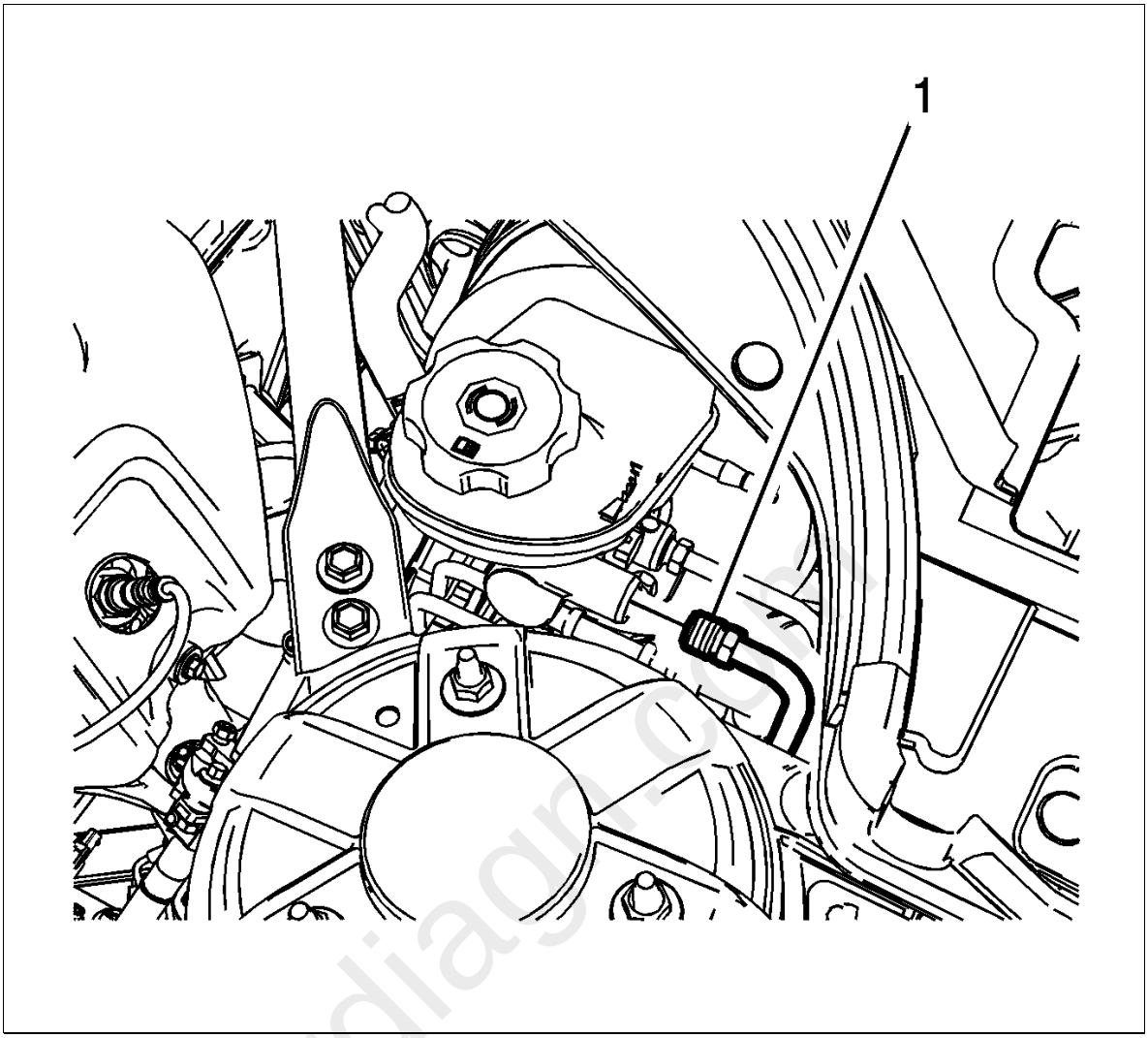
CAUTION:

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

1. Turn the ignition switch to the OFF position.
2. Apply and release the brake pedal several times until the brake pedal becomes firm to deplete the power vacuum brake booster vacuum reserve.
3. Using a suitable tool, remove and properly dispose of the brake fluid from the master cylinder reservoir.
4. Disconnect the brake fluid level indicator switch electrical connector.
5. If equipped, disconnect the clutch master cylinder feed hose.

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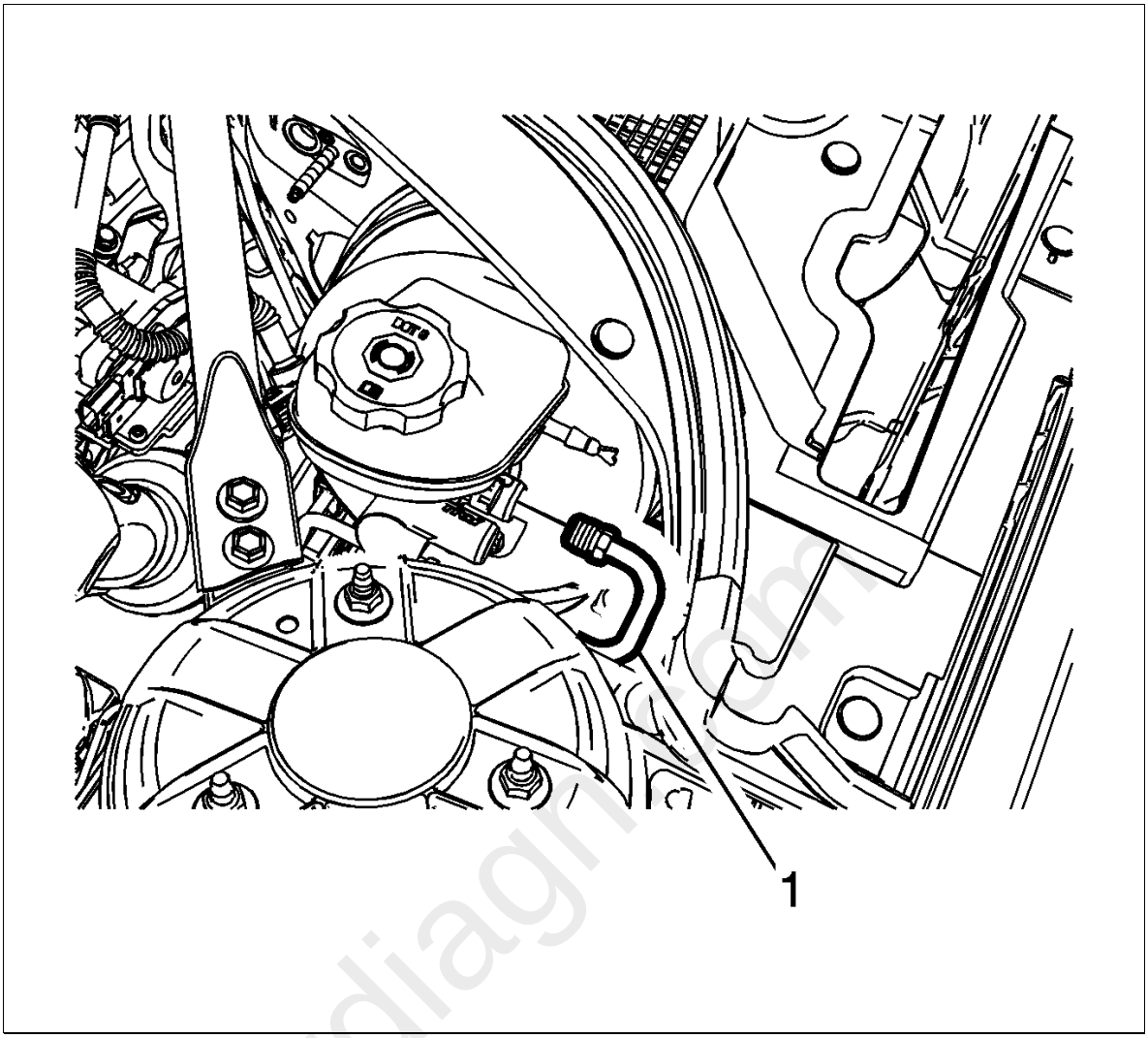
Fig 1: Brake Pressure Modulator Valve Secondary Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

6. Disconnect the brake pressure modulator valve secondary brake pipe fitting (1).
7. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

Fig 2: Brake Pressure Modulator Valve Primary Brake Pipe Fitting

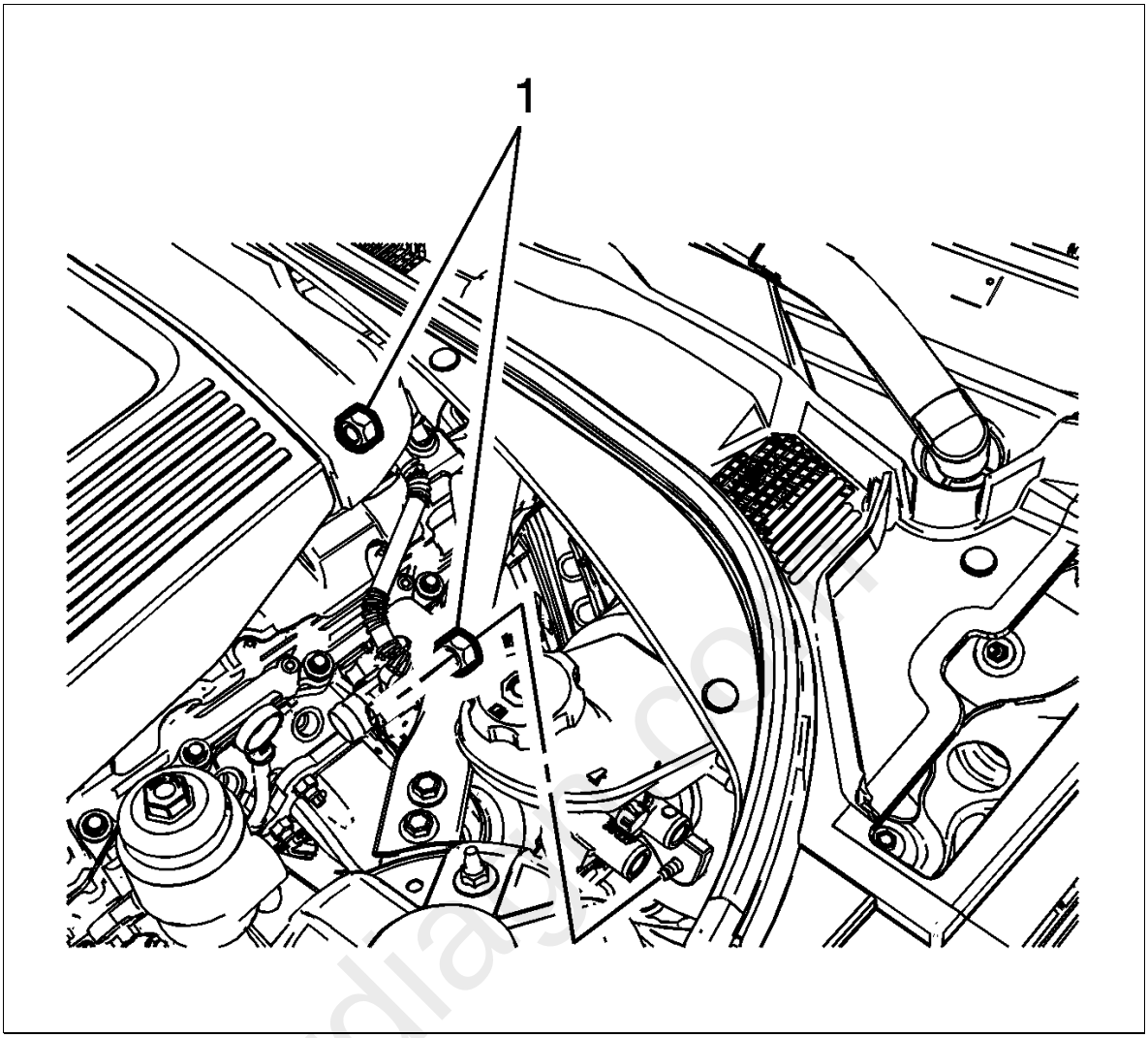


Courtesy of GENERAL MOTORS COMPANY

8. Disconnect the brake pressure modulator valve primary brake pipe fitting (1).
9. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

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Fig 3: Master Cylinder Nuts



Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not reuse the master cylinder nuts.

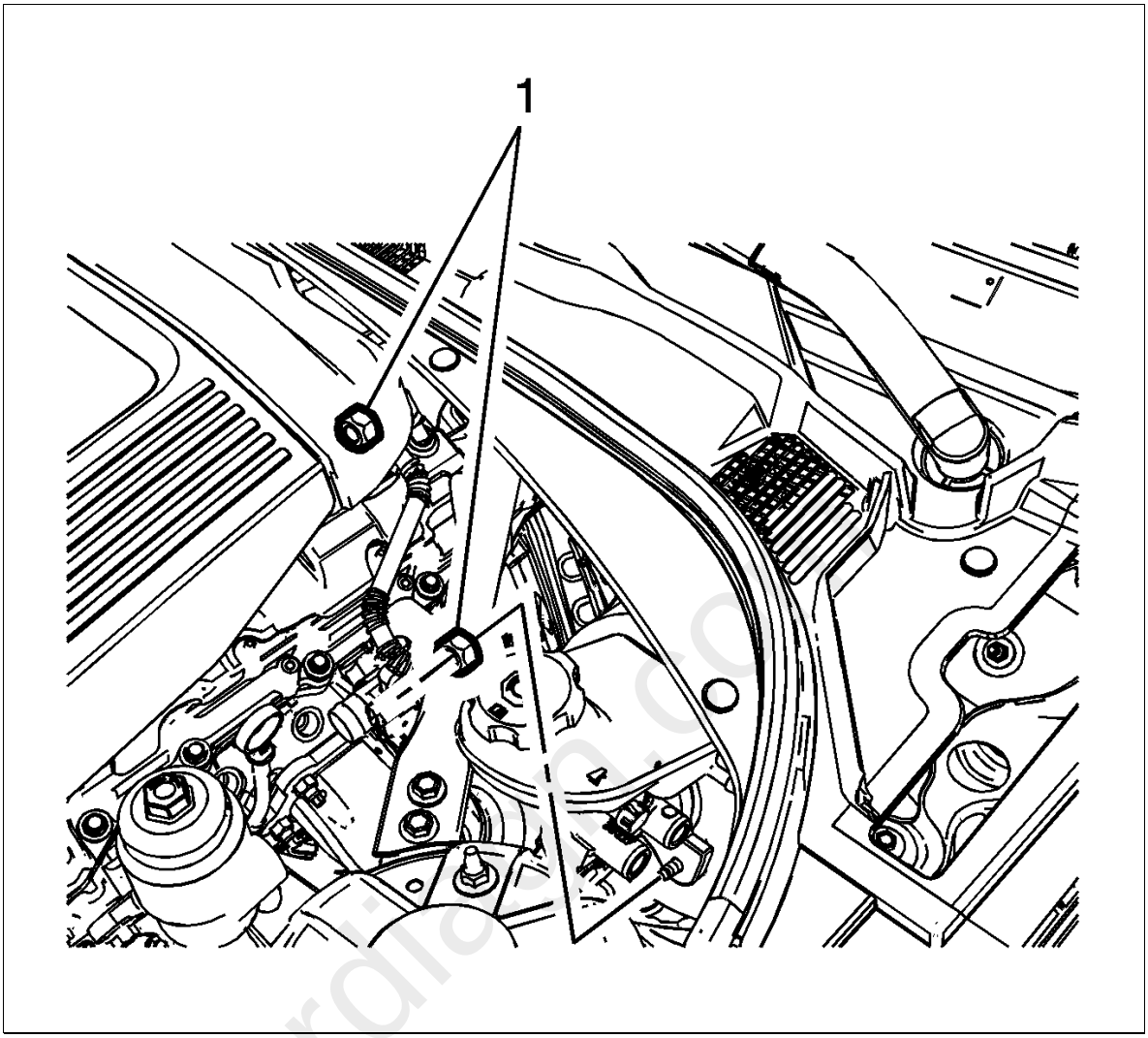
10. Remove and discard the master cylinder nuts (1).
11. Remove the master cylinder.

REPAIR INSTRUCTIONS > MASTER CYLINDER REPLACEMENT > INSTALLATION PROCEDURE

1. If installing a new master cylinder, bench bleed the master cylinder. Refer to Master Cylinder Bench Bleeding .

2. Install the master cylinder.

Fig 1: Master Cylinder Nuts



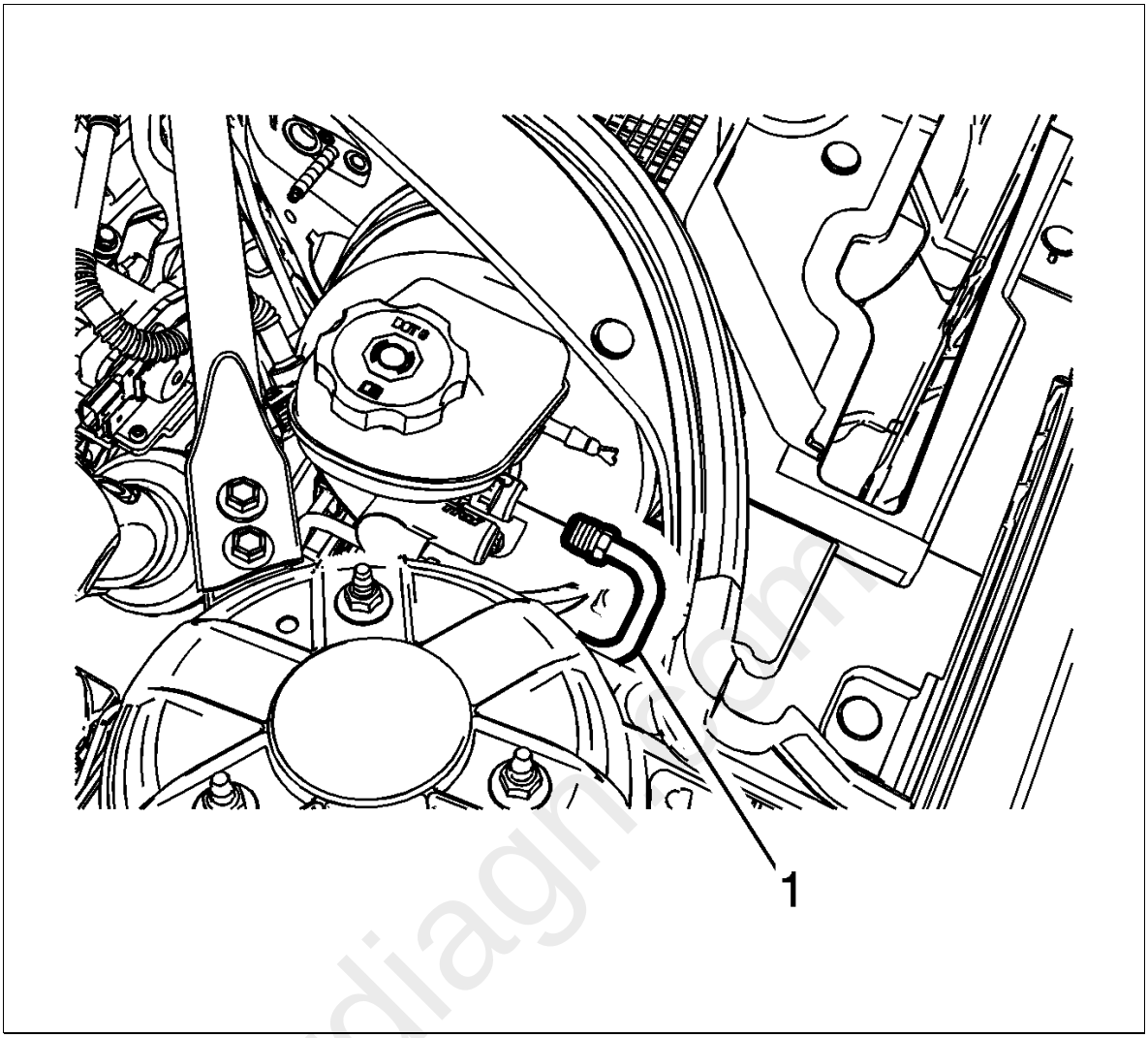
Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

> *NOTE:*
>
> *Install new master cylinder nuts.*

3. Install new master cylinder nuts (1) and tighten to 23 N.m (17 lb ft).

Fig 2: Brake Pressure Modulator Valve Primary Brake Pipe Fitting

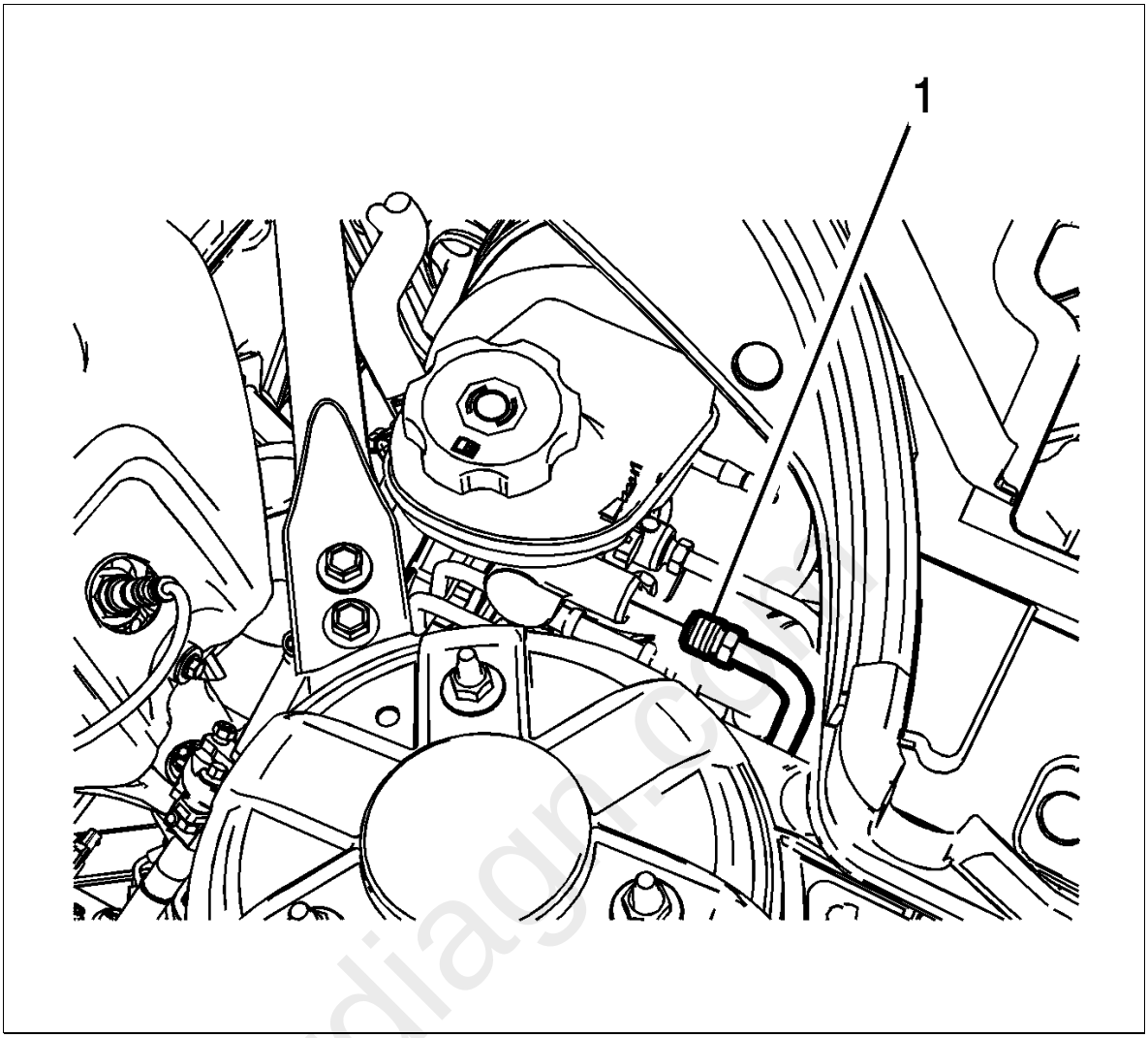


Courtesy of GENERAL MOTORS COMPANY

4. Connect the brake pressure modulator valve primary brake pipe fitting (1) and tighten to 30 N.m (22 lb ft).

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Fig 3: Brake Pressure Modulator Valve Secondary Brake Pipe Fitting

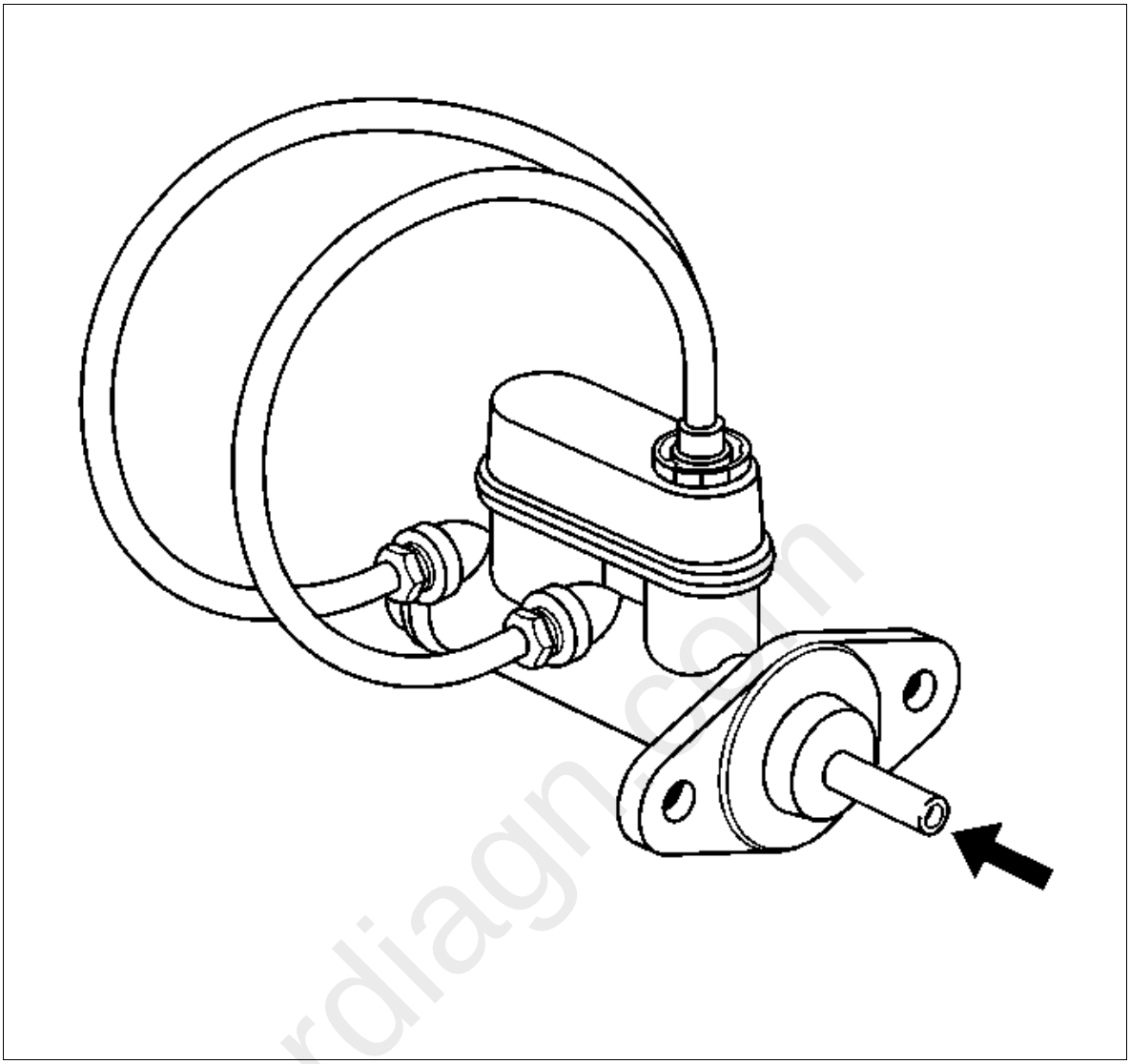


Courtesy of GENERAL MOTORS COMPANY

5. Connect the brake pressure modulator valve secondary brake pipe fitting (1) and tighten to 30 N.m (22 lb ft).
6. If equipped, connect the clutch master cylinder feed hose.
7. Connect the brake fluid level indicator switch electrical connector.
8. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) .

REPAIR INSTRUCTIONS > MASTER CYLINDER BENCH BLEEDING

Fig 1: Bleeding Master Cylinder



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Refer to Brake Fluid Irritant Warning .

CAUTION:

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

1. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible.
2. Remove the master cylinder reservoir cap and diaphragm.

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3. Install suitable fittings to the master cylinder ports that match the type of flare seat required and also provide for hose attachment.
4. Install transparent hoses to the fittings installed to the master cylinder ports, then route the hoses into the master cylinder reservoir.
5. Fill the master cylinder reservoir to at least the half-way point with GM approved brake fluid from a clean, sealed brake fluid container. Refer to Master Cylinder Reservoir Filling .
6. Ensure that the ends of the transparent hoses running into the master cylinder reservoir are fully submerged in the brake fluid.
7. Using a smooth, round-ended tool, depress and release the primary piston as far as it will travel, a depth of about 25 mm (1 in), several times. Observe the flow of fluid coming from the ports.

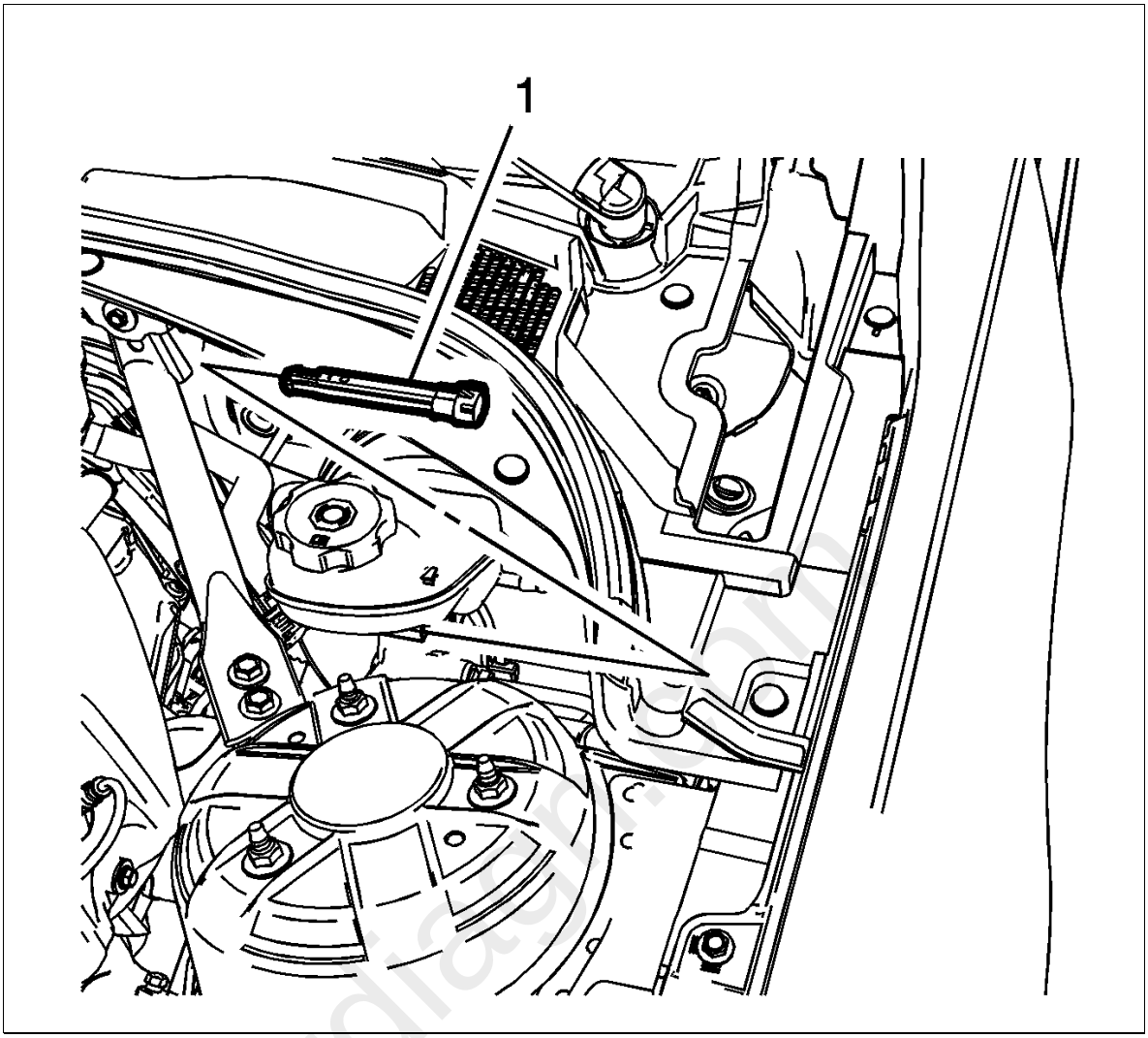
   As air is bled from the primary and secondary pistons, the effort required to depress the primary piston will increase and the amount of travel will decrease.
8. Continue to depress and release the primary piston until fluid flows freely from the ports with no evidence of air bubbles.
9. Remove the transparent hoses from the master cylinder reservoir.
10. Install the master cylinder reservoir cap and diaphragm.
11. Remove the fittings with the transparent hoses from the master cylinder ports. Wrap the master cylinder with a clean shop cloth to prevent brake fluid spills.
12. Remove the master cylinder from the vise.

REPAIR INSTRUCTIONS > BRAKE FLUID LEVEL INDICATOR SWITCH REPLACEMENT > REMOVAL PROCEDURE

1. Disconnect the brake fluid level indicator switch electrical connector.

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Fig 1: Brake Fluid Level Indicator Switch

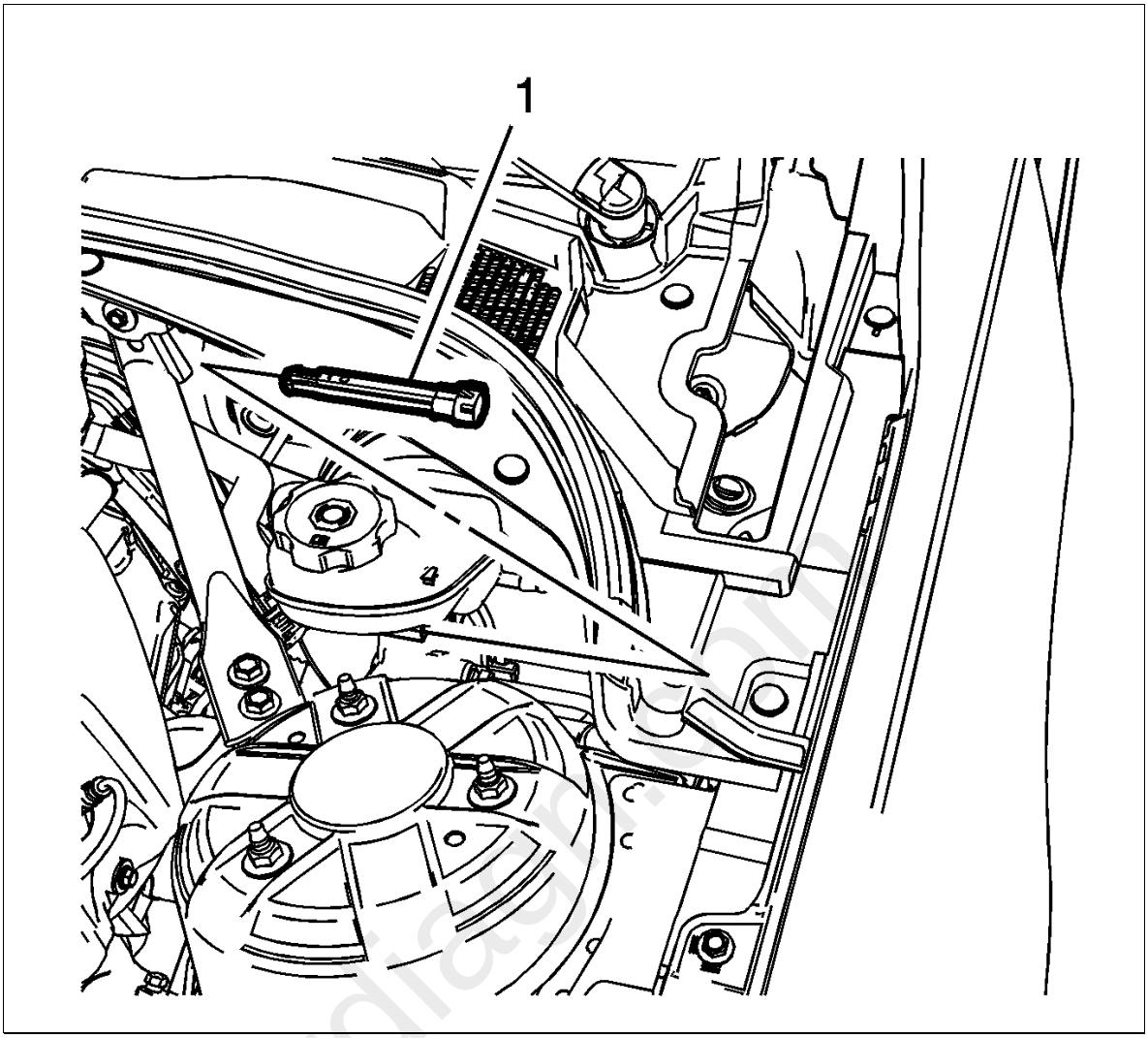


Courtesy of GENERAL MOTORS COMPANY

2. Compress the locking tabs on the inboard side of the master cylinder reservoir and remove the brake fluid level indicator switch (1).

REPAIR INSTRUCTIONS > BRAKE FLUID LEVEL INDICATOR SWITCH REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Brake Fluid Level Indicator Switch

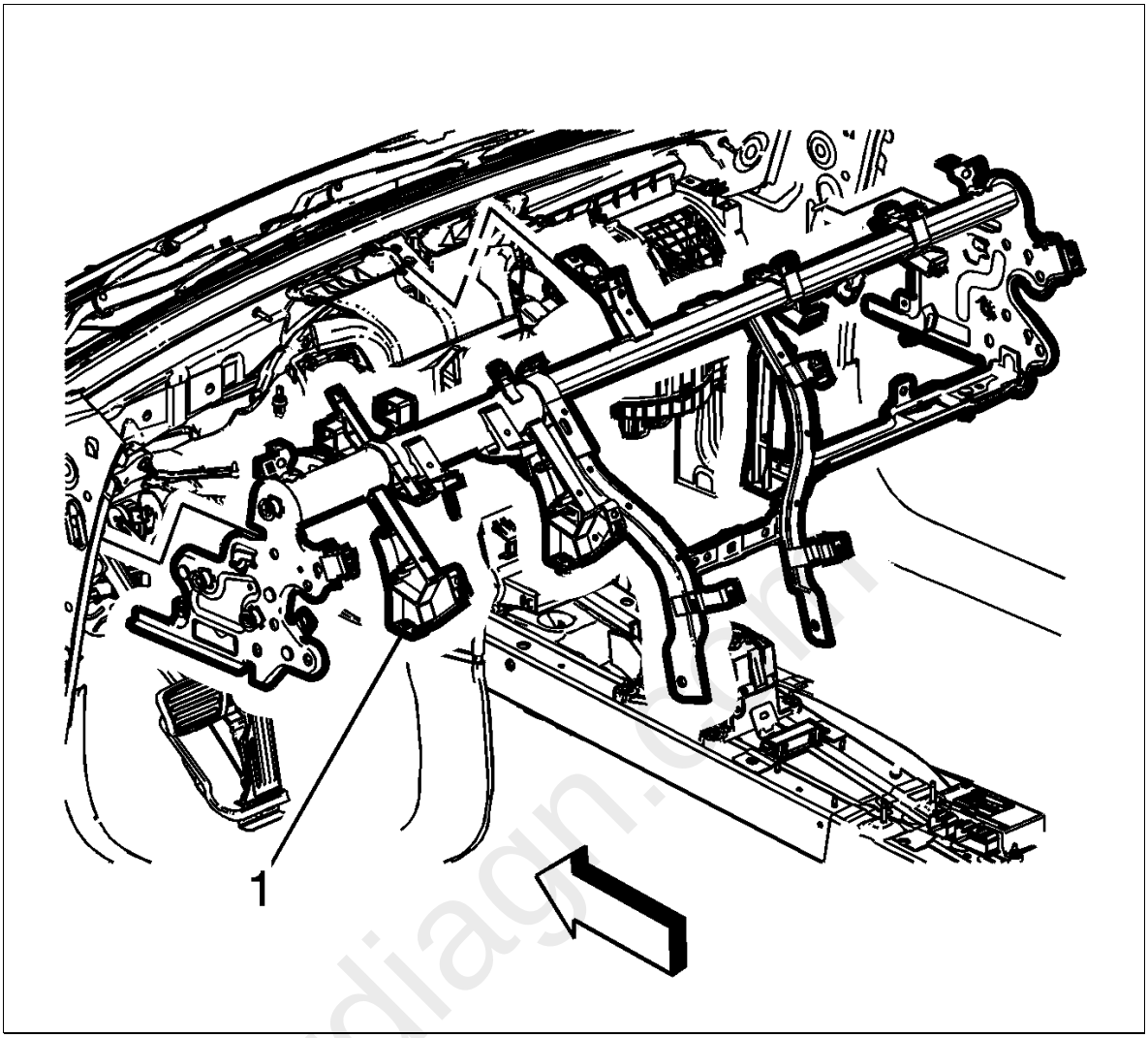


Courtesy of GENERAL MOTORS COMPANY

1. Install the brake fluid level indicator switch (1).
2. Ensure the locking tabs of the brake fluid level indicator switch are fully engaged in the master cylinder reservoir.
3. Connect the brake fluid level indicator switch electrical connector.

REPAIR INSTRUCTIONS > BRAKE PEDAL ASSEMBLY REPLACEMENT (AUTOMATIC TRANSMISSION) > REMOVAL PROCEDURE

Fig 1: Instrument Panel Tie Bar

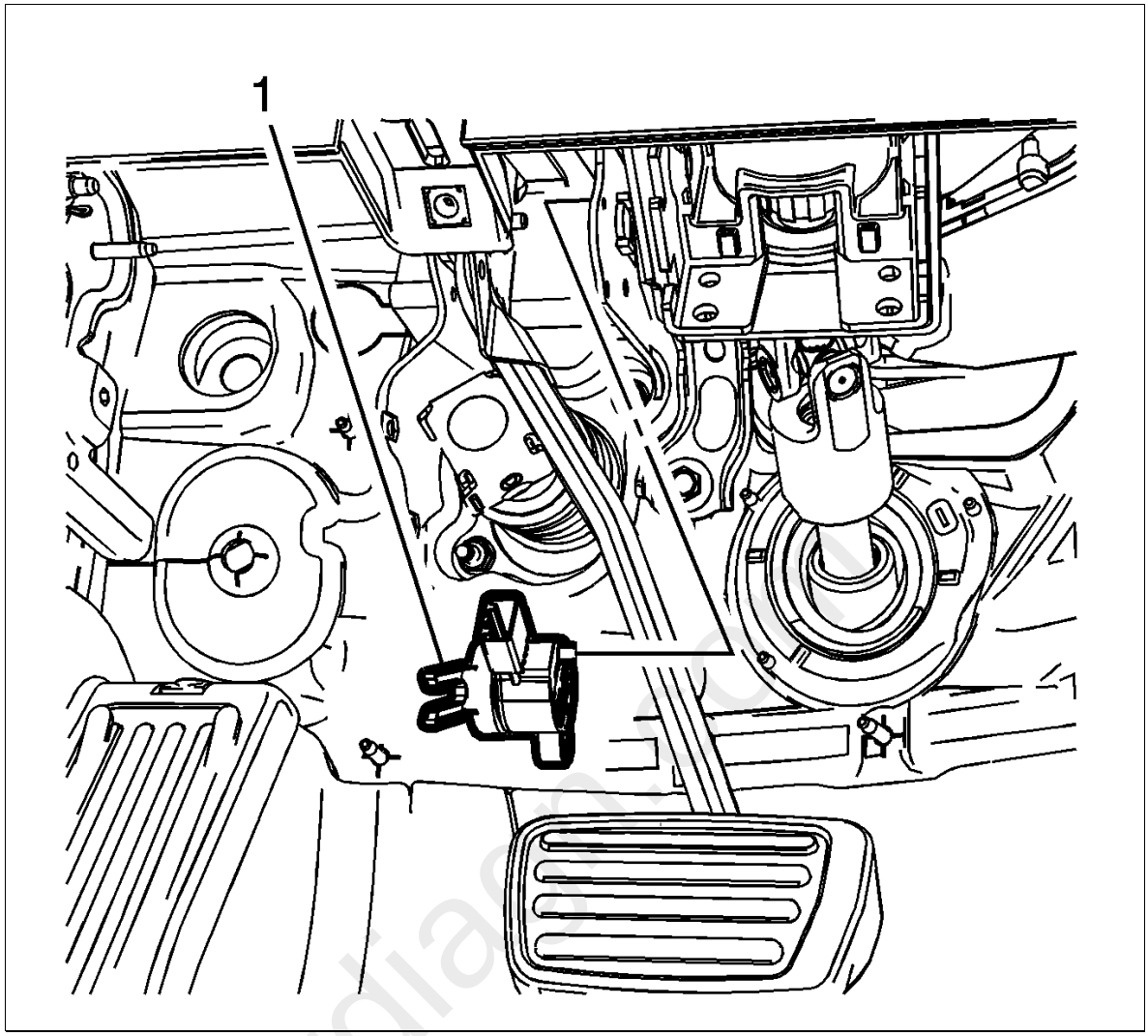


Courtesy of GENERAL MOTORS COMPANY

1. Remove the instrument panel tie bar (1). Refer to Instrument Panel Tie Bar Replacement .

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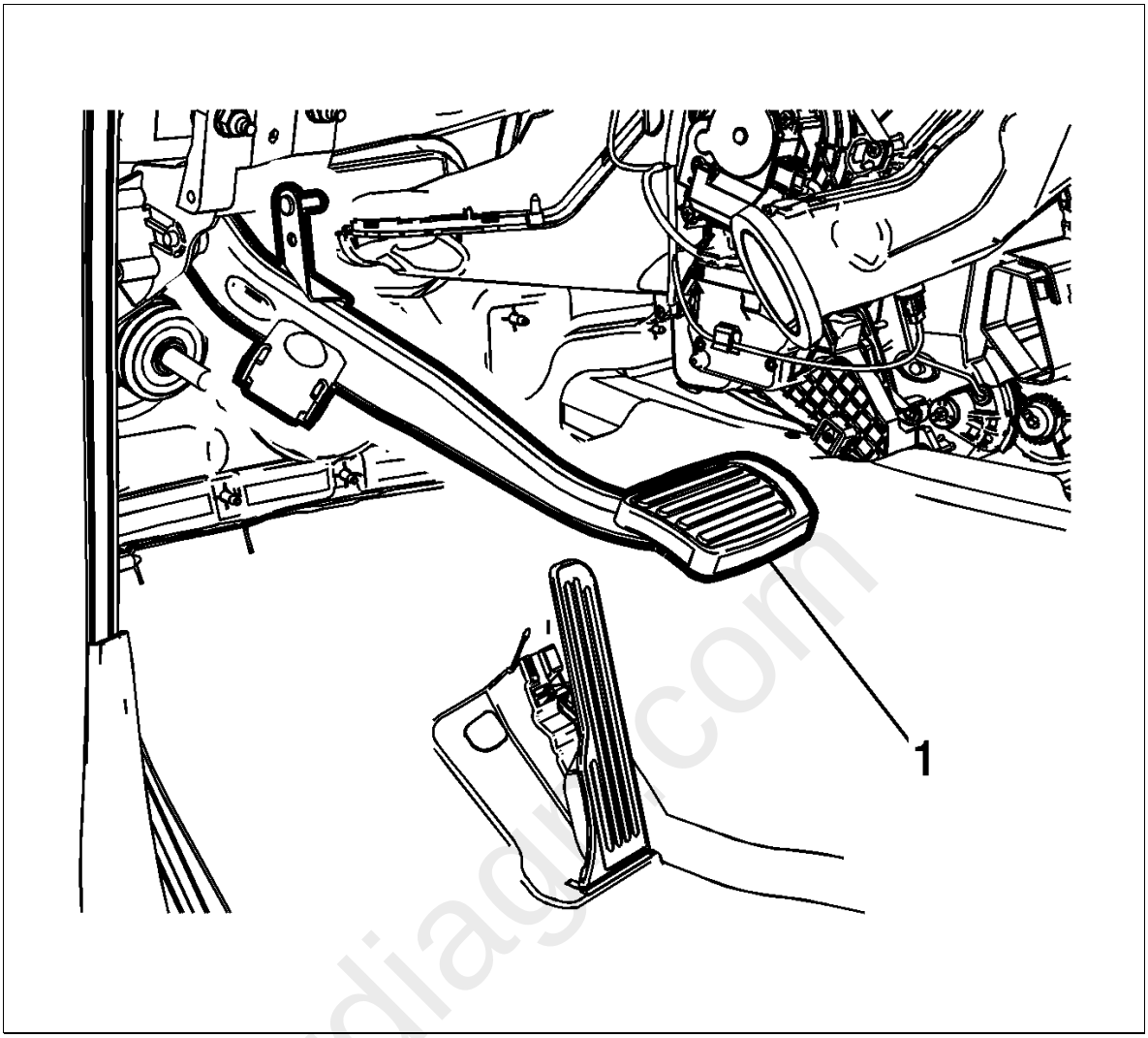
Fig 2: Brake Pedal Position Sensor



Courtesy of GENERAL MOTORS COMPANY

2. Remove the brake pedal position sensor (1). Refer to Brake Pedal Position Sensor Replacement .

Fig 3: Brake Pedal

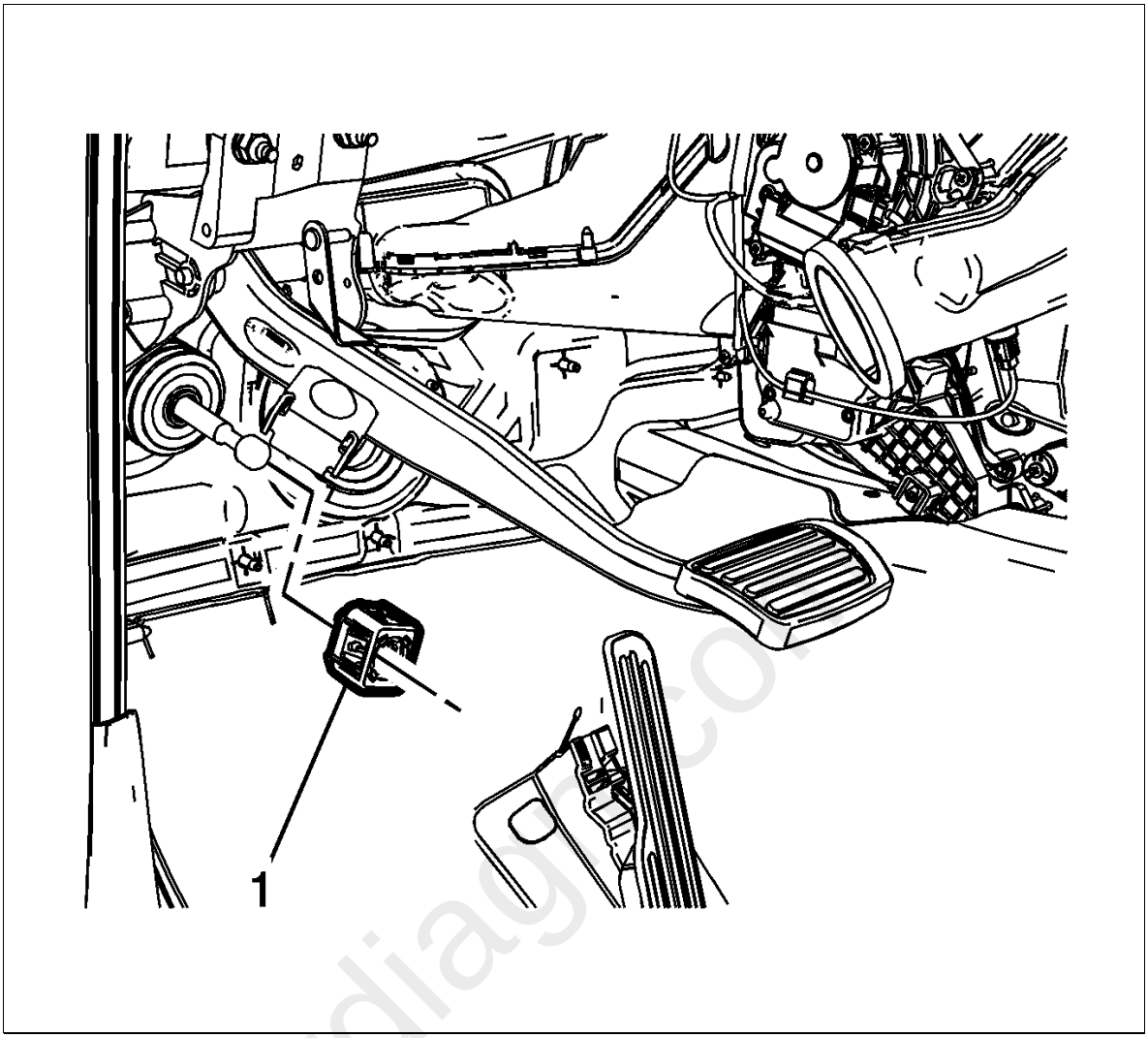


Courtesy of GENERAL MOTORS COMPANY

3. Pull the brake pedal (1) rearward to release the power vacuum brake booster pushrod retainer.

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Fig 4: Power Vacuum Brake Booster Pushrod Retainer



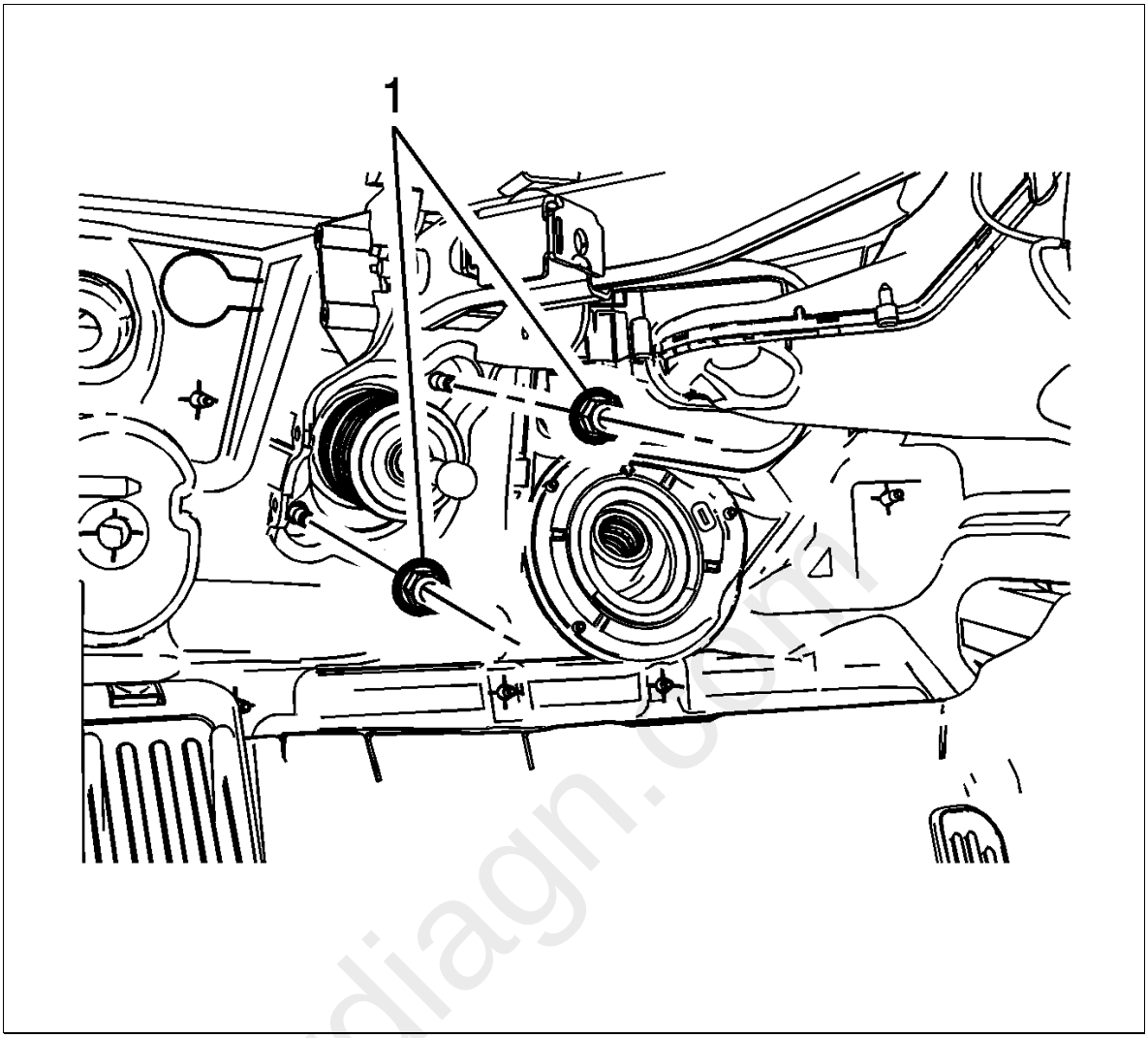
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not reuse the power vacuum brake booster pushrod retainer.

4. Remove and discard the power vacuum brake booster pushrod retainer (1).

Fig 5: Power Vacuum Brake Booster Nuts

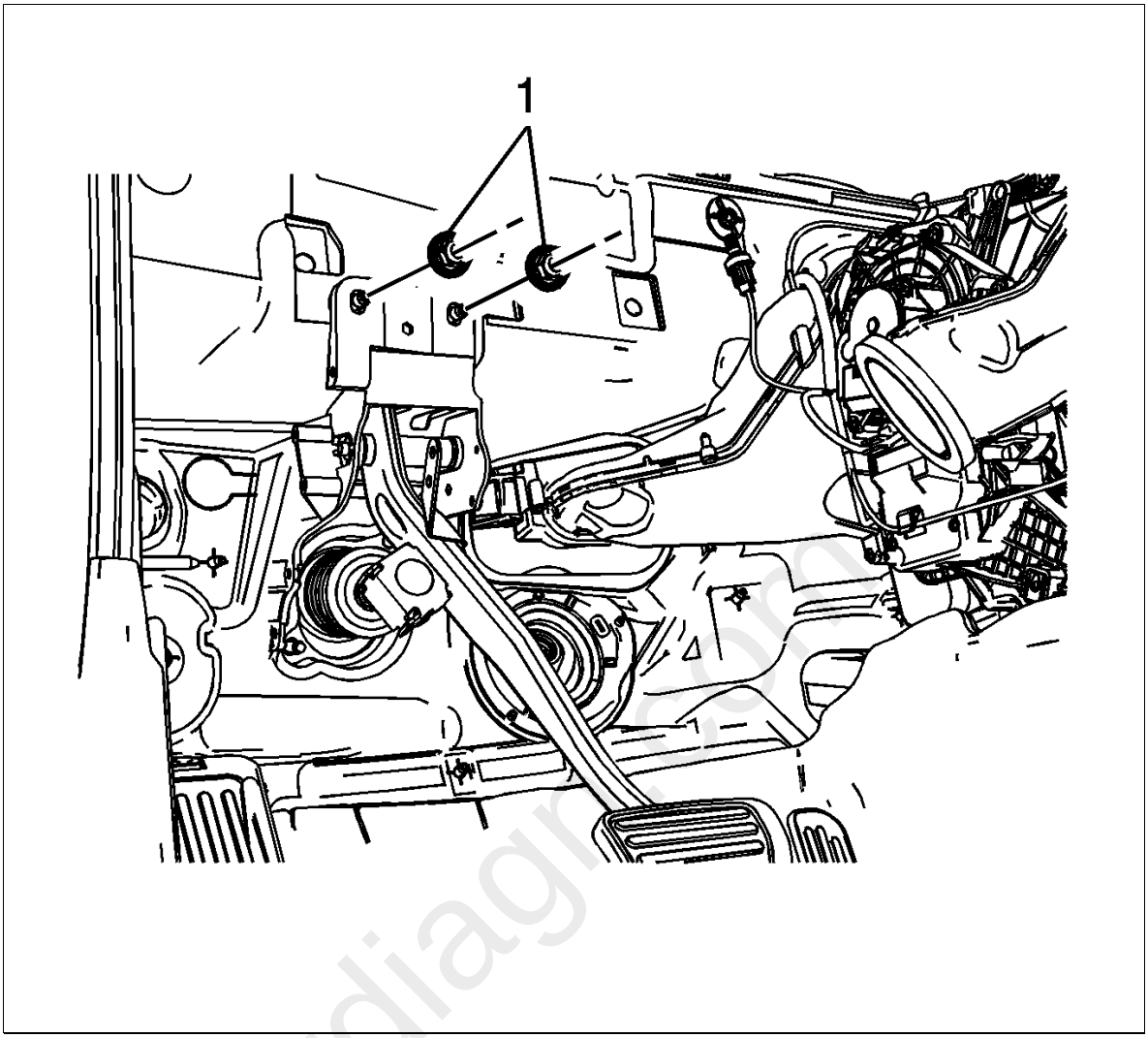


Courtesy of GENERAL MOTORS COMPANY

5. Remove the power vacuum brake booster nuts (1).

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Fig 6: Brake Pedal Assembly Nuts



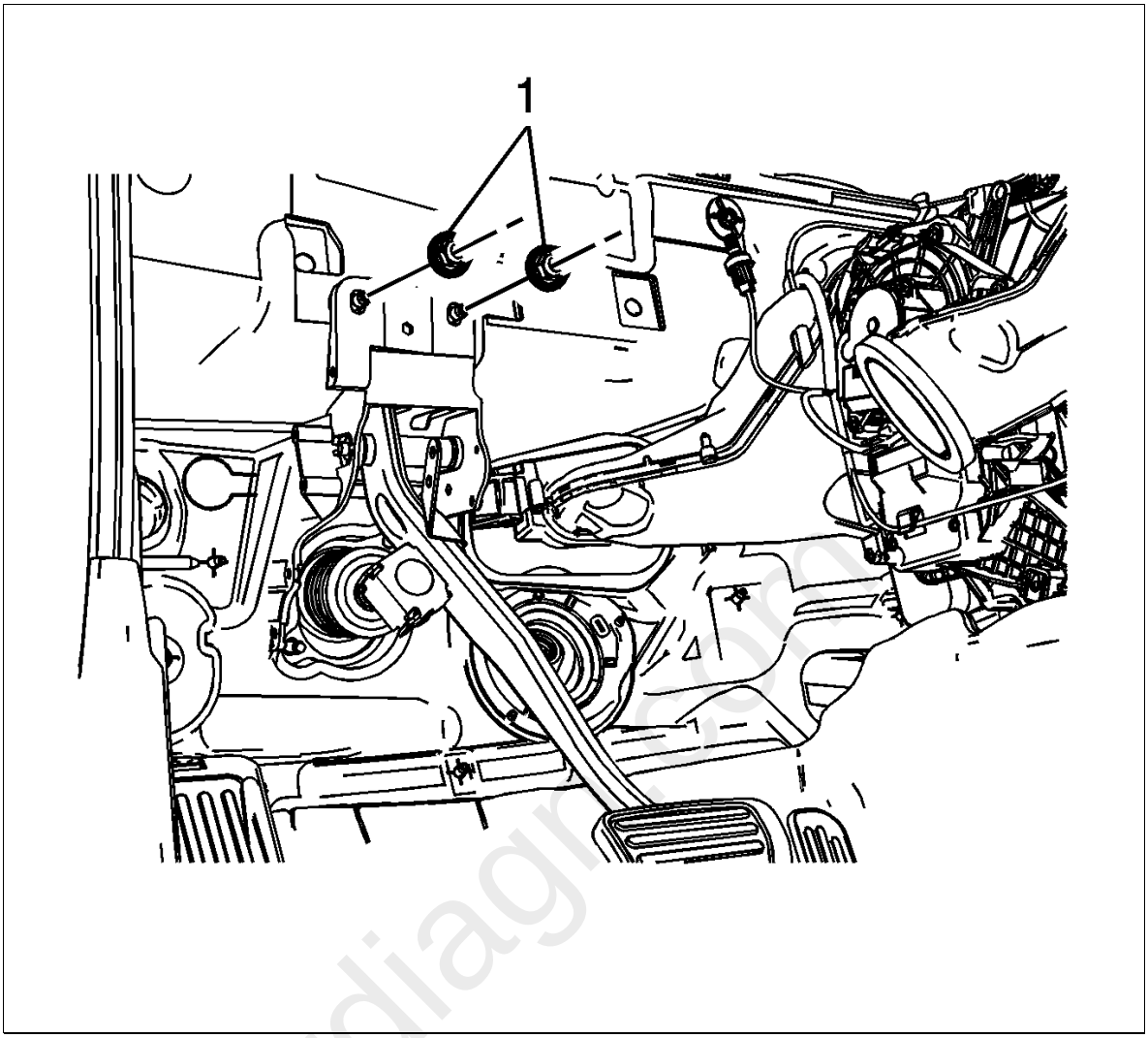
Courtesy of GENERAL MOTORS COMPANY

6. Remove the brake pedal assembly nuts (1).
7. Remove the brake pedal assembly.

REPAIR INSTRUCTIONS > BRAKE PEDAL ASSEMBLY REPLACEMENT (AUTOMATIC TRANSMISSION) > INSTALLATION PROCEDURE

1. Install the brake pedal assembly.

Fig 1: Brake Pedal Assembly Nuts



Courtesy of GENERAL MOTORS COMPANY

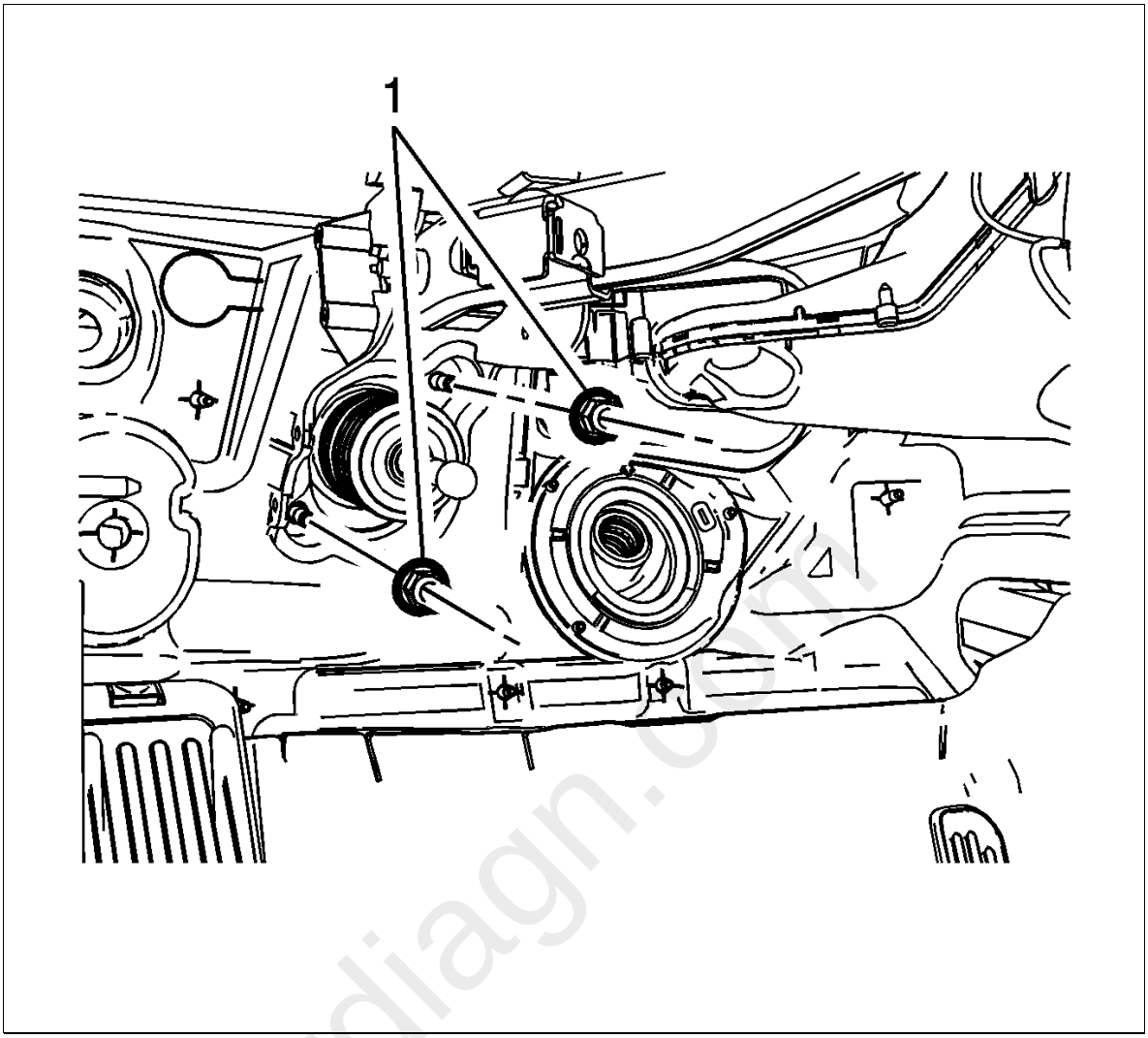
cardiagn.com

⚠ *CAUTION:*

Refer to Fastener Caution .

2. Install the brake pedal assembly nuts (1) and tighten to 25 N.m (18 lb ft).

Fig 2: Power Vacuum Brake Booster Nuts

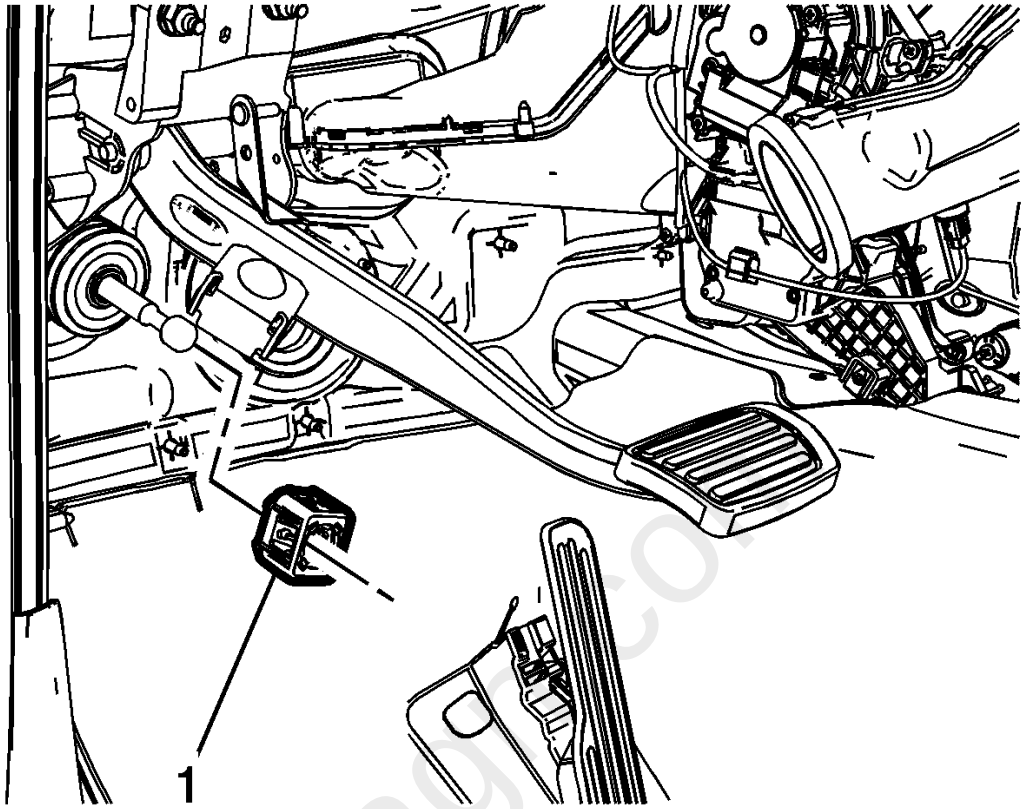


Courtesy of GENERAL MOTORS COMPANY

3. Install the power vacuum brake booster nuts (1) and tighten to 25 N.m (18 lb ft).

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Fig 3: Power Vacuum Brake Booster Pushrod Retainer



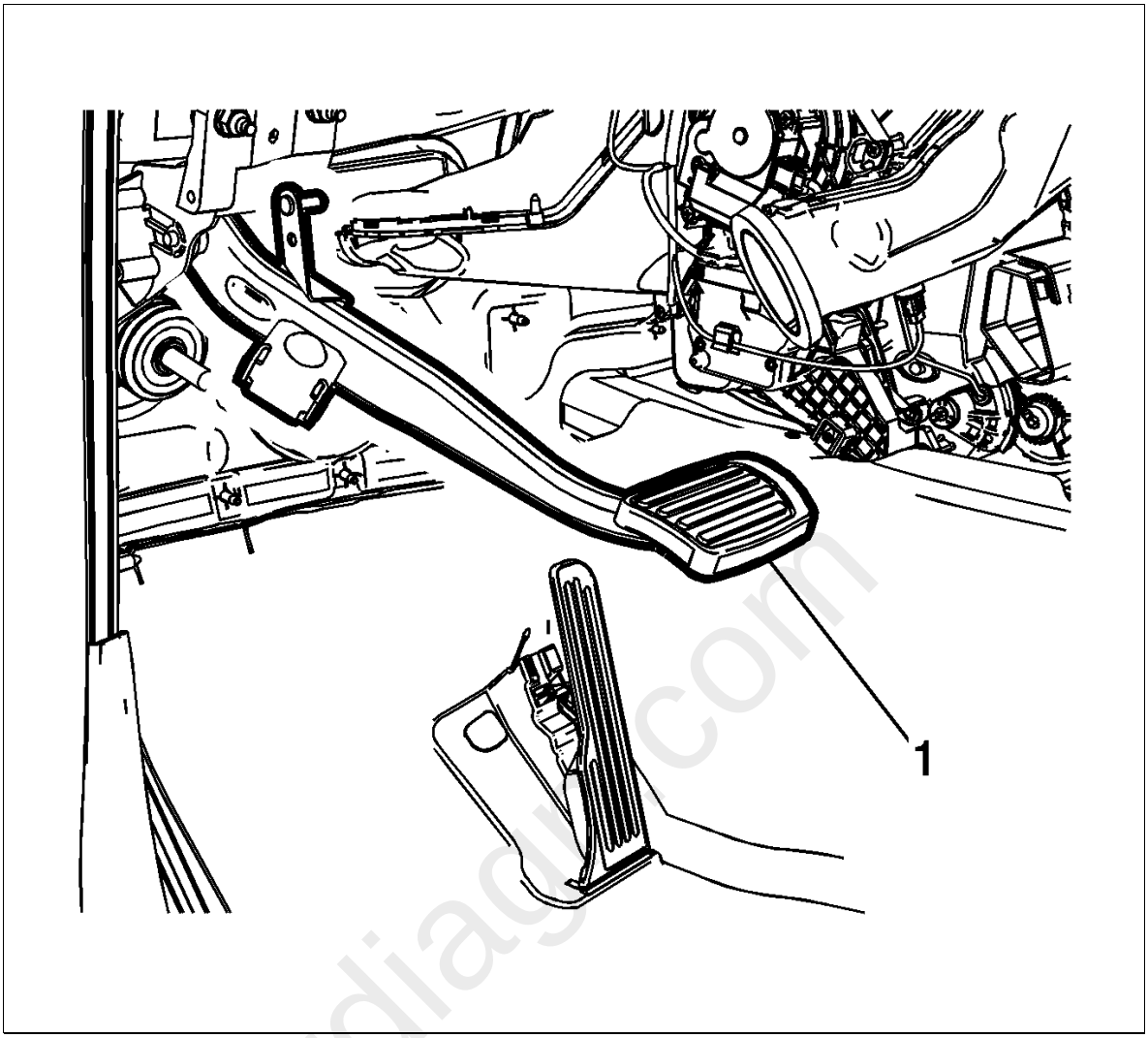
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Install a new power vacuum brake booster pushrod retainer.

4. Install a new power vacuum brake booster pushrod retainer (1) to the brake pedal.

Fig 4: Brake Pedal



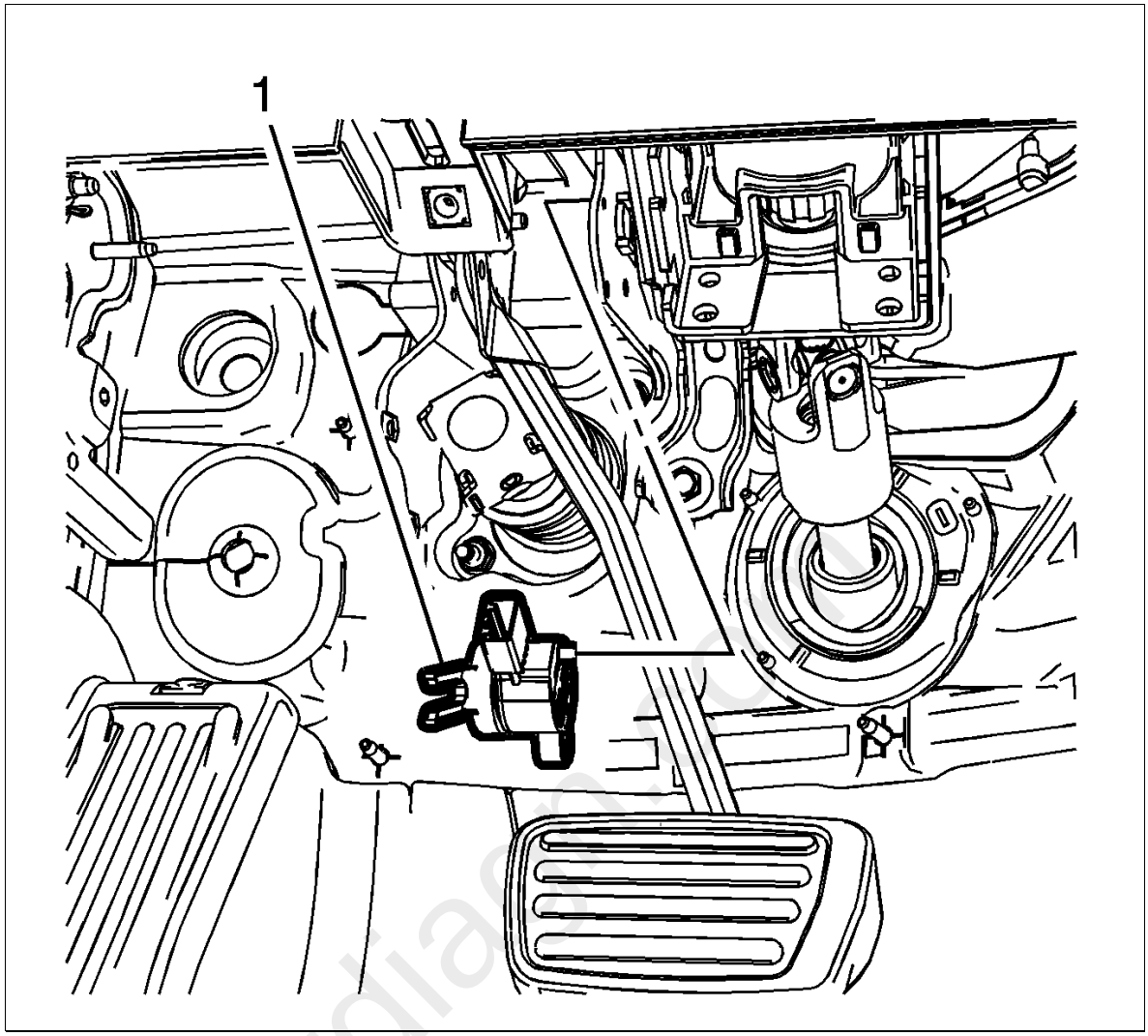
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Ensure the power vacuum brake booster pushrod retainer is fully seated in the brake pedal arm.

5. Install the brake pedal (1) to the power vacuum brake booster pushrod.

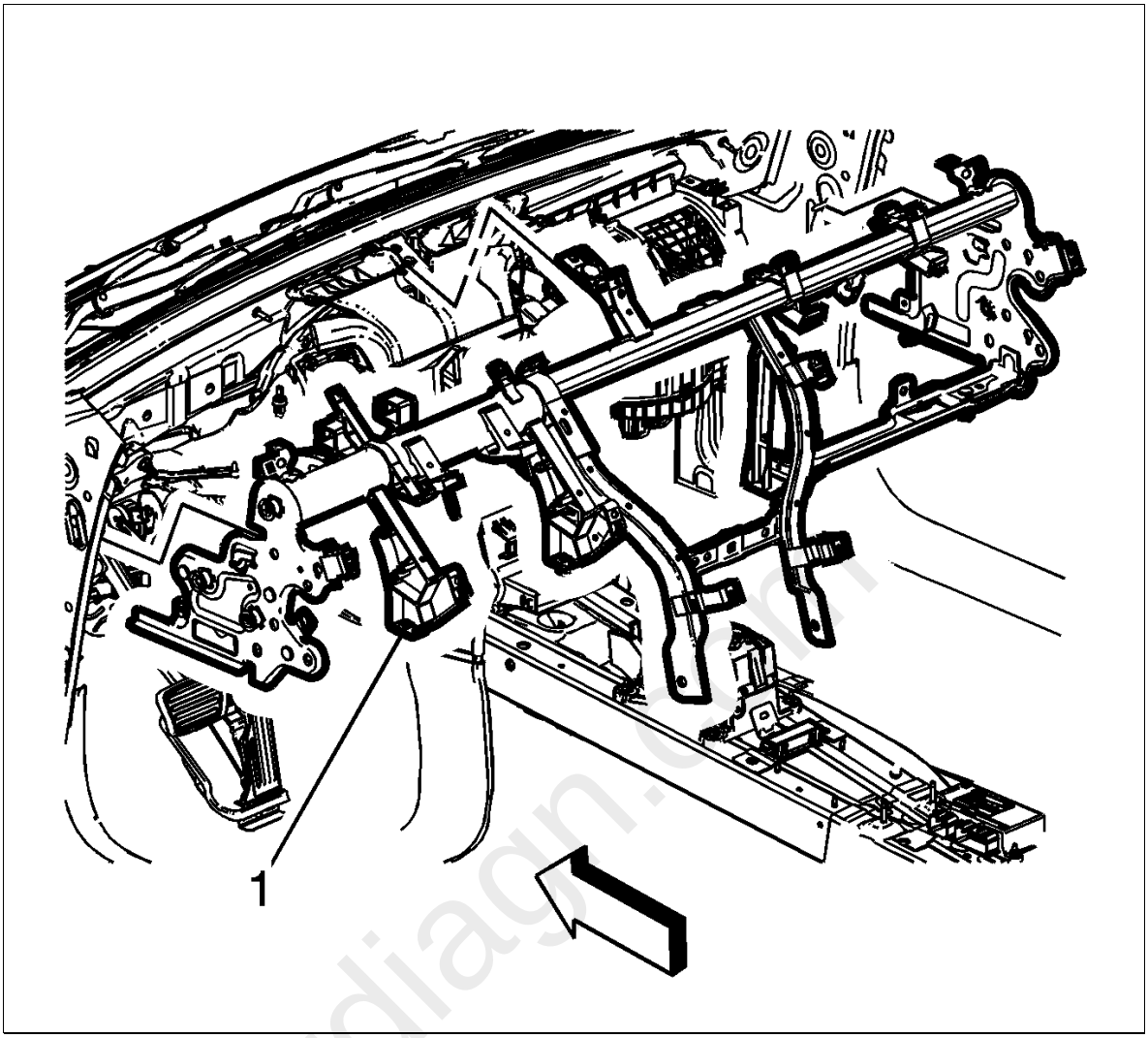
Fig 5: Brake Pedal Position Sensor



Courtesy of GENERAL MOTORS COMPANY

6. Install the brake pedal position sensor (1). Refer to Brake Pedal Position Sensor Replacement .

Fig 6: Instrument Panel Tie Bar

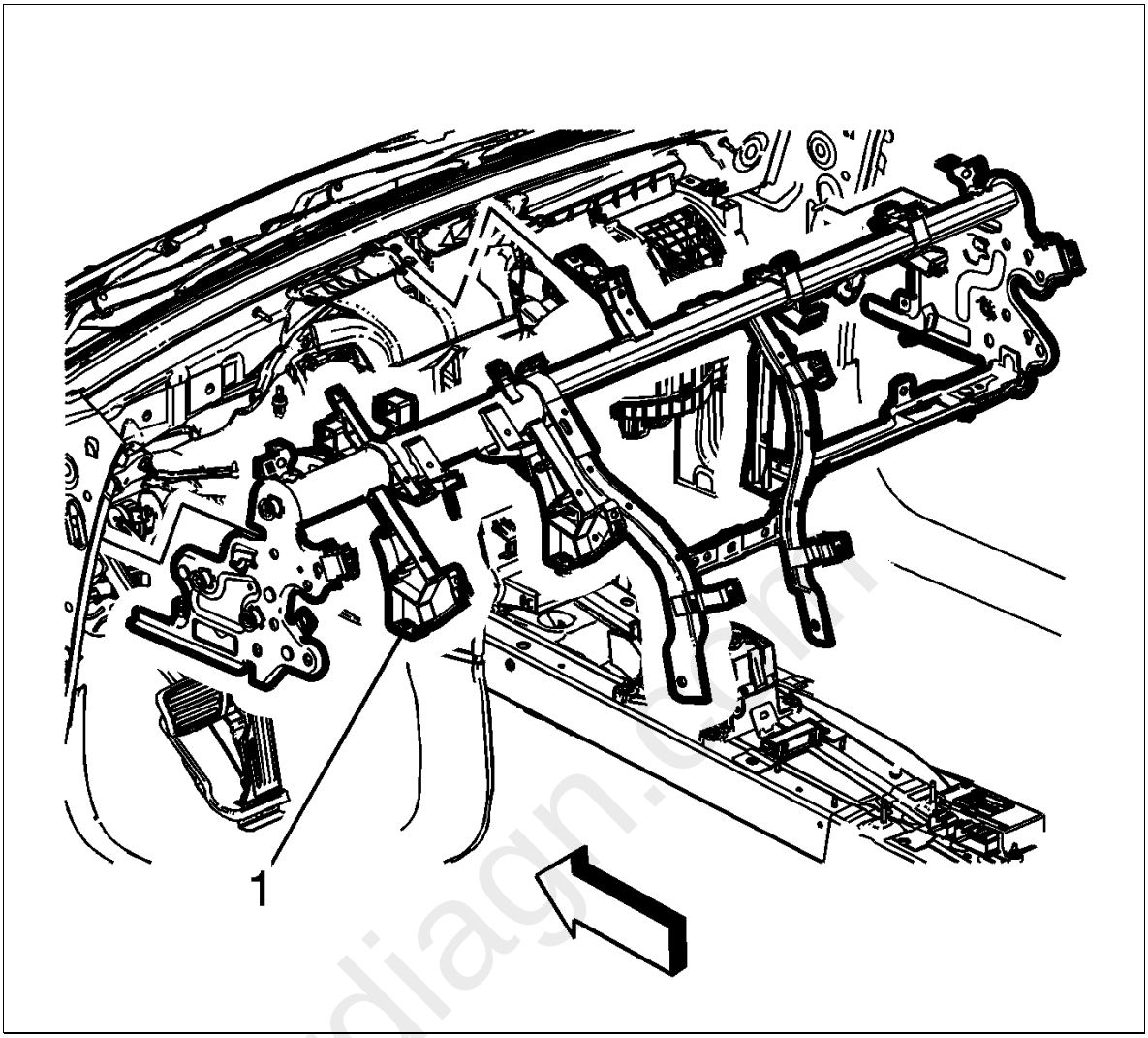


Courtesy of GENERAL MOTORS COMPANY

7. Install the instrument panel tie bar (1). Refer to Instrument Panel Tie Bar Replacement .

REPAIR INSTRUCTIONS > BRAKE PEDAL ASSEMBLY REPLACEMENT (MANUAL TRANSMISSION) > REMOVAL PROCEDURE

Fig 1: Instrument Panel Tie Bar

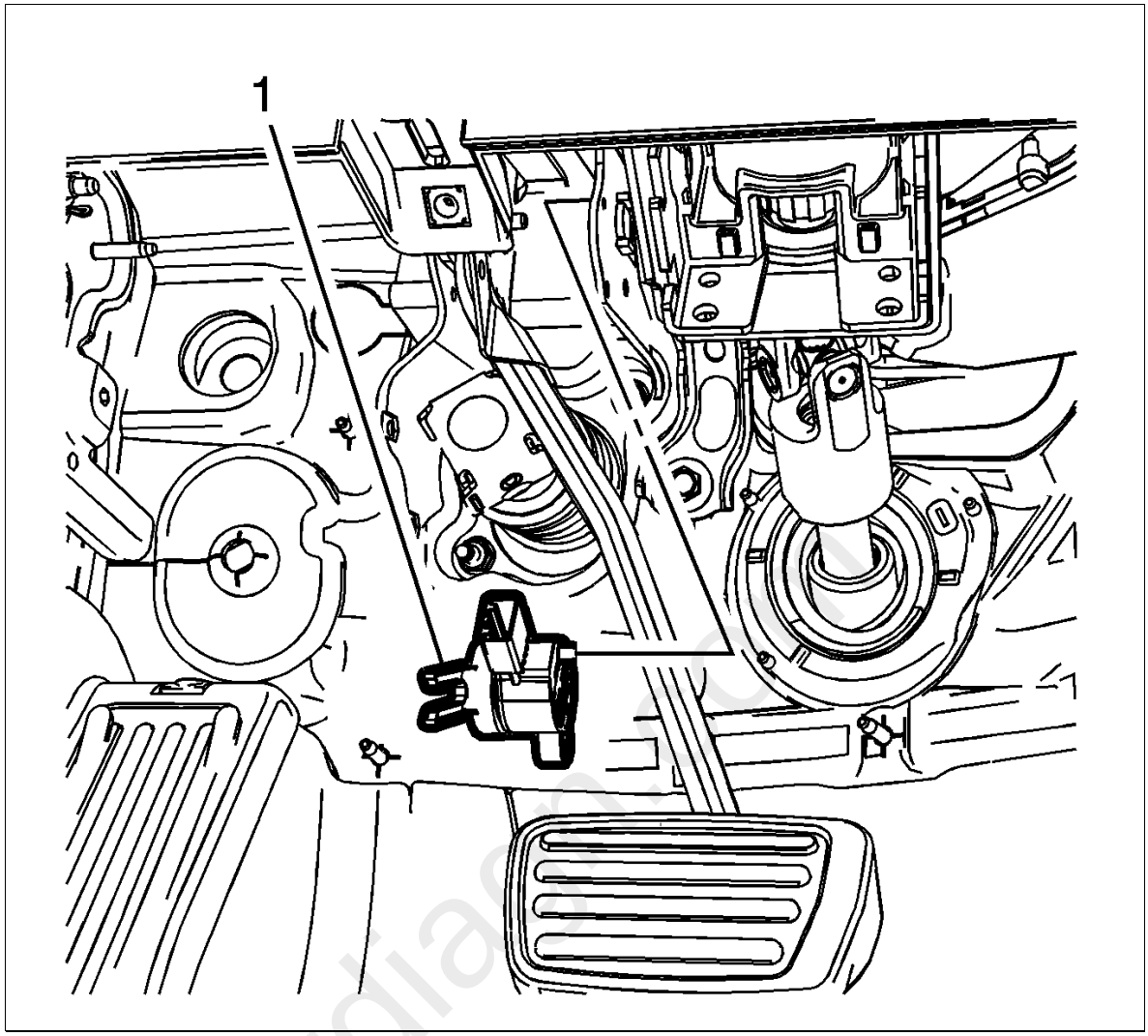


Courtesy of GENERAL MOTORS COMPANY

1. Remove the instrument panel tie bar (1). Refer to Instrument Panel Tie Bar Replacement .

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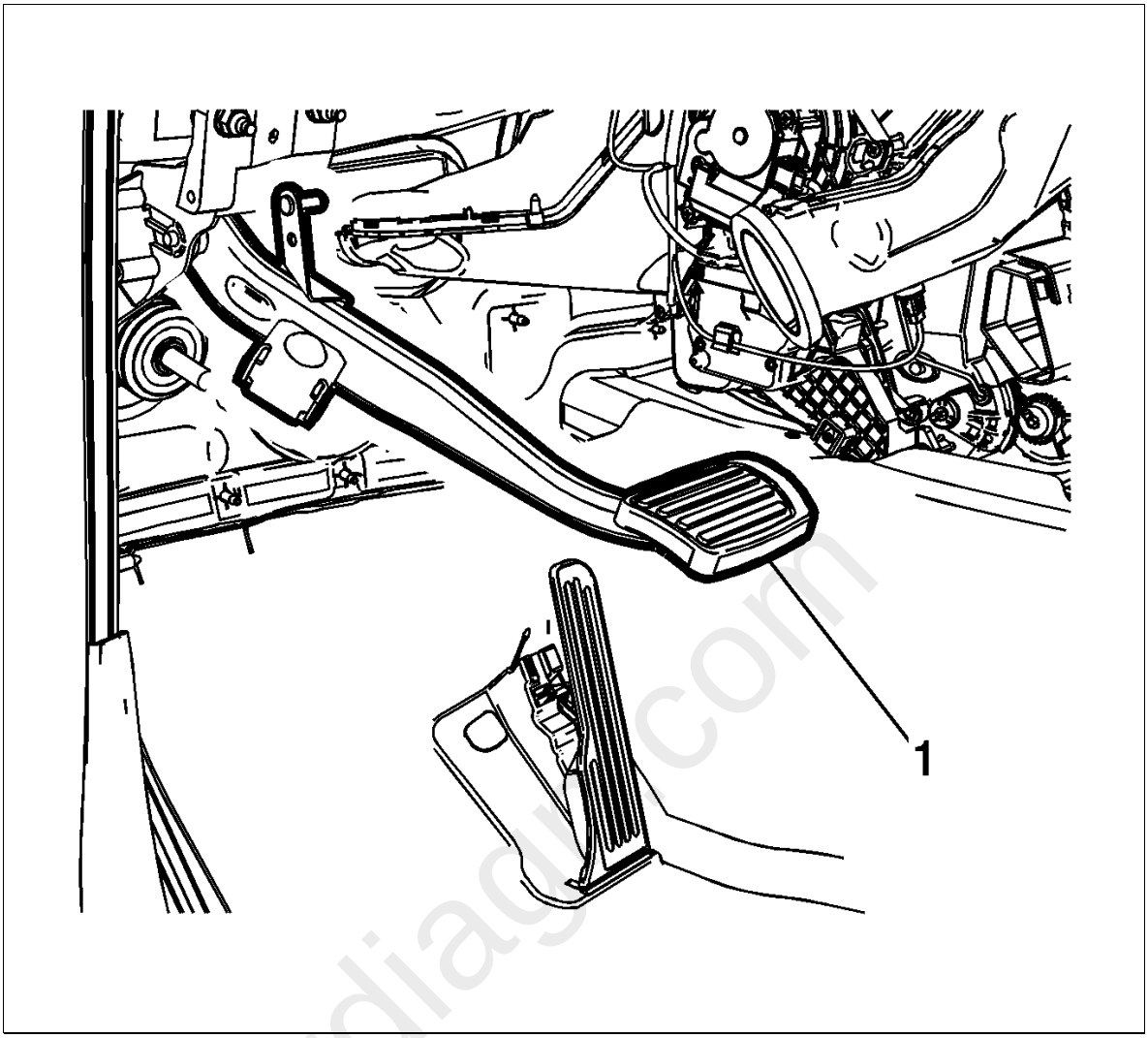
Fig 2: Brake Pedal Position Sensor



Courtesy of GENERAL MOTORS COMPANY

2. Remove the brake pedal position sensor (1). Refer to Brake Pedal Position Sensor Replacement .

Fig 3: Brake Pedal

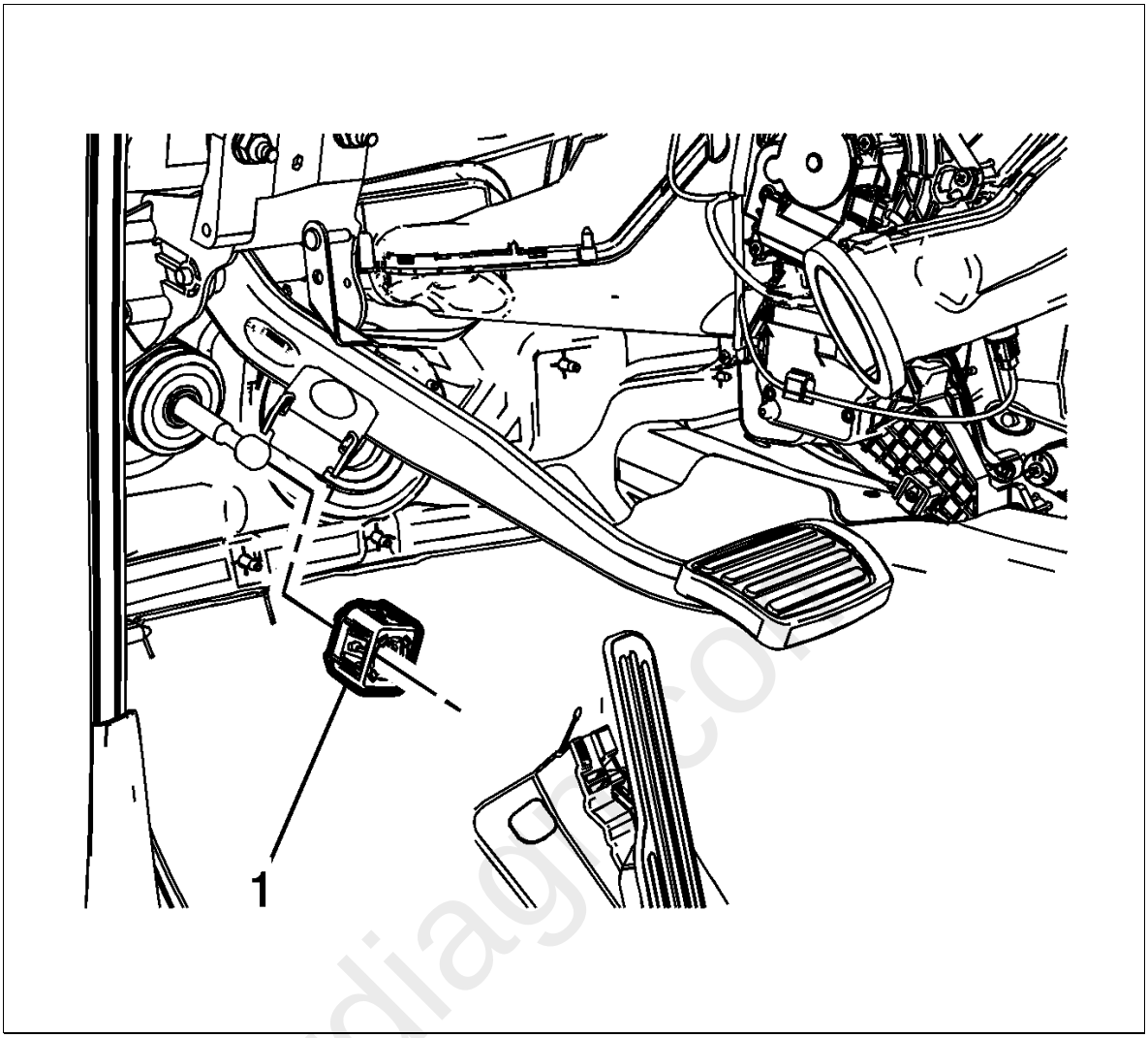


Courtesy of GENERAL MOTORS COMPANY

3. Pull the brake pedal (1) rearward to release the power vacuum brake booster pushrod retainer.

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Fig 4: Power Vacuum Brake Booster Pushrod Retainer



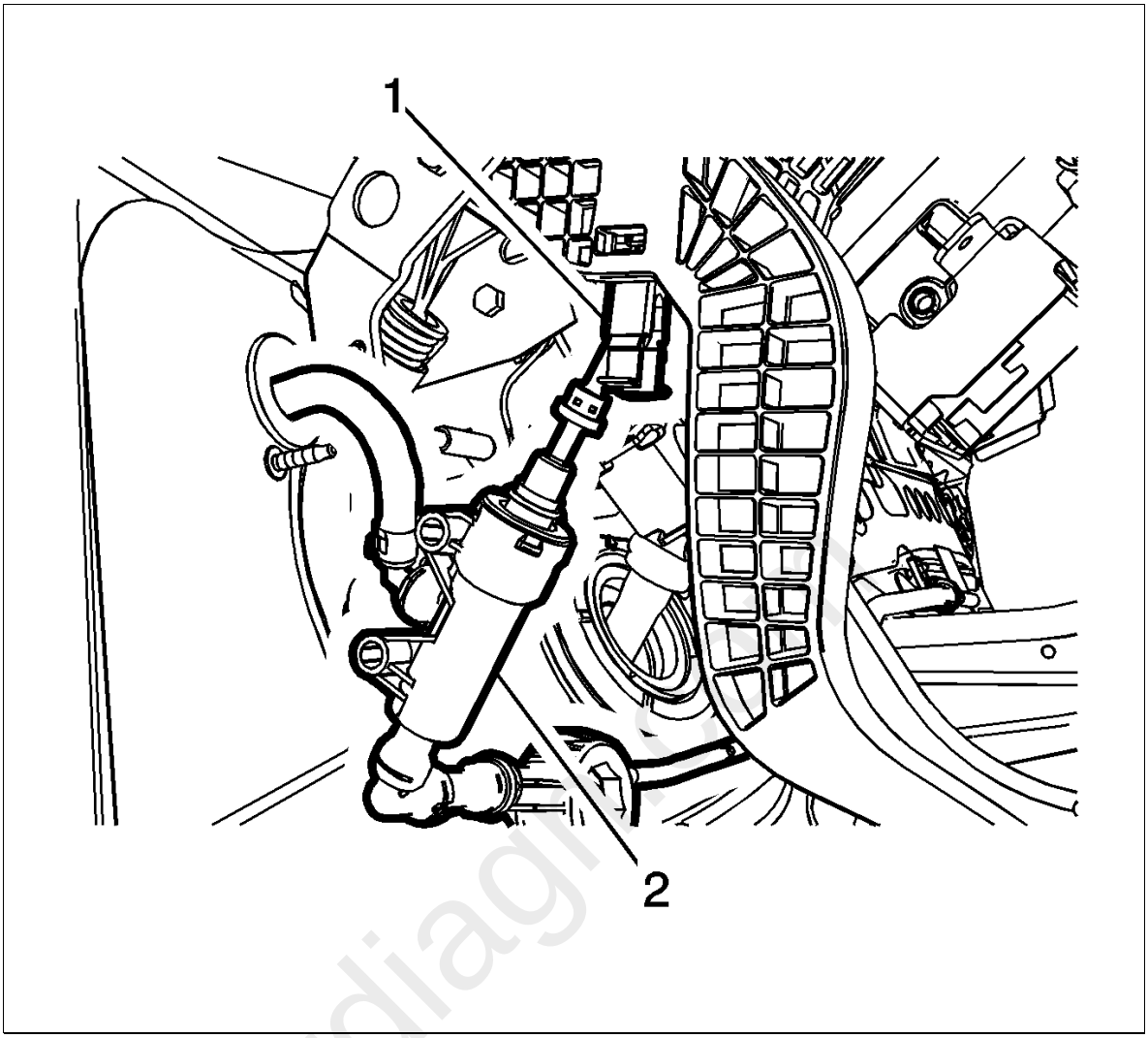
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not reuse the power vacuum brake booster pushrod retainer.

4. Remove and discard the power vacuum brake booster pushrod retainer (1).

Fig 5: Clutch Master Cylinder & Pedal Retainer



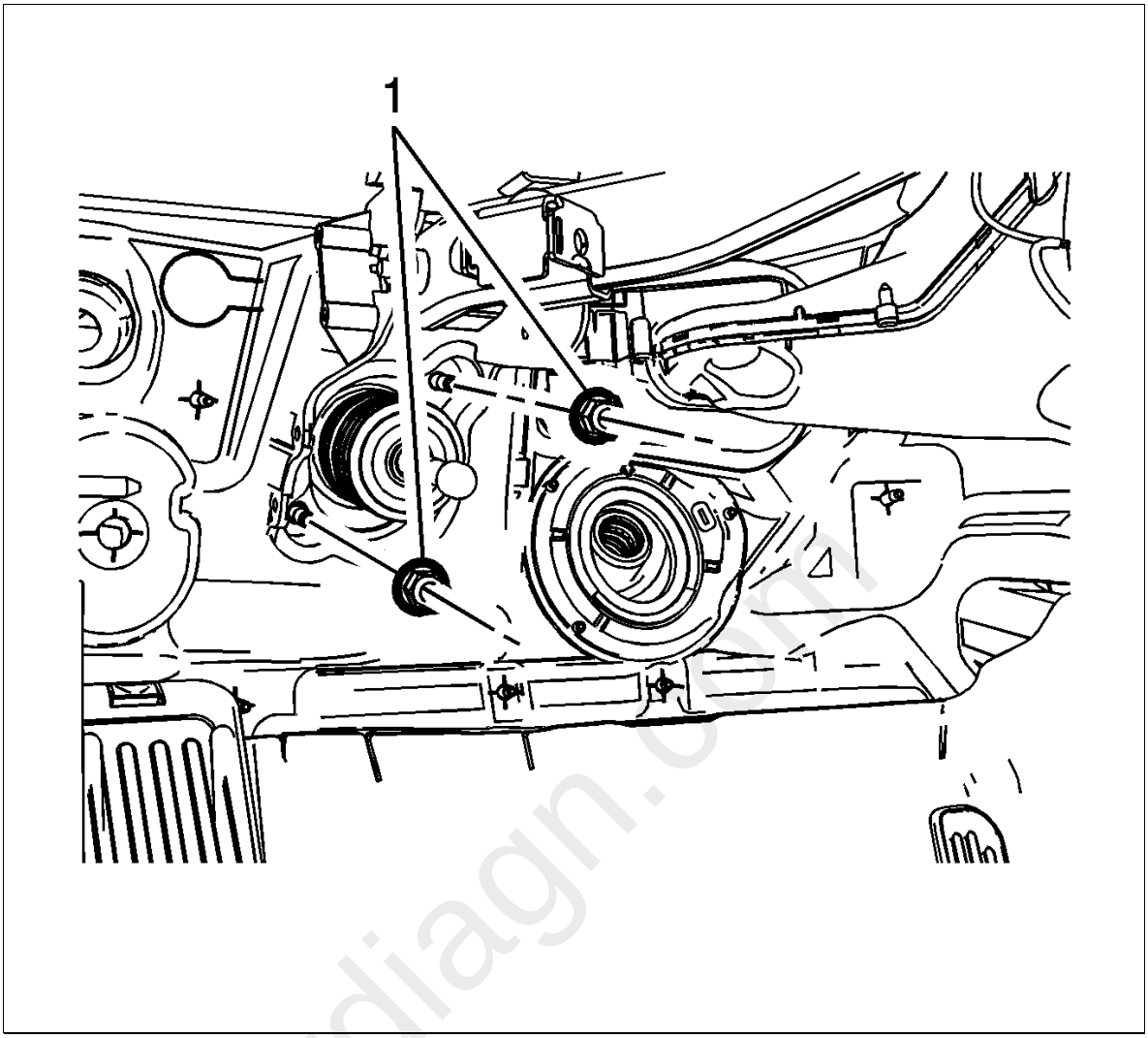
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Do not disconnect the clutch master cylinder hydraulic hose or pipe from the clutch master cylinder.

5. Disconnect the clutch master cylinder pushrod retainer (1), remove the nuts and position aside the clutch master cylinder (2). Refer to Clutch Pedal Replacement .

Fig 6: Power Vacuum Brake Booster Nuts

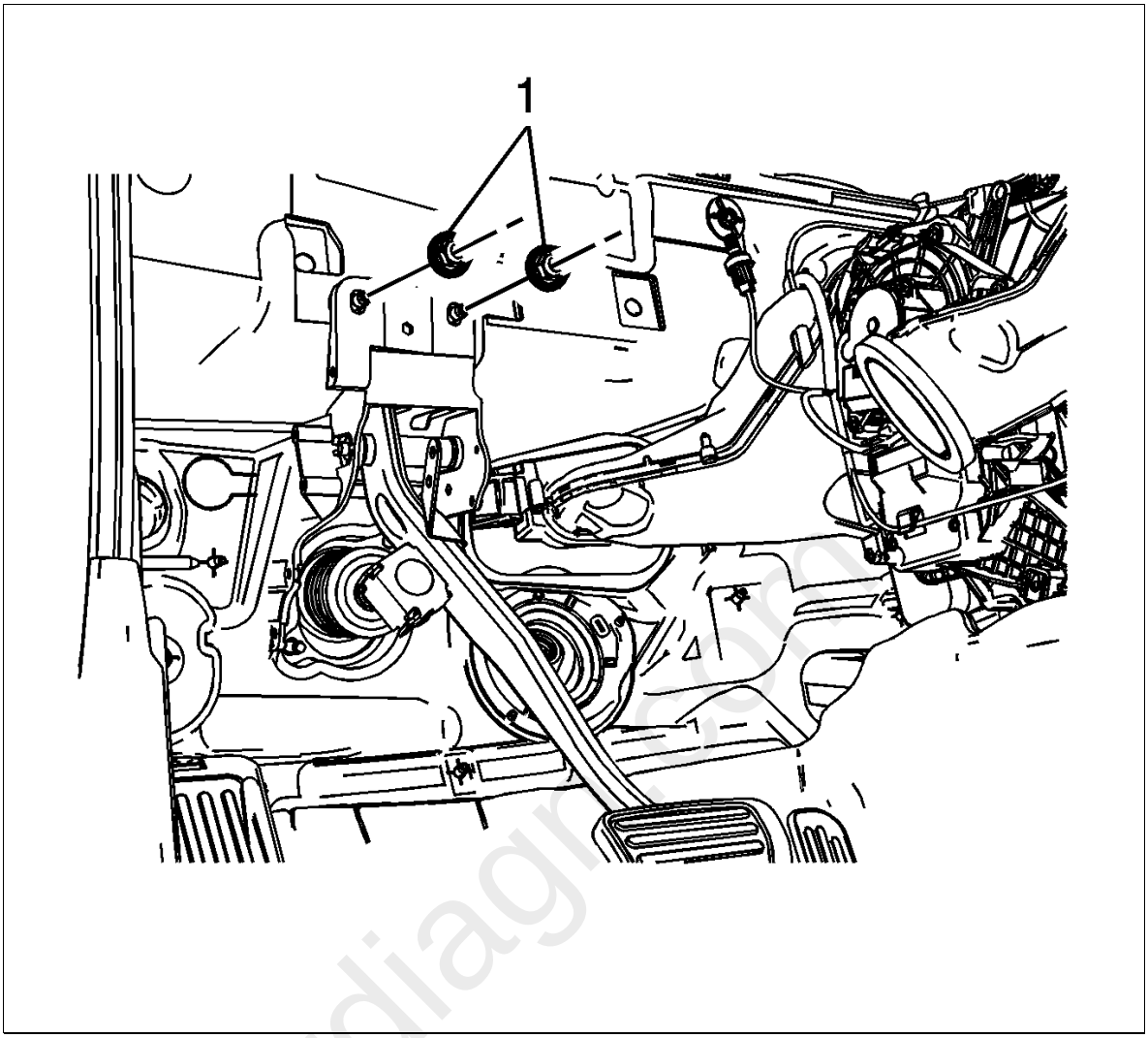


Courtesy of GENERAL MOTORS COMPANY

6. Remove the power vacuum brake booster nuts (1).

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Fig 7: Brake Pedal Assembly Nuts



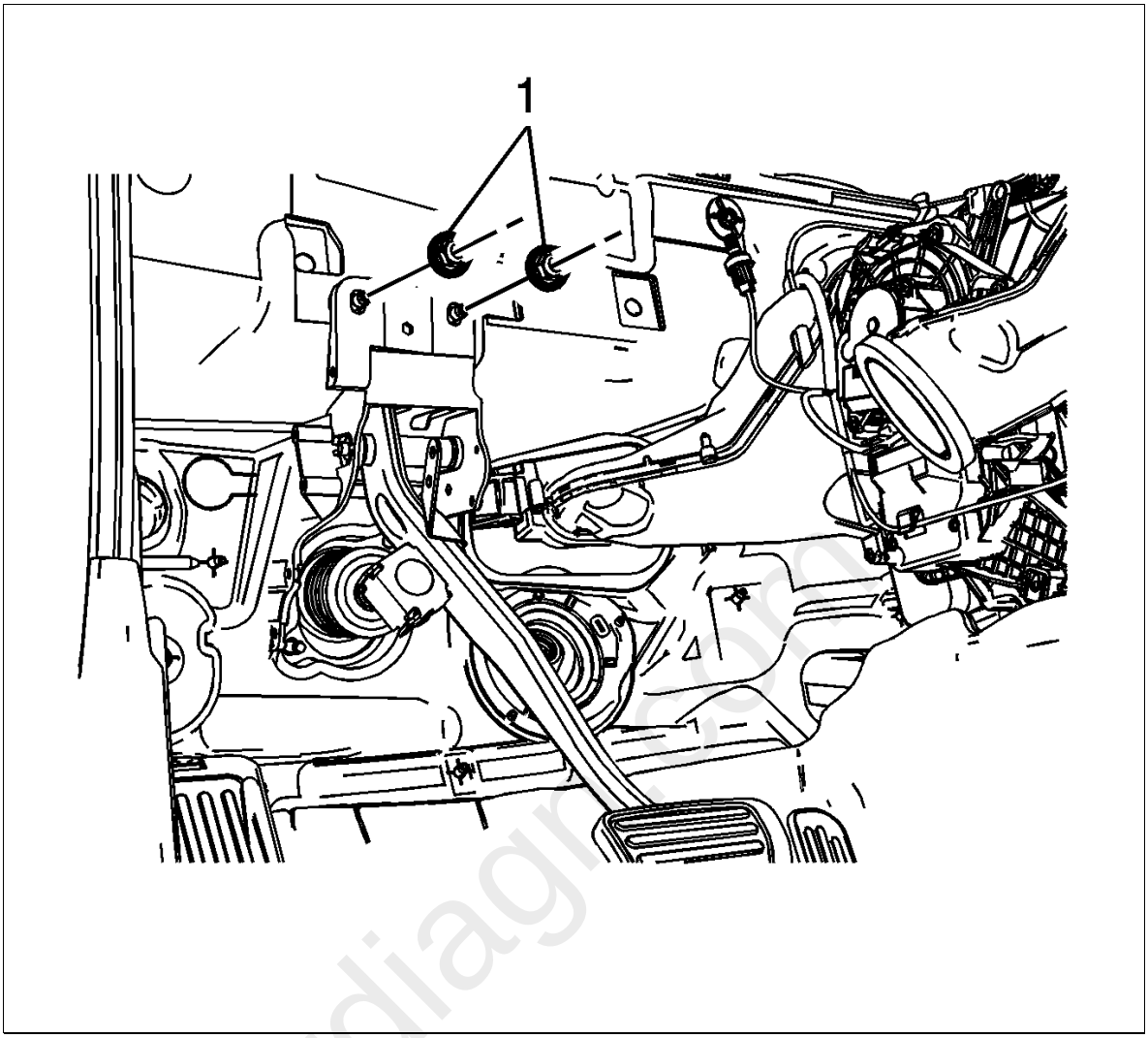
Courtesy of GENERAL MOTORS COMPANY

7. Remove the brake pedal assembly nuts (1).
8. Remove the brake pedal assembly.

REPAIR INSTRUCTIONS > BRAKE PEDAL ASSEMBLY REPLACEMENT (MANUAL TRANSMISSION) > INSTALLATION PROCEDURE

1. Install the brake pedal assembly.

Fig 1: Brake Pedal Assembly Nuts



Courtesy of GENERAL MOTORS COMPANY

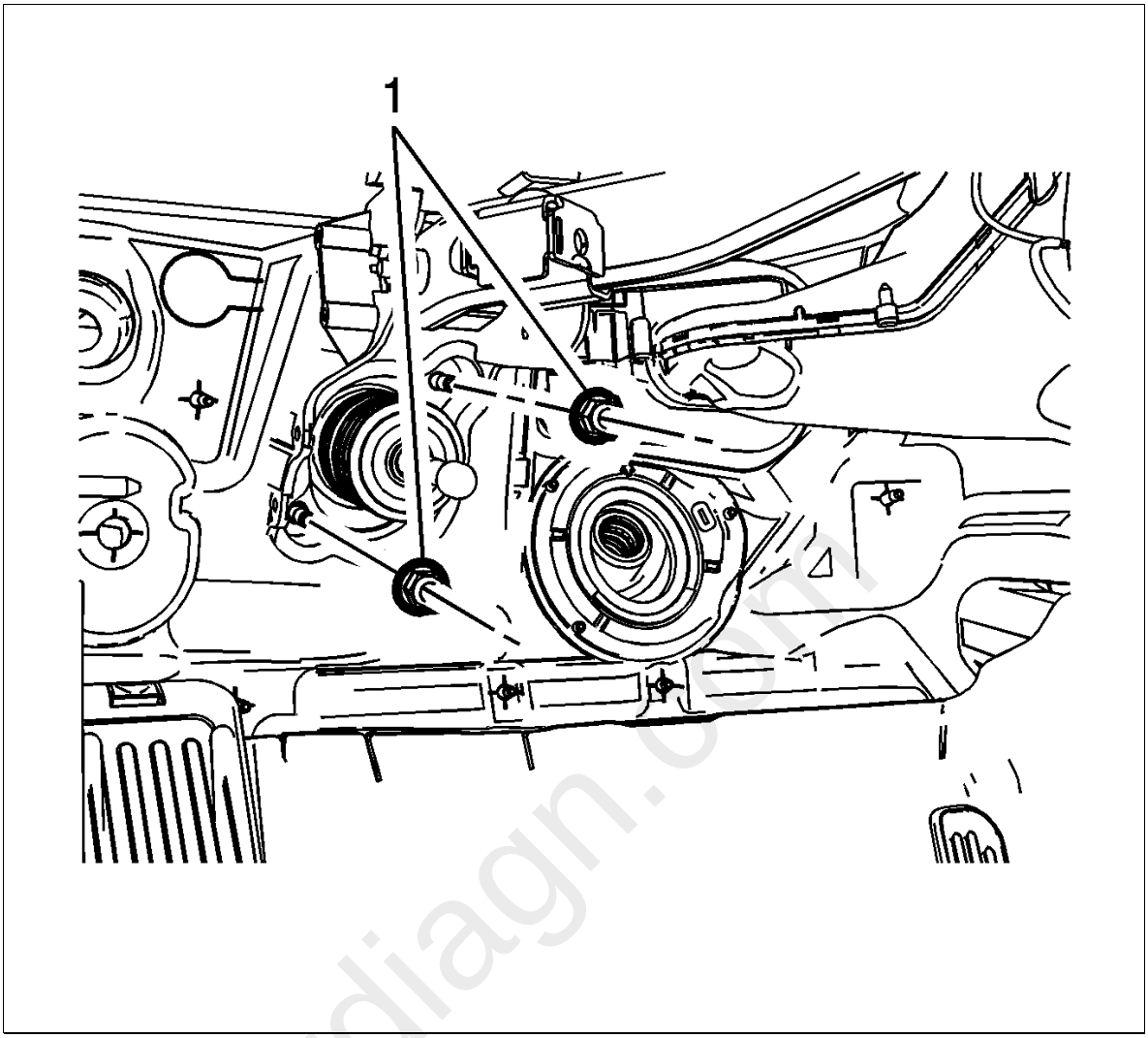
cardiagn.com

⚠ *CAUTION:*

Refer to Fastener Caution .

2. Install the brake pedal assembly nuts (1) and tighten to 25 N.m (18 lb ft).

Fig 2: Power Vacuum Brake Booster Nuts

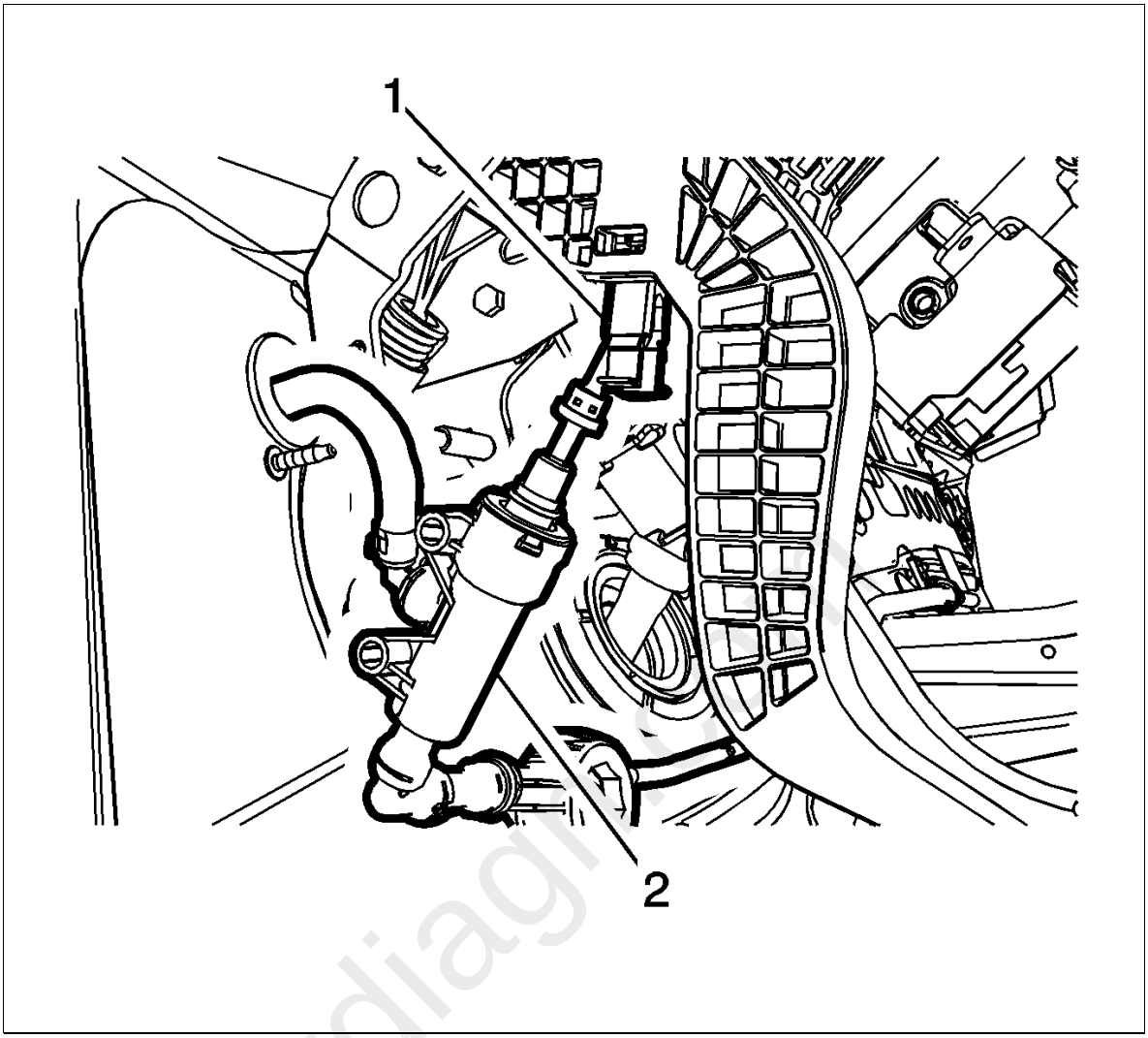


Courtesy of GENERAL MOTORS COMPANY

3. Install the power vacuum brake booster nuts (1) and tighten to 25 N.m (18 lb ft).

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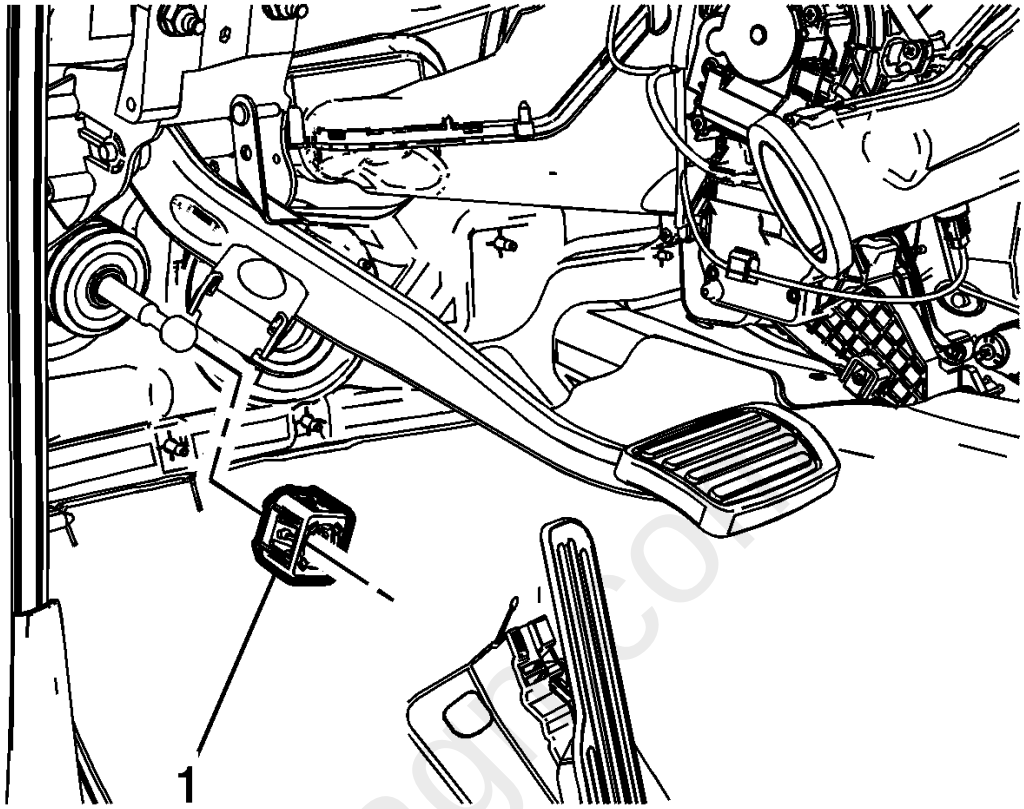
Fig 3: Clutch Master Cylinder & Pedal Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Connect the clutch master cylinder pushrod retainer (1) and install the clutch master cylinder (2). Refer to Clutch Pedal Replacement .

Fig 4: Power Vacuum Brake Booster Pushrod Retainer



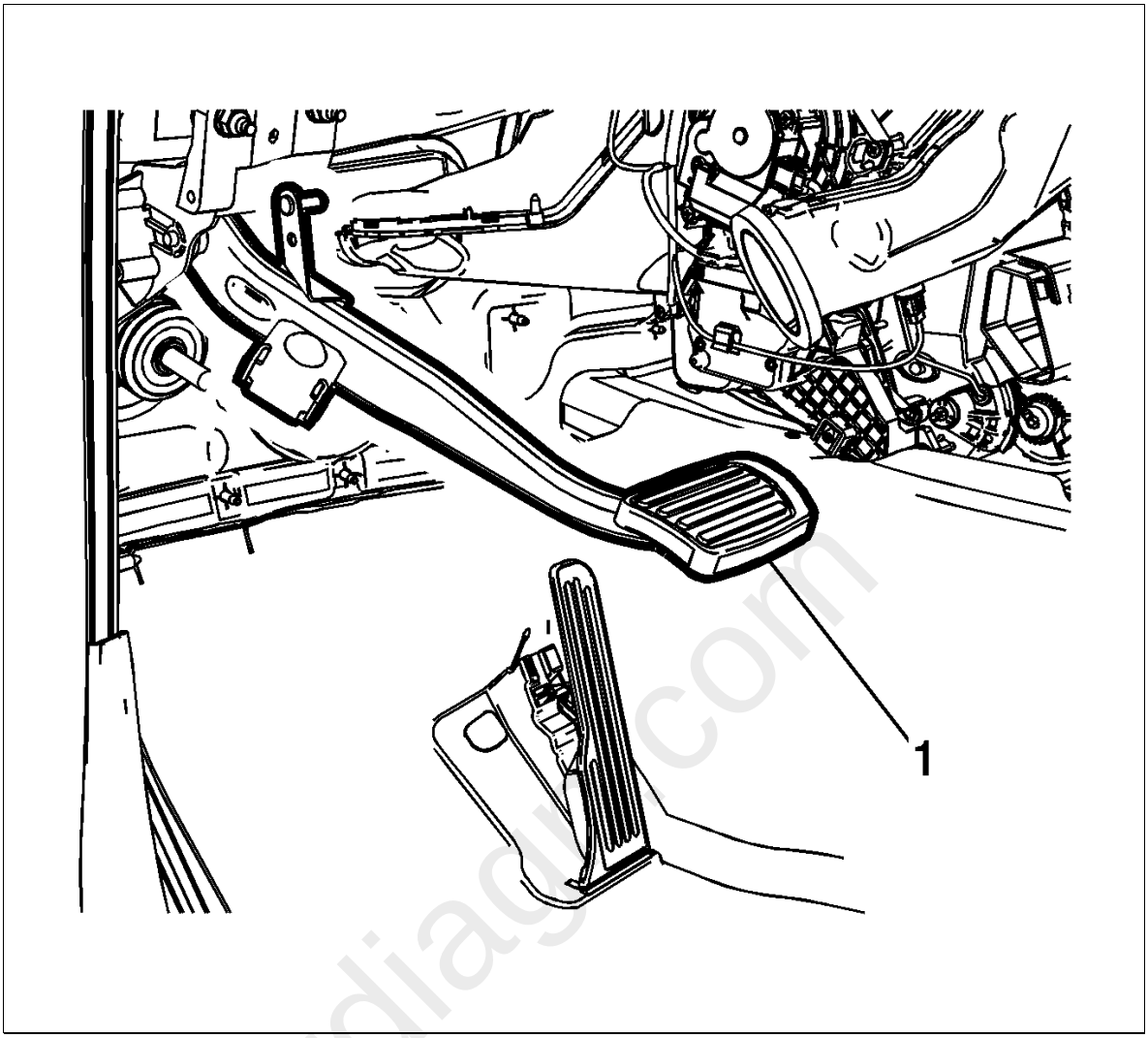
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Install a new power vacuum brake booster pushrod retainer.

5. Install a new power vacuum brake booster pushrod retainer (1) to the brake pedal.

Fig 5: Brake Pedal



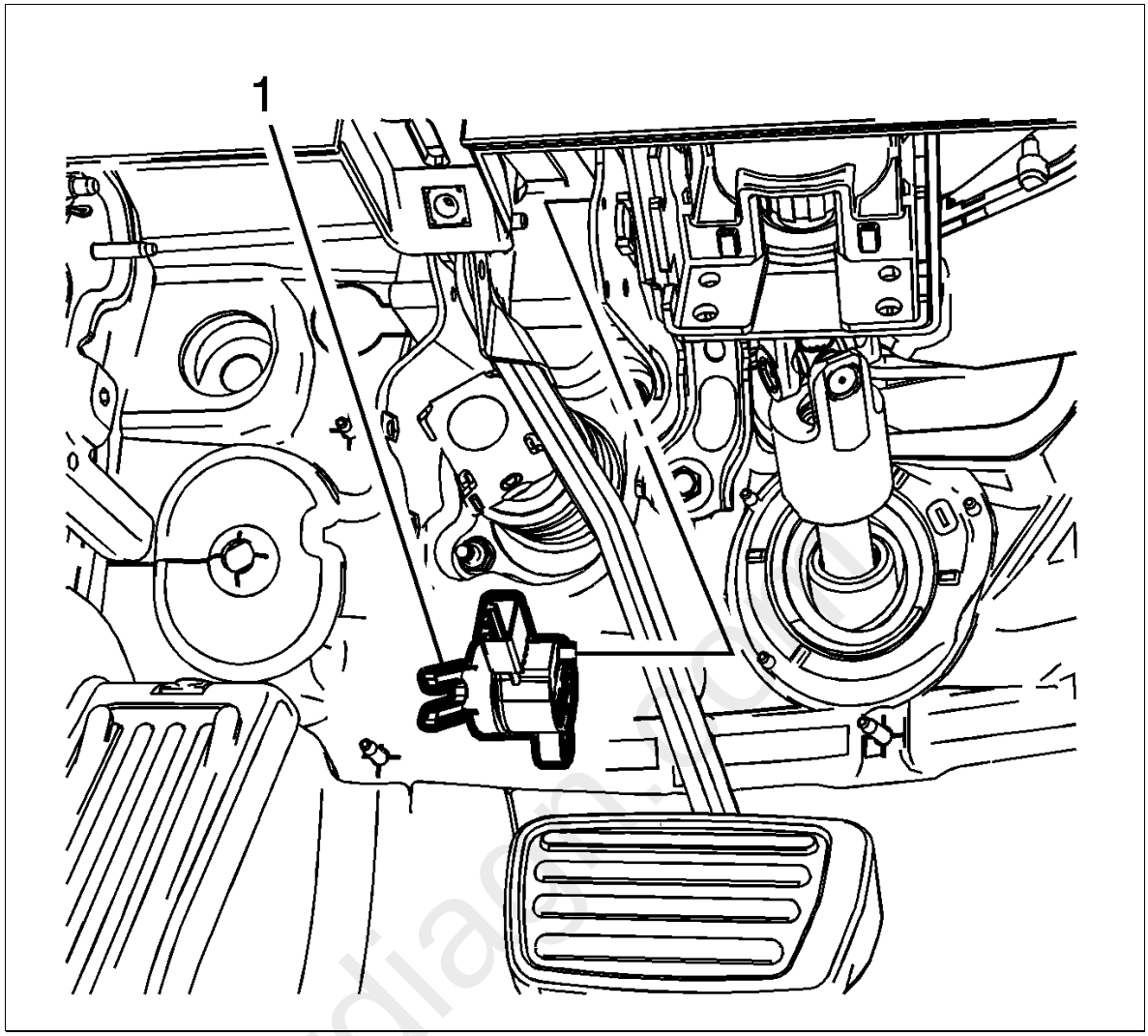
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Ensure the power vacuum brake booster pushrod retainer is fully seated in the brake pedal arm.

6. Install the brake pedal (1) to the power vacuum brake booster pushrod.

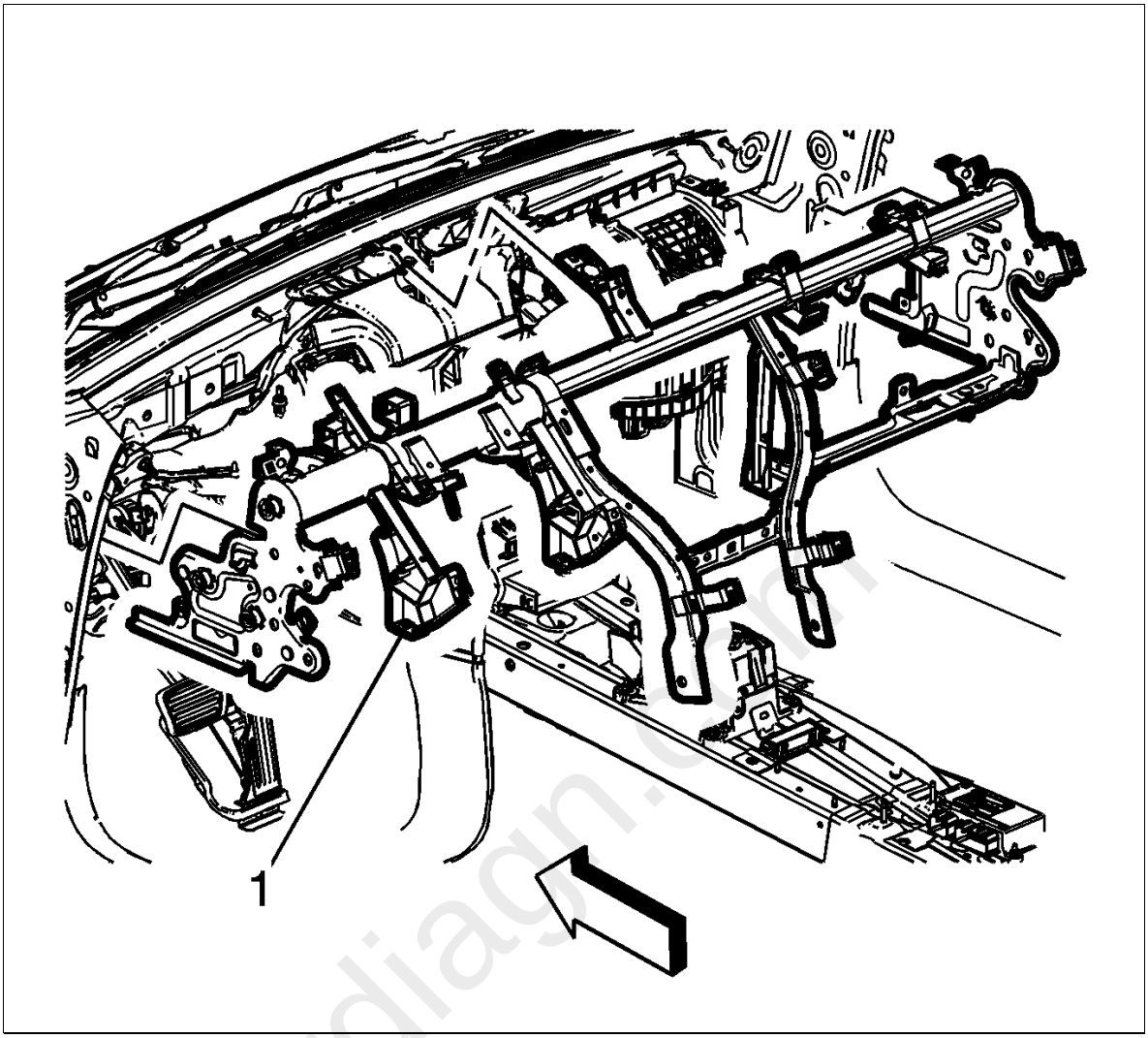
Fig 6: Brake Pedal Position Sensor



Courtesy of GENERAL MOTORS COMPANY

7. Install the brake pedal position sensor (1). Refer to Brake Pedal Position Sensor Replacement .

Fig 7: Instrument Panel Tie Bar



Courtesy of GENERAL MOTORS COMPANY

8. Install the instrument panel tie bar (1). Refer to Instrument Panel Tie Bar Replacement .

REPAIR INSTRUCTIONS > BRAKE PRESSURE MODULATOR VALVE PIPE REPLACEMENT (LT1 - PRIMARY) > REMOVAL PROCEDURE

WARNING:

Refer to Brake Fluid Irritant Warning .

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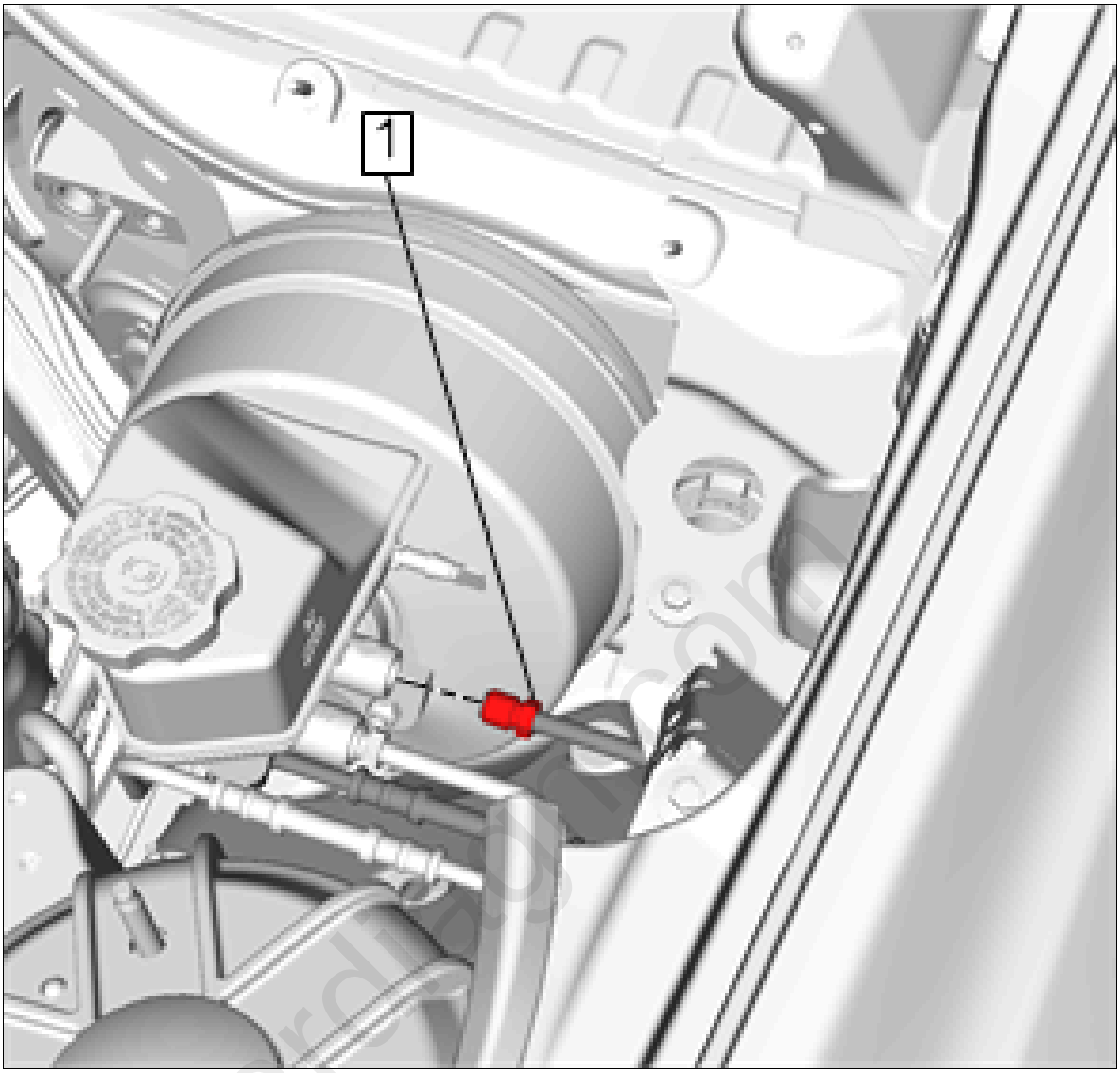
CAUTION:

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

1. Remove Plenum Front Panel Replacement .
2. Remove Front End Sheet Metal Diagonal Brace - Left Side - Front End Sheet Metal Diagonal Brace Replacement - Left Side
3. Disconnect Air Conditioning Evaporator Hose Assembly at Thermal Expansion Valve - Air Conditioning Evaporator Hose Assembly Replacement (LT1)
4. Disconnect Heater Inlet Hose at Heater Core - Heater Inlet Hose Replacement (LT1)
5. Disconnect Heater Outlet Hose at Heater Core - Heater Outlet Hose Replacement (LT1)
6. Separate Upper Intermediate Steering Shaft at Mid Intermediate Steering Shaft - Upper Intermediate Steering Shaft Replacement (Without Rolloboot, On/After VIN 1G1FB1RSXG0140963)Upper Intermediate Steering Shaft Replacement (With Rolloboot, Before VIN 1G1FB1RSXG0140963)
7. Using a suitable tool, remove and properly dispose of the brake fluid from the master cylinder reservoir.

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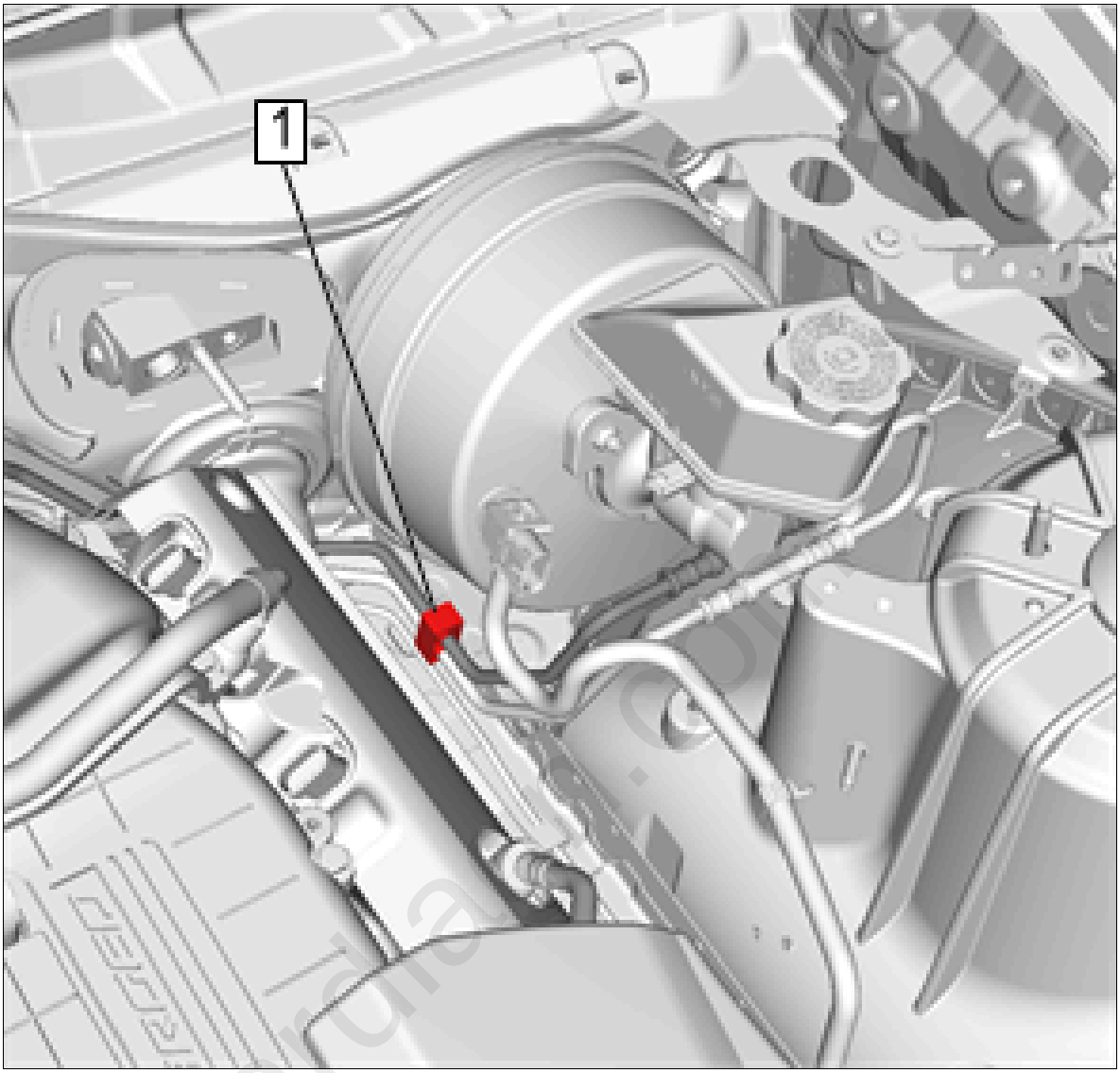
Fig 1: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

8. Disconnect Brake Pipe Fitting (1).
9. Plug the master cylinder outlet port to prevent brake fluid loss and contamination.

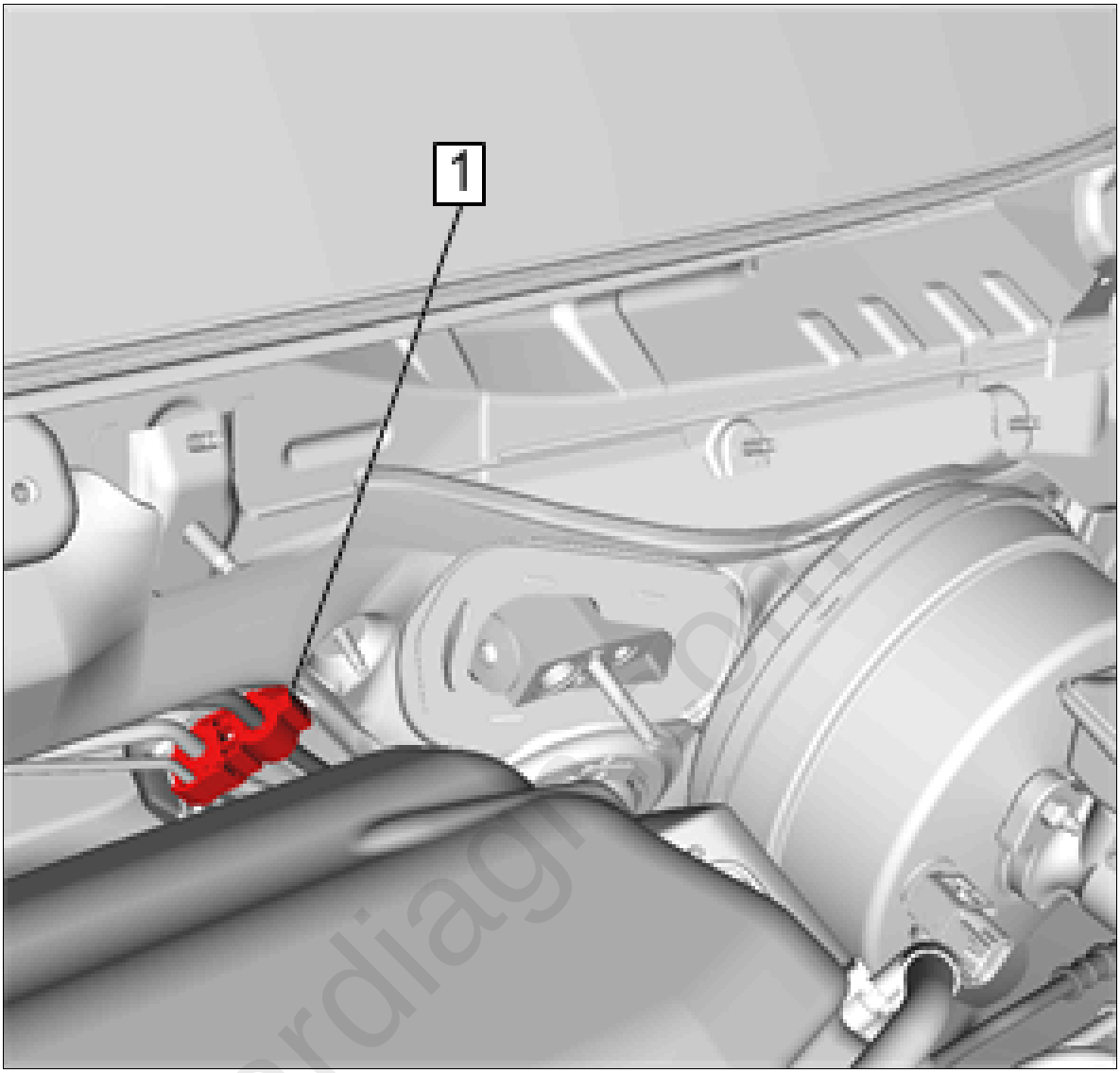
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

10. Release Retainer (1).

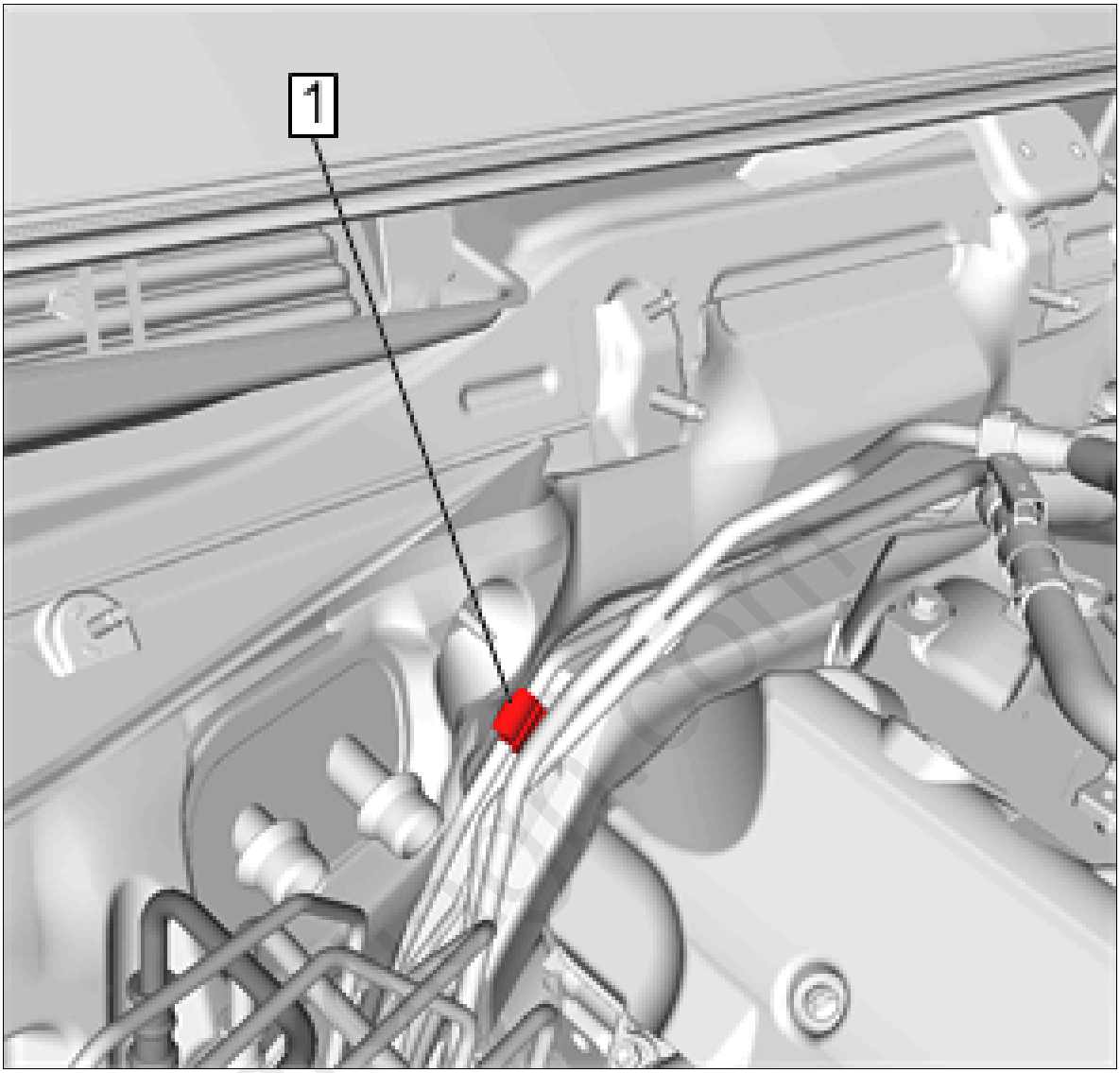
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

11. Release Retainer (1).

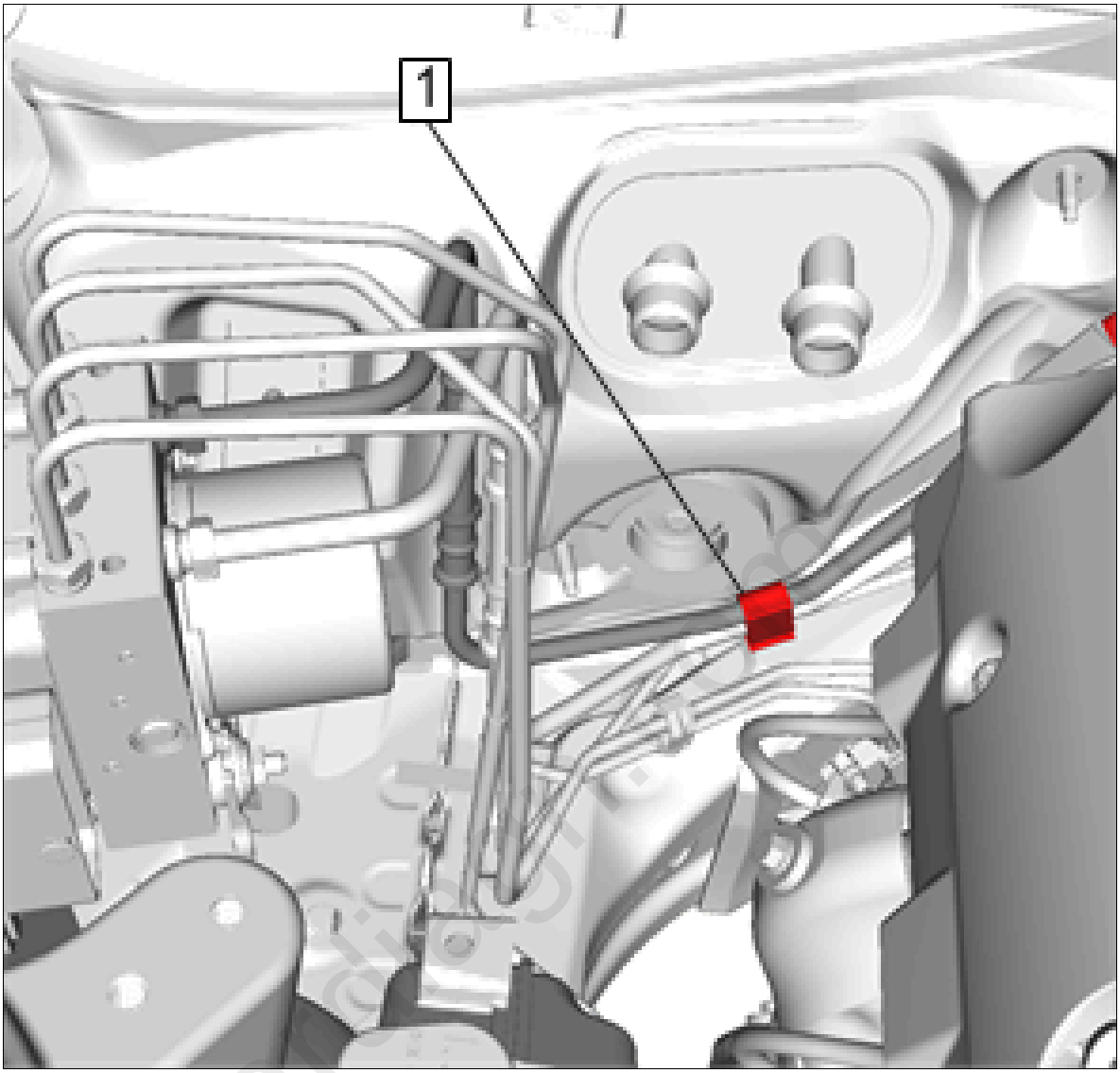
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

12. Release Retainer (1).

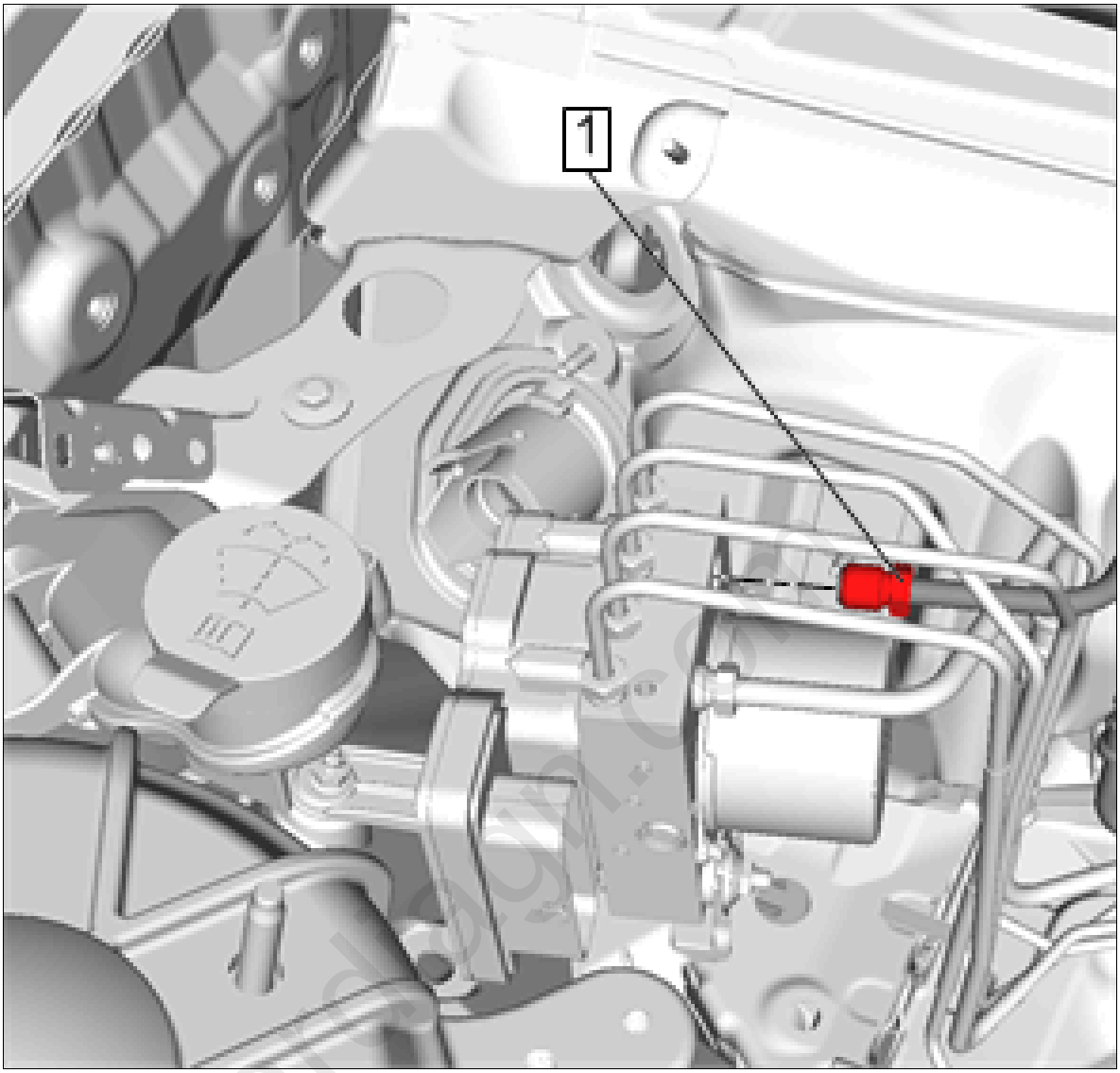
Fig 5: Retainer



Courtesy of GENERAL MOTORS COMPANY

13. Release Retainer (1).

Fig 6: Brake Pipe Fitting



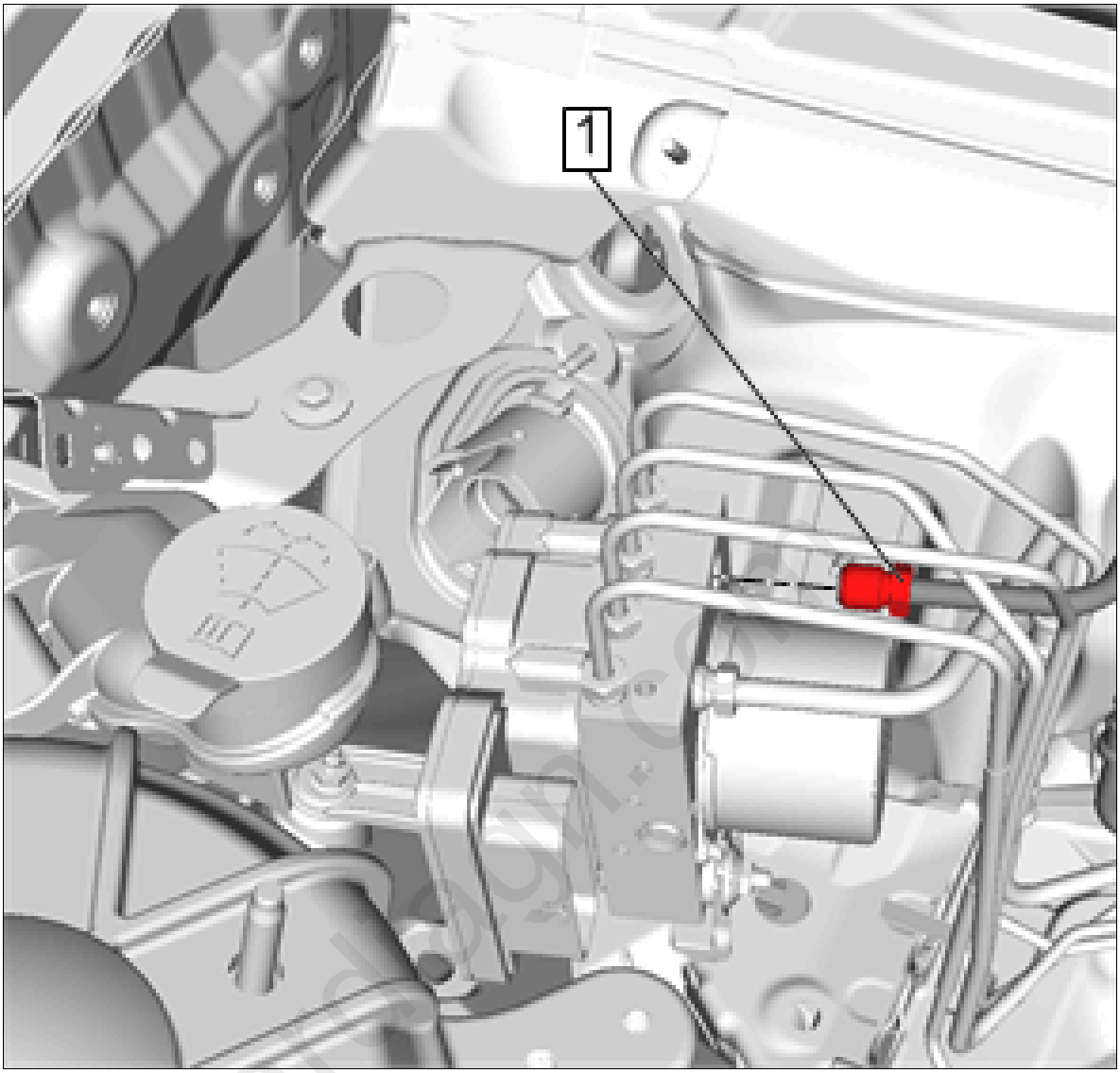
Courtesy of GENERAL MOTORS COMPANY

14. Disconnect Brake Pipe Fitting (1).
15. Plug the brake pressure modulator valve (BPMV) inlet port to prevent brake fluid loss and contamination.
16. Remove the BPMV primary brake pipe.

REPAIR INSTRUCTIONS > BRAKE PRESSURE MODULATOR VALVE PIPE REPLACEMENT (LT1 - PRIMARY) > INSTALLATION PROCEDURE

1. Install the BPMV primary brake pipe.

Fig 1: Brake Pipe Fitting

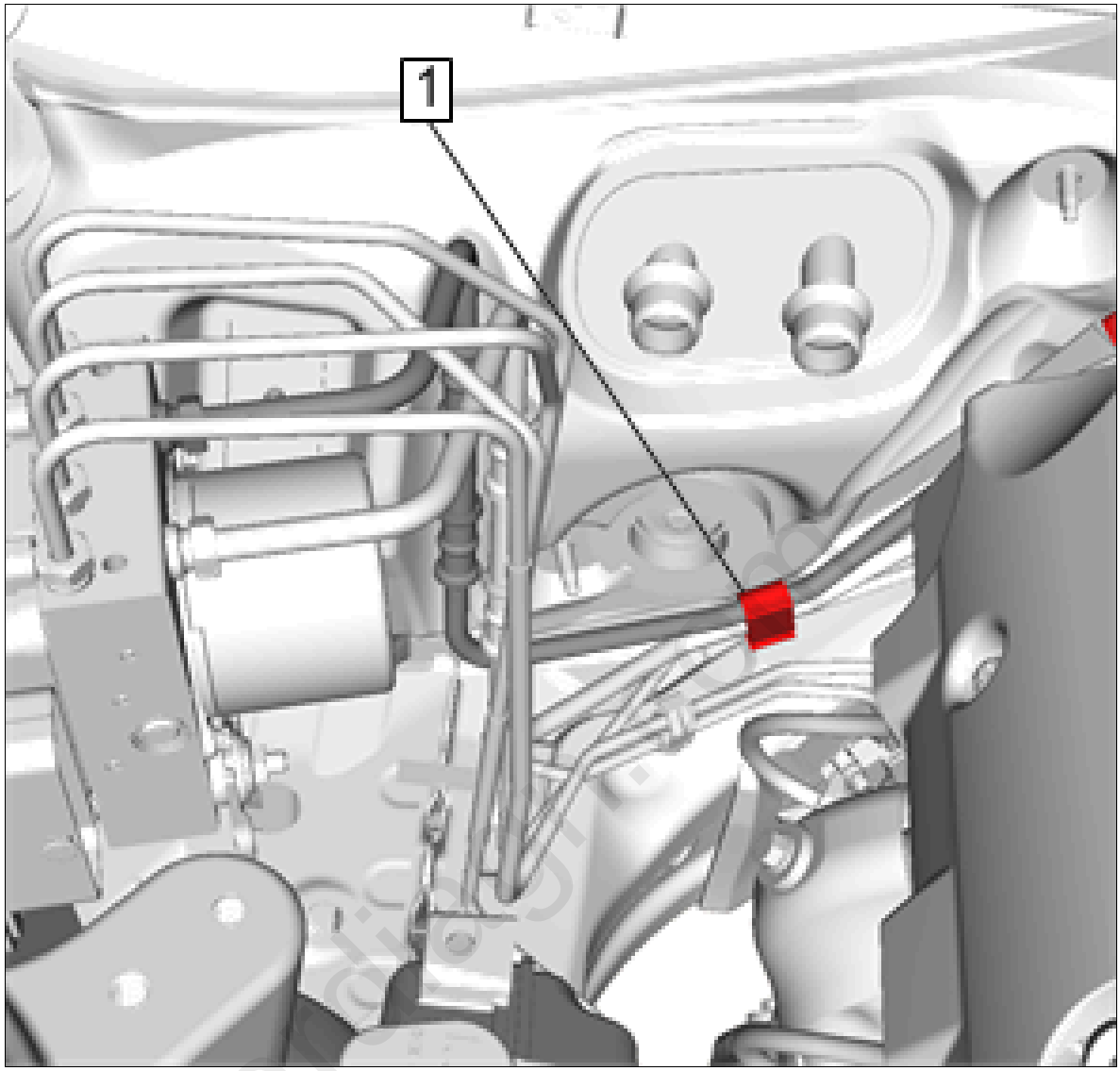


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install Brake Pipe Fitting (1) and tighten to 32 N.m (24 lb ft)

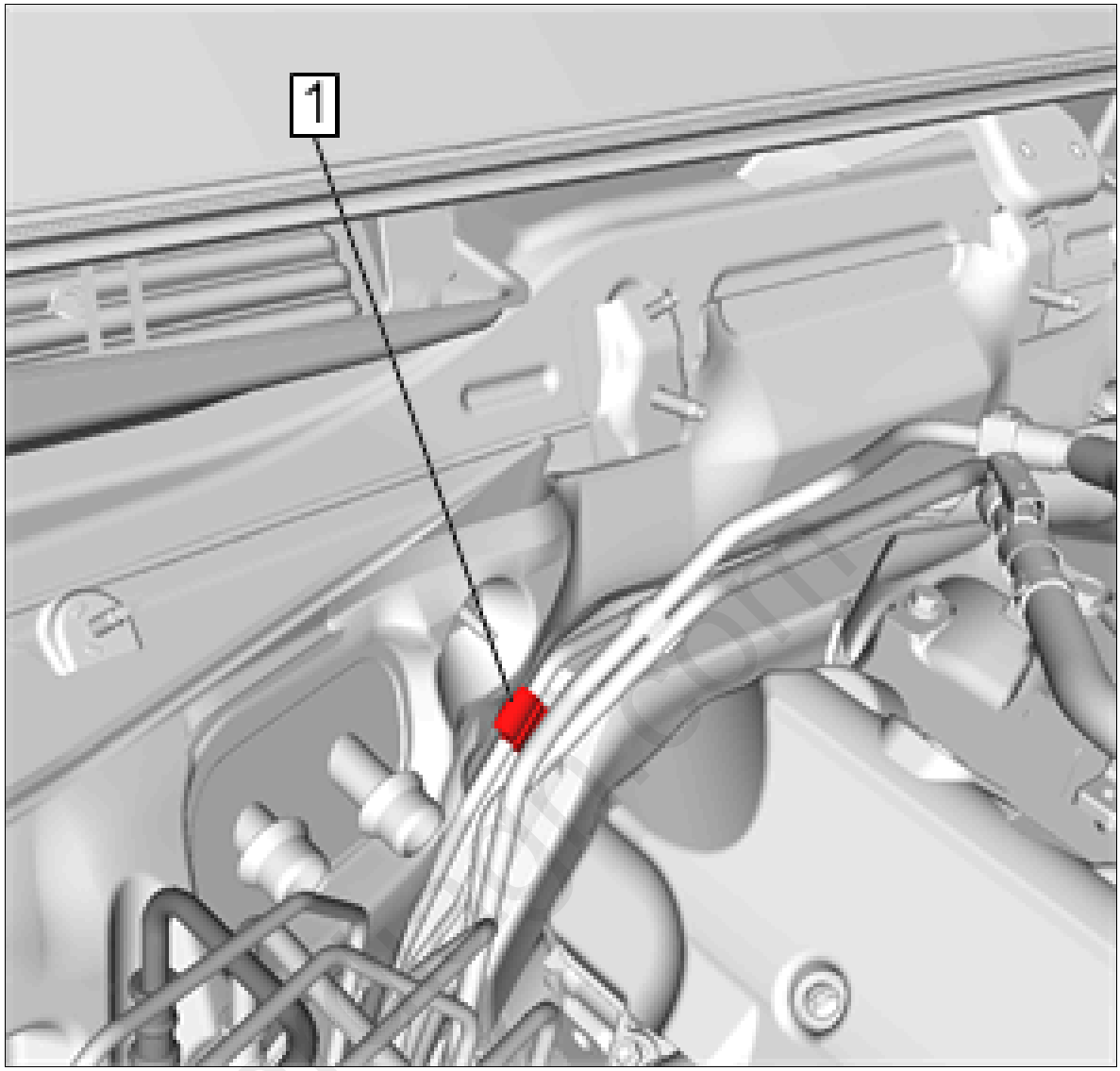
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

3. Install Retainer (1).

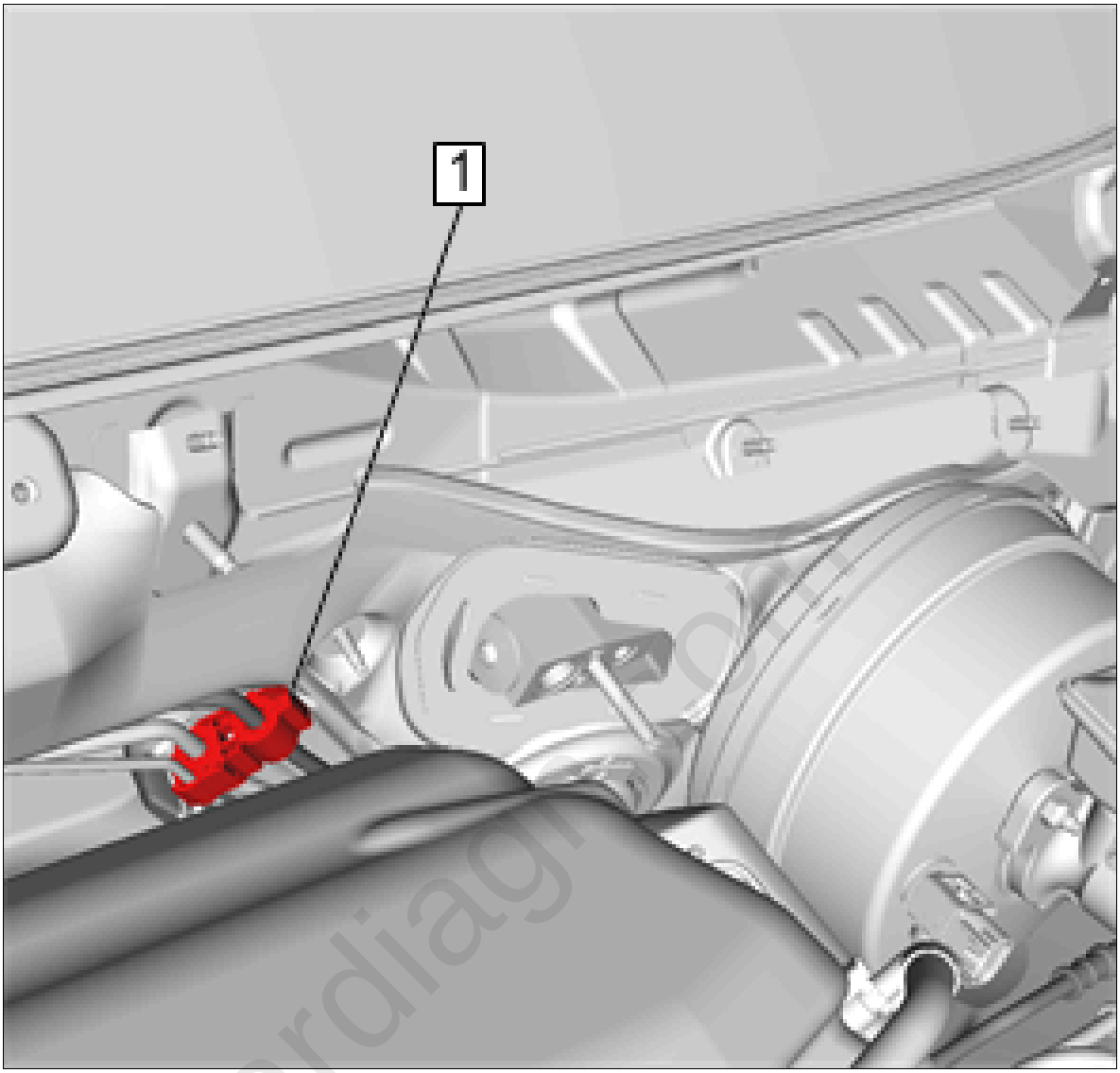
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Install Retainer (1).

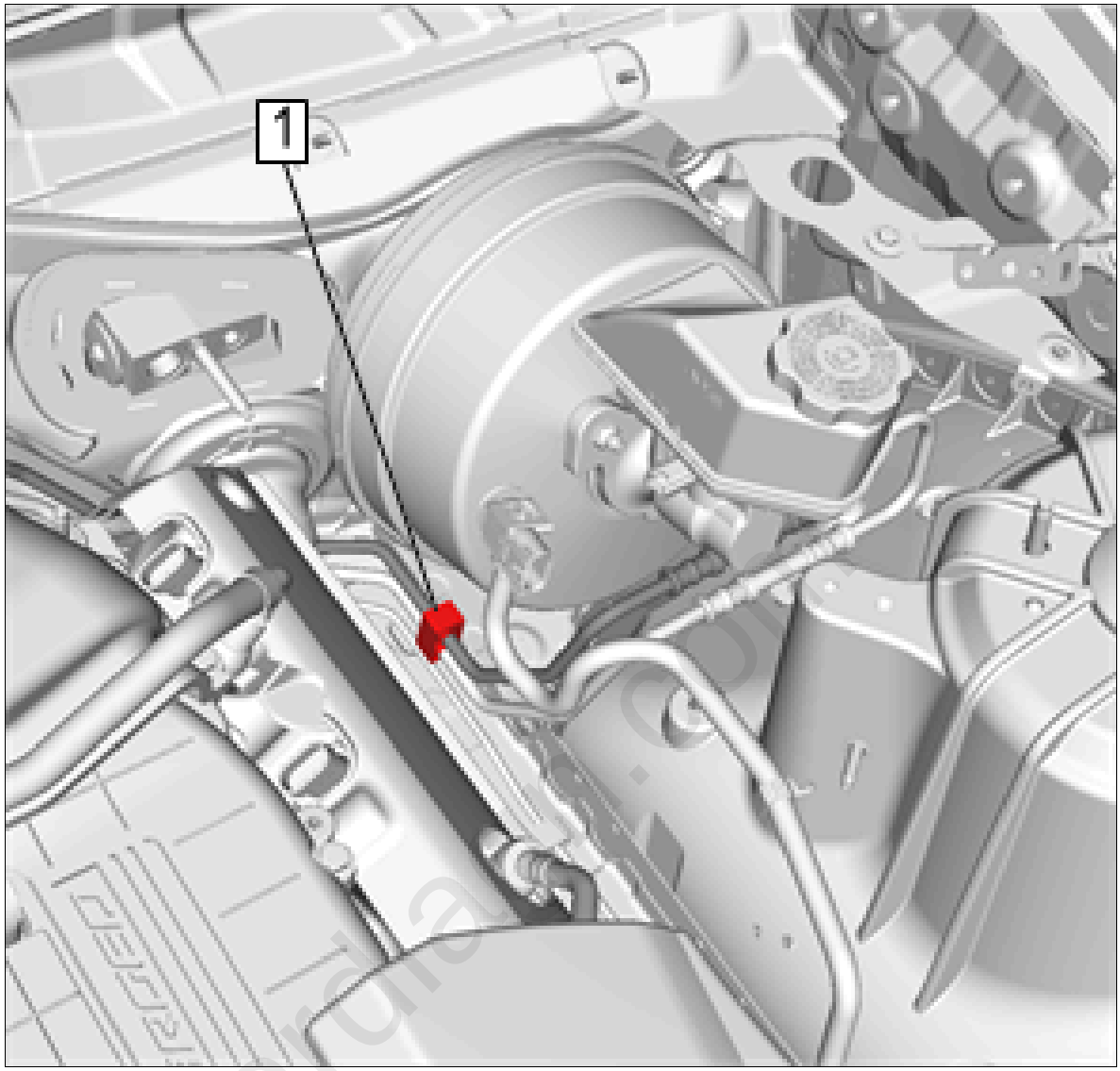
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Install Retainer (1).

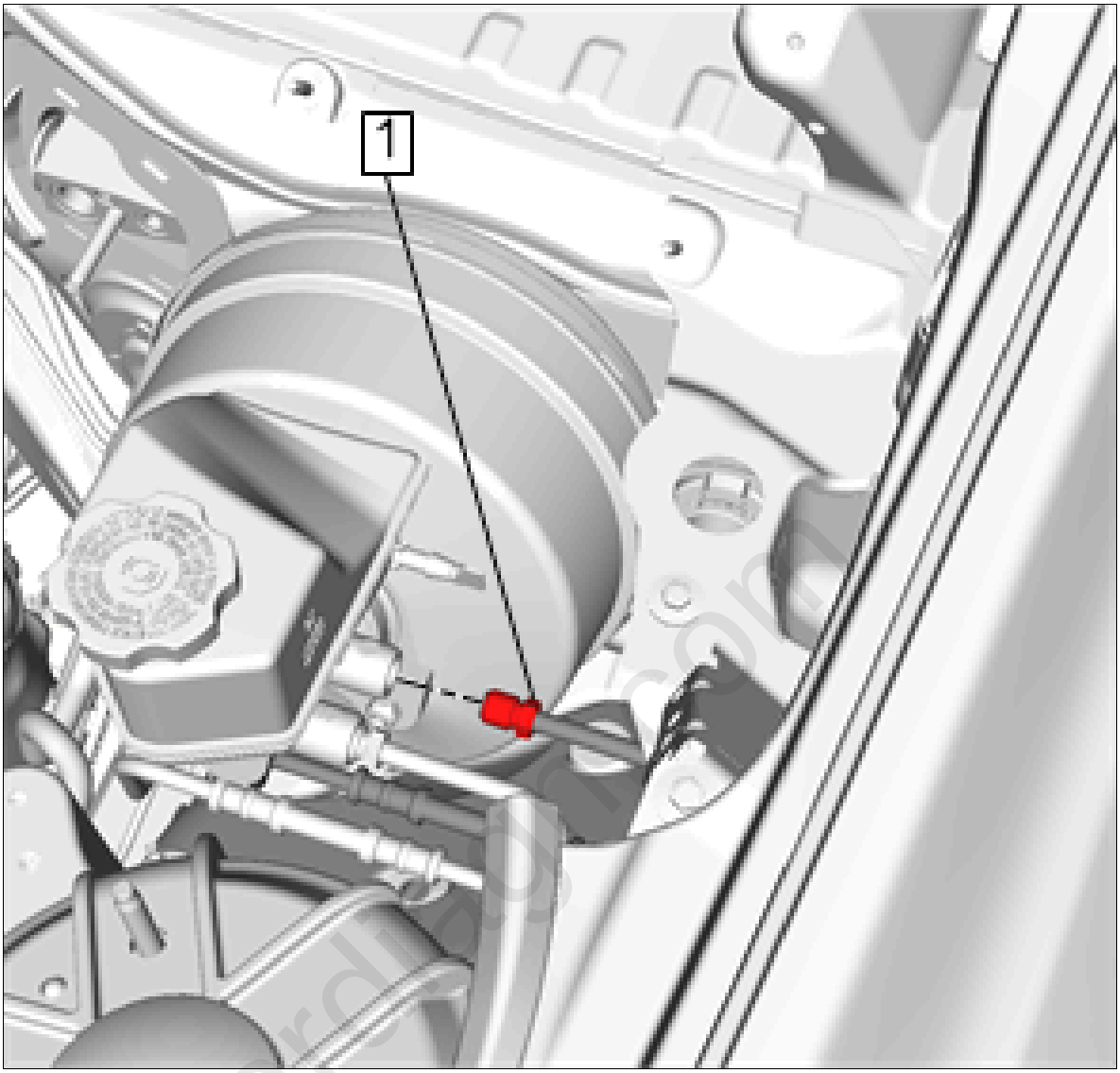
Fig 5: Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Install Retainer (1).

Fig 6: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

7. Install Brake Pipe Fitting (1) and tighten to 30 N.m (22 lb ft)
8. Install Upper Intermediate Steering Shaft at Mid Intermediate Steering Shaft - Upper Intermediate Steering Shaft Replacement (Without Rolloboot, On/After VIN 1G1FB1RSXG0140963)Upper Intermediate Steering Shaft Replacement (With Rolloboot, Before VIN 1G1FB1RSXG0140963)
9. Install Heater Outlet Hose at Heater Core - Heater Outlet Hose Replacement (LT1)
10. Install Heater Inlet Hose at Heater Core - Heater Inlet Hose Replacement (LT1)
11. Install Air Conditioning Evaporator Hose Assembly at Thermal Expansion Valve - Air Conditioning Evaporator Hose Assembly Replacement (LT1)
12. Remove Front End Sheet Metal Diagonal Brace - Left Side - Front End Sheet Metal Diagonal Brace Replacement - Left Side
13. Install Plenum Front Panel Replacement .

REPAIR INSTRUCTIONS > BRAKE PRESSURE MODULATOR VALVE PIPE REPLACEMENT (LT1 - SECONDARY) > REMOVAL PROCEDURE

WARNING:

Refer to Brake Fluid Irritant Warning .

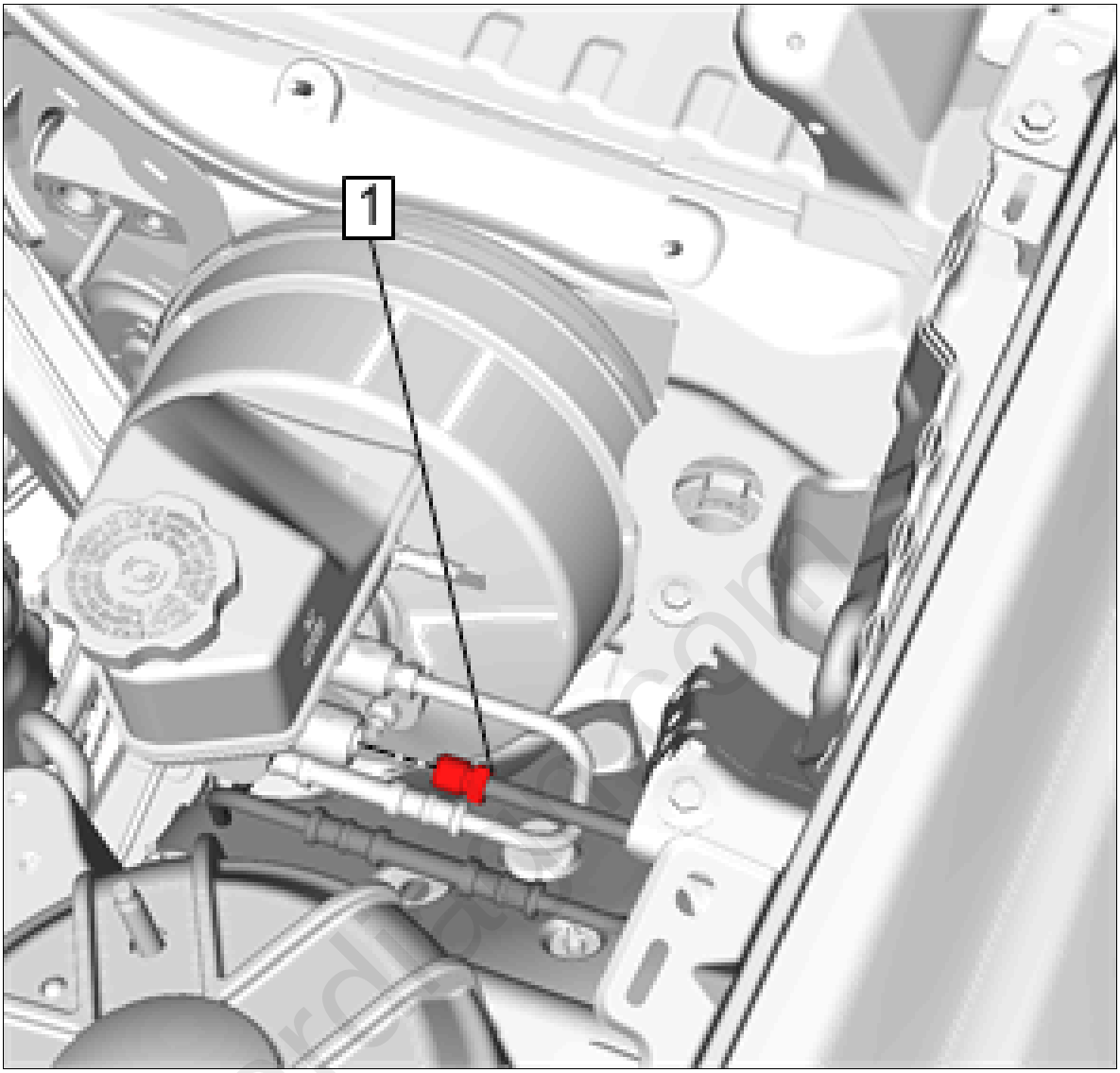
CAUTION:

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

1. Remove Plenum Front Panel Replacement .
2. Remove Front End Sheet Metal Diagonal Brace - Left Side - Front End Sheet Metal Diagonal Brace Replacement - Left Side
3. Disconnect Air Conditioning Evaporator Hose Assembly at Thermal Expansion Valve - Air Conditioning Evaporator Hose Assembly Replacement (LT1)
4. Disconnect Heater Inlet Hose at Heater Core - Heater Inlet Hose Replacement (LT1)
5. Disconnect Heater Outlet Hose at Heater Core - Heater Outlet Hose Replacement (LT1)
6. Separate Upper Intermediate Steering Shaft at Mid Intermediate Steering Shaft - Upper Intermediate Steering Shaft Replacement (Without Rolloboot, On/After VIN 1G1FB1RSXG0140963)Upper Intermediate Steering Shaft Replacement (With Rolloboot, Before VIN 1G1FB1RSXG0140963)
7. Using a suitable tool, remove and properly dispose of the brake fluid from the master cylinder reservoir.

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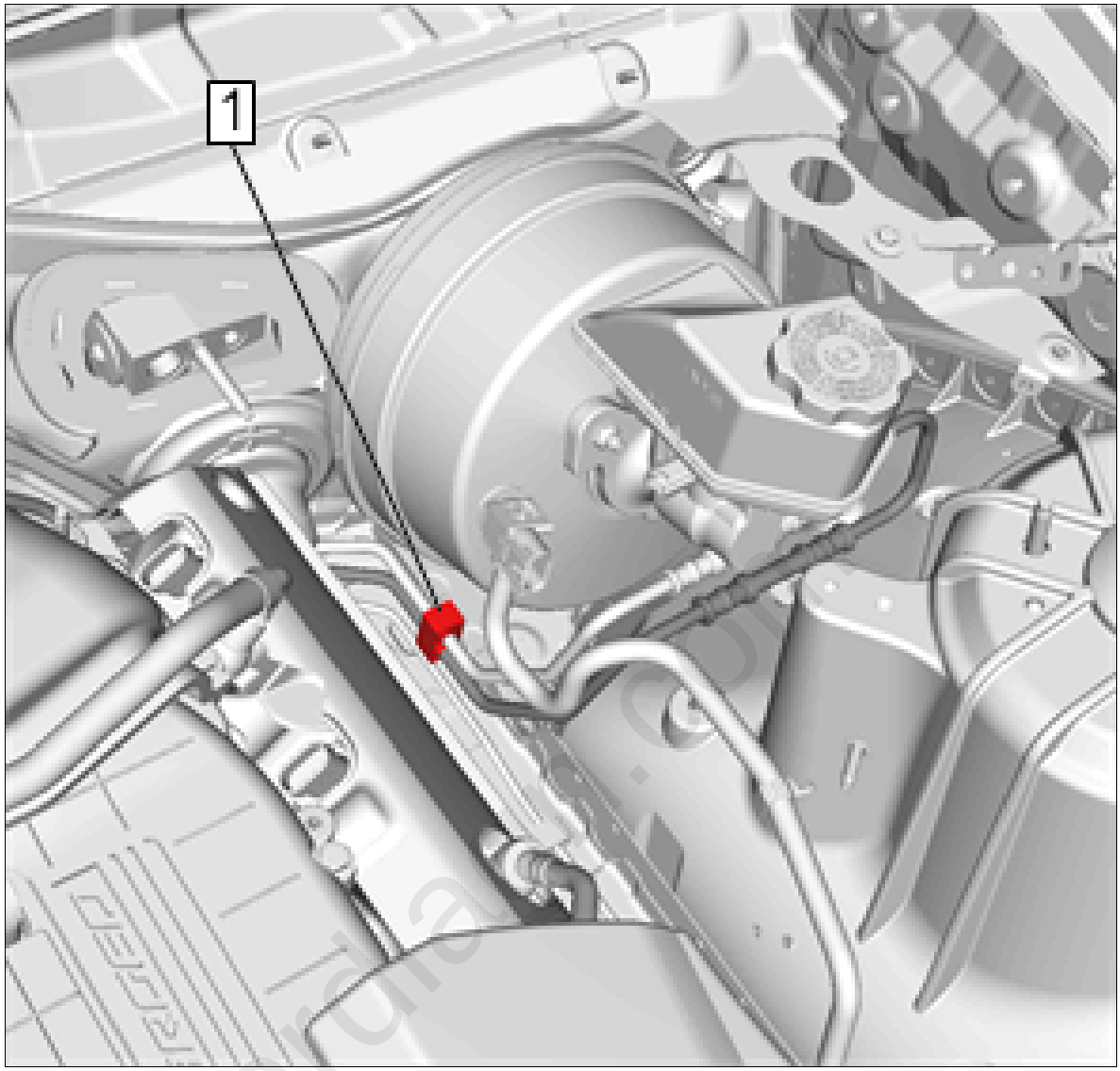
Fig 1: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

8. Disconnect Brake Pipe Fitting (1).
9. Plug the master cylinder outlet port to prevent brake fluid loss and contamination.

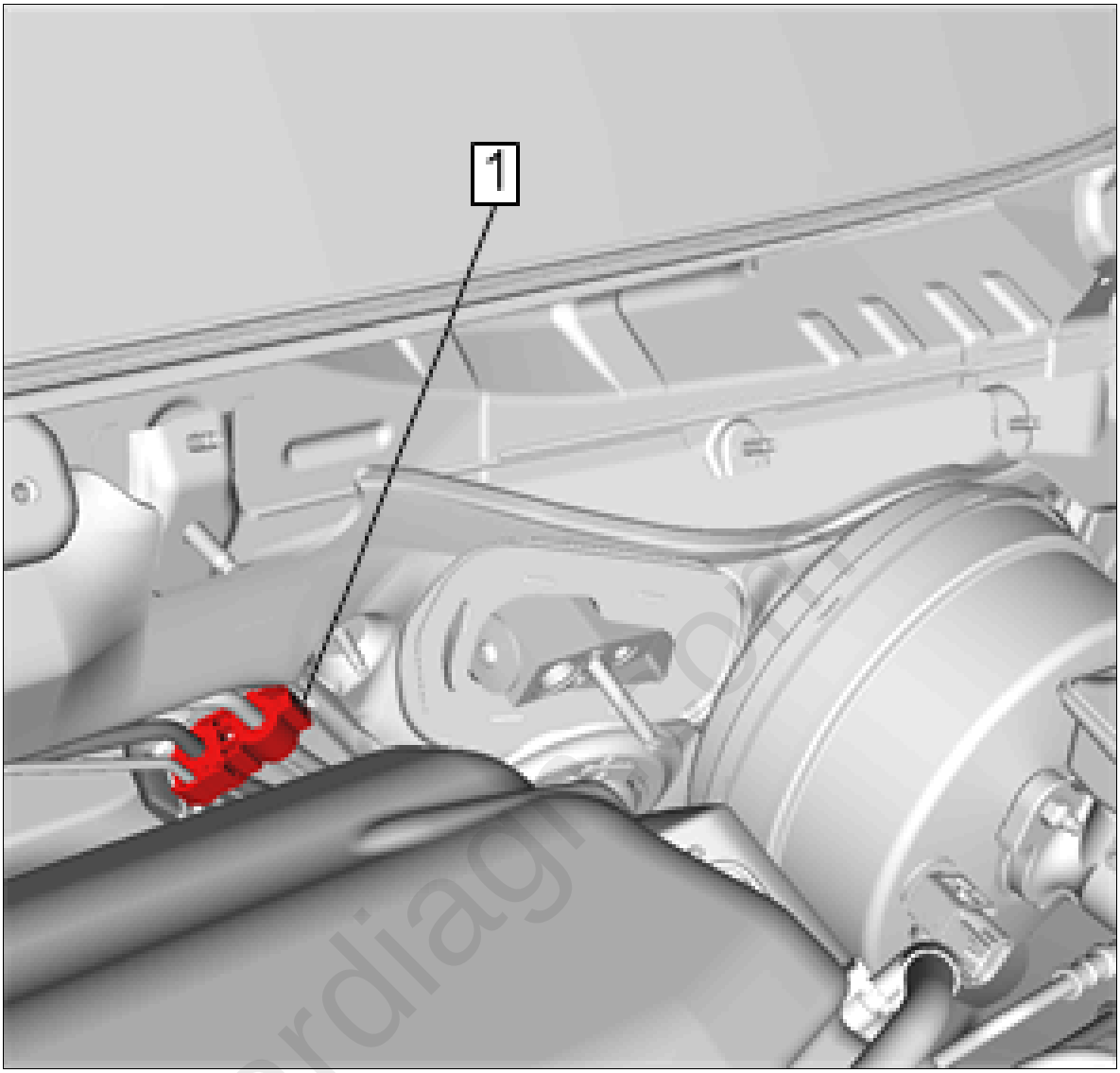
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

10. Release Retainer (1).

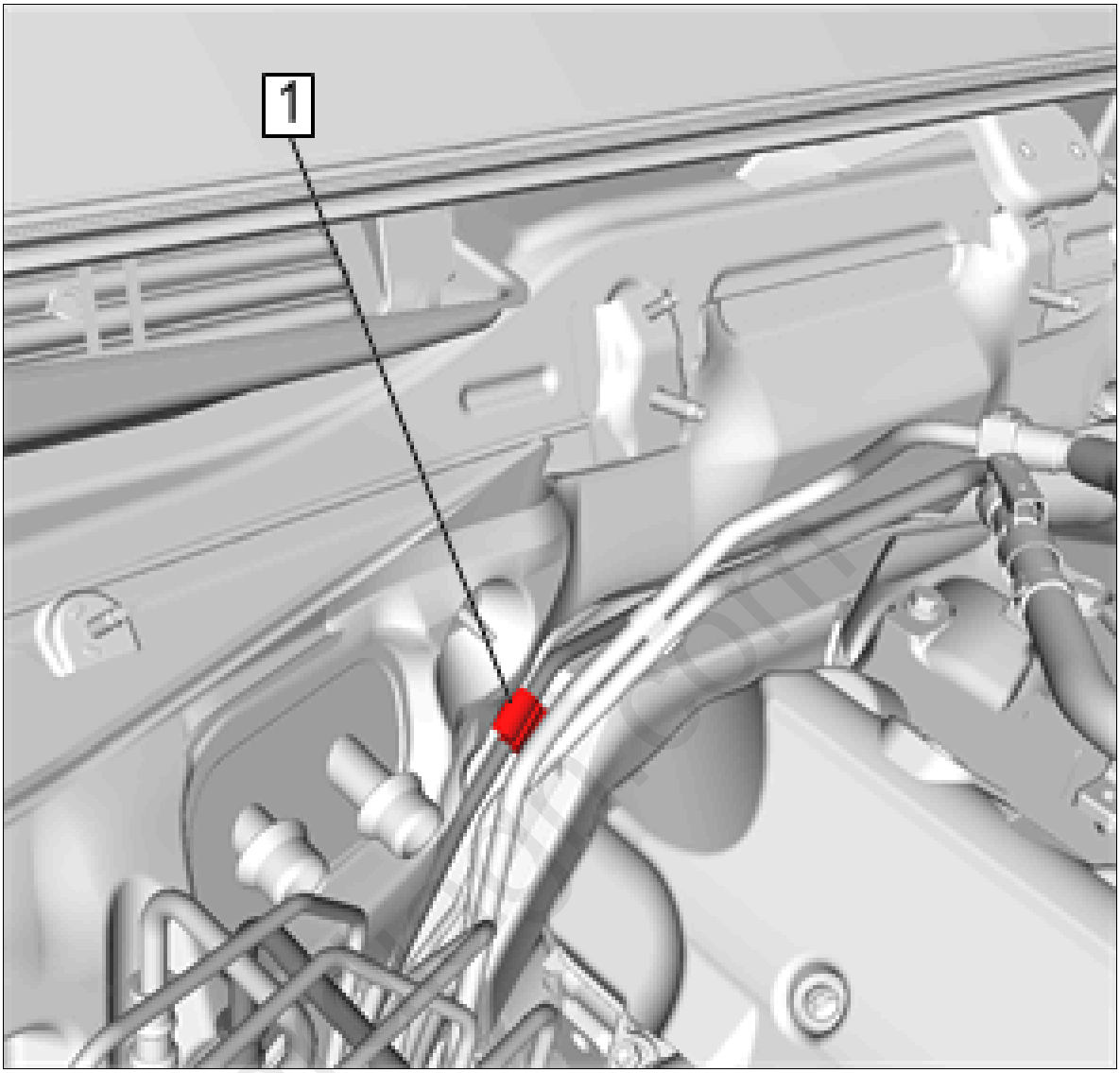
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

11. Release Retainer (1).

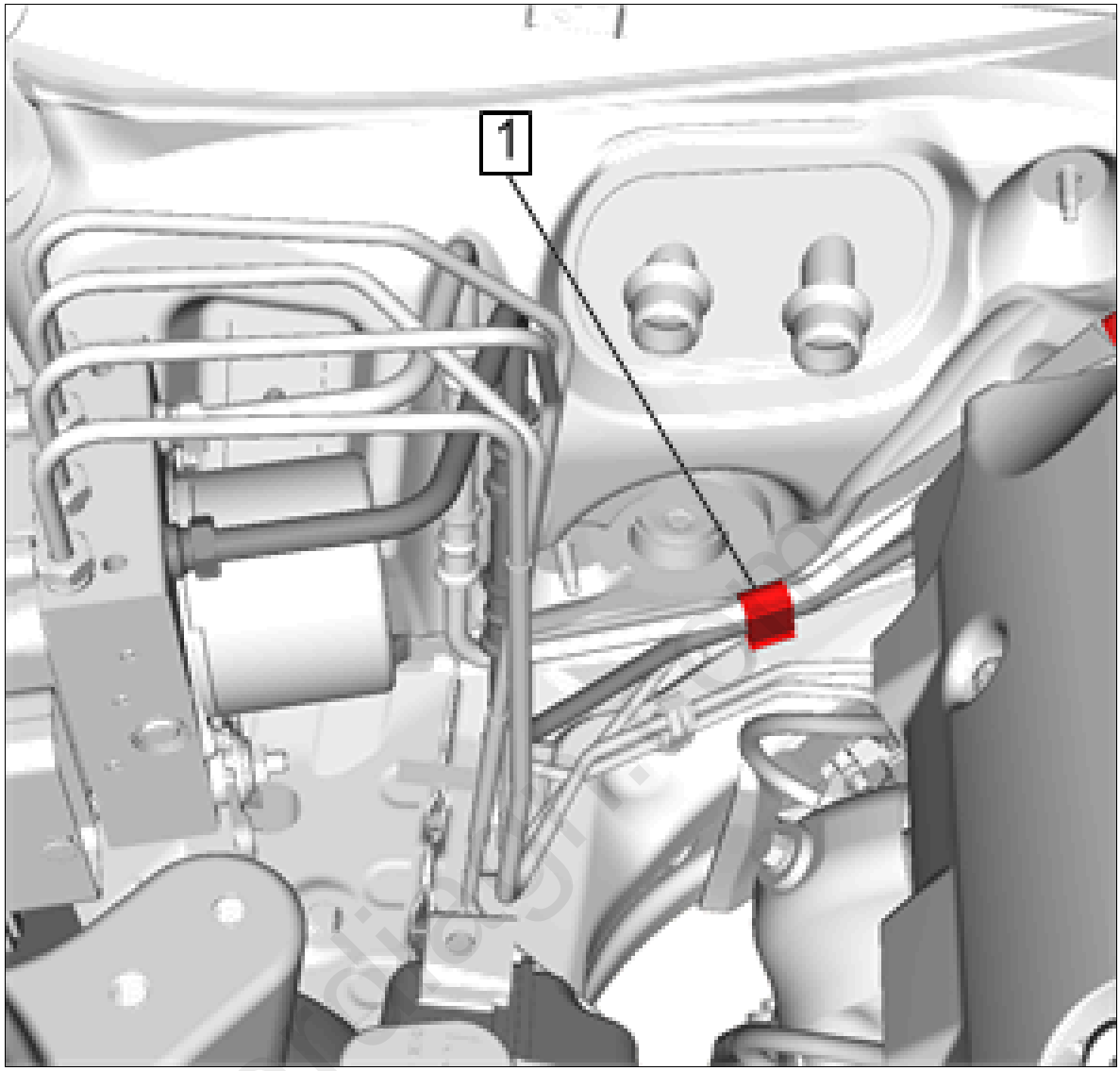
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

12. Release Retainer (1).

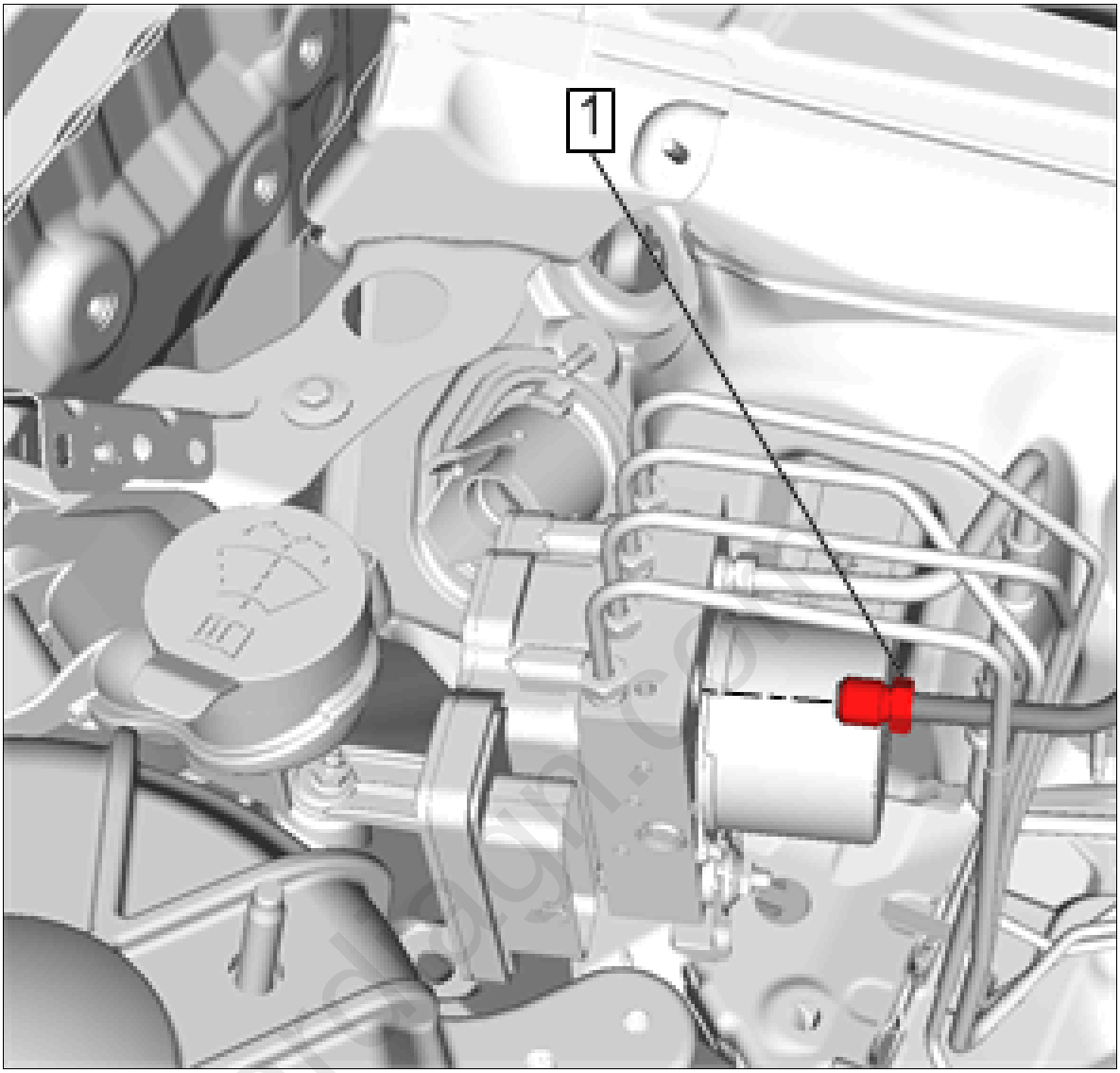
Fig 5: Retainer



Courtesy of GENERAL MOTORS COMPANY

13. Release Retainer (1).

Fig 6: Brake Pipe Fitting



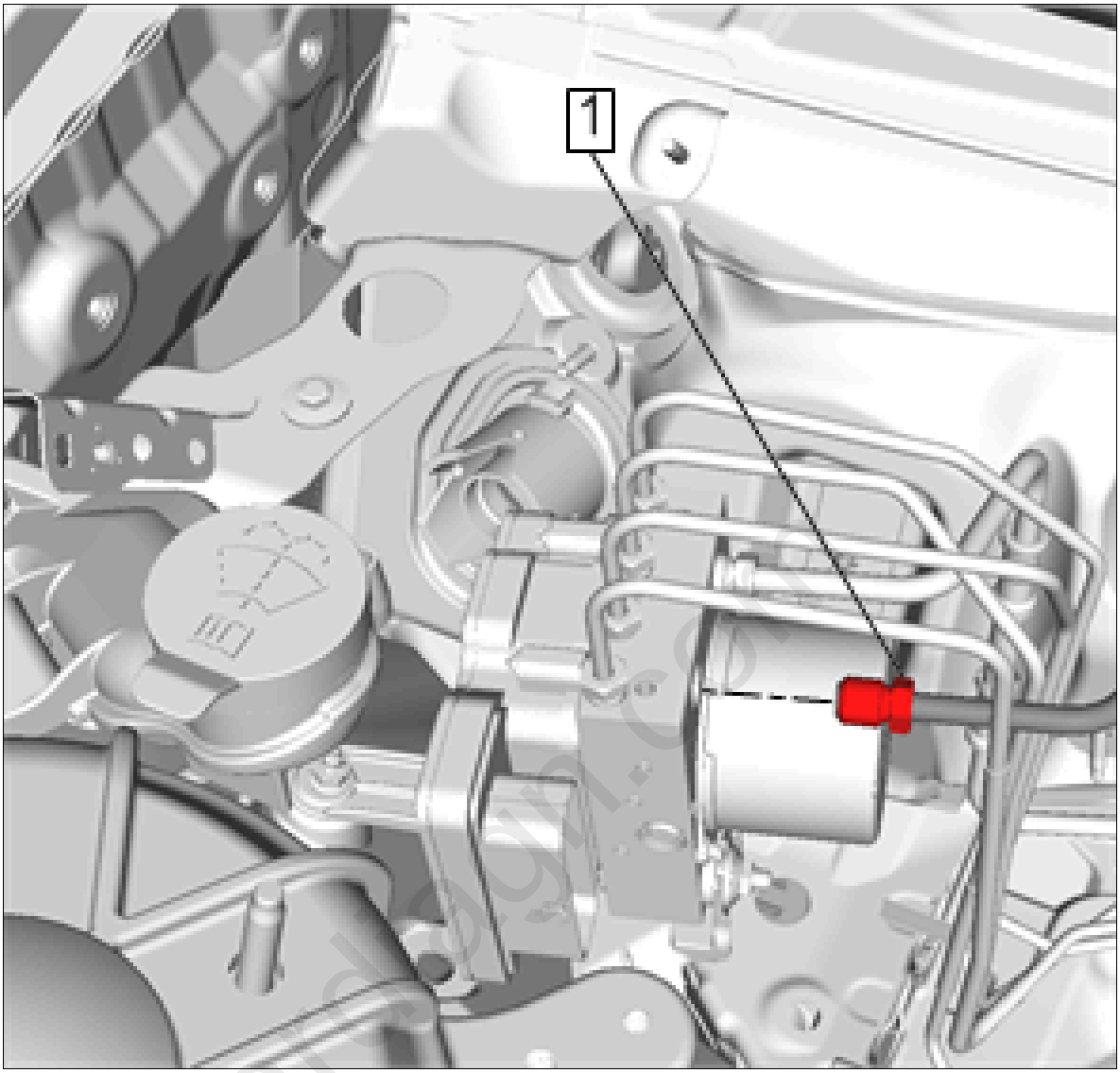
Courtesy of GENERAL MOTORS COMPANY

14. Disconnect Brake Pipe Fitting (1).
15. Plug the brake pressure modulator valve (BPMV) inlet port to prevent brake fluid loss and contamination.
16. Remove the BPMV secondary brake pipe.

REPAIR INSTRUCTIONS > BRAKE PRESSURE MODULATOR VALVE PIPE REPLACEMENT (LT1 - SECONDARY) > INSTALLATION PROCEDURE

1. Install the BPMV secondary brake pipe.

Fig 1: Brake Pipe Fitting

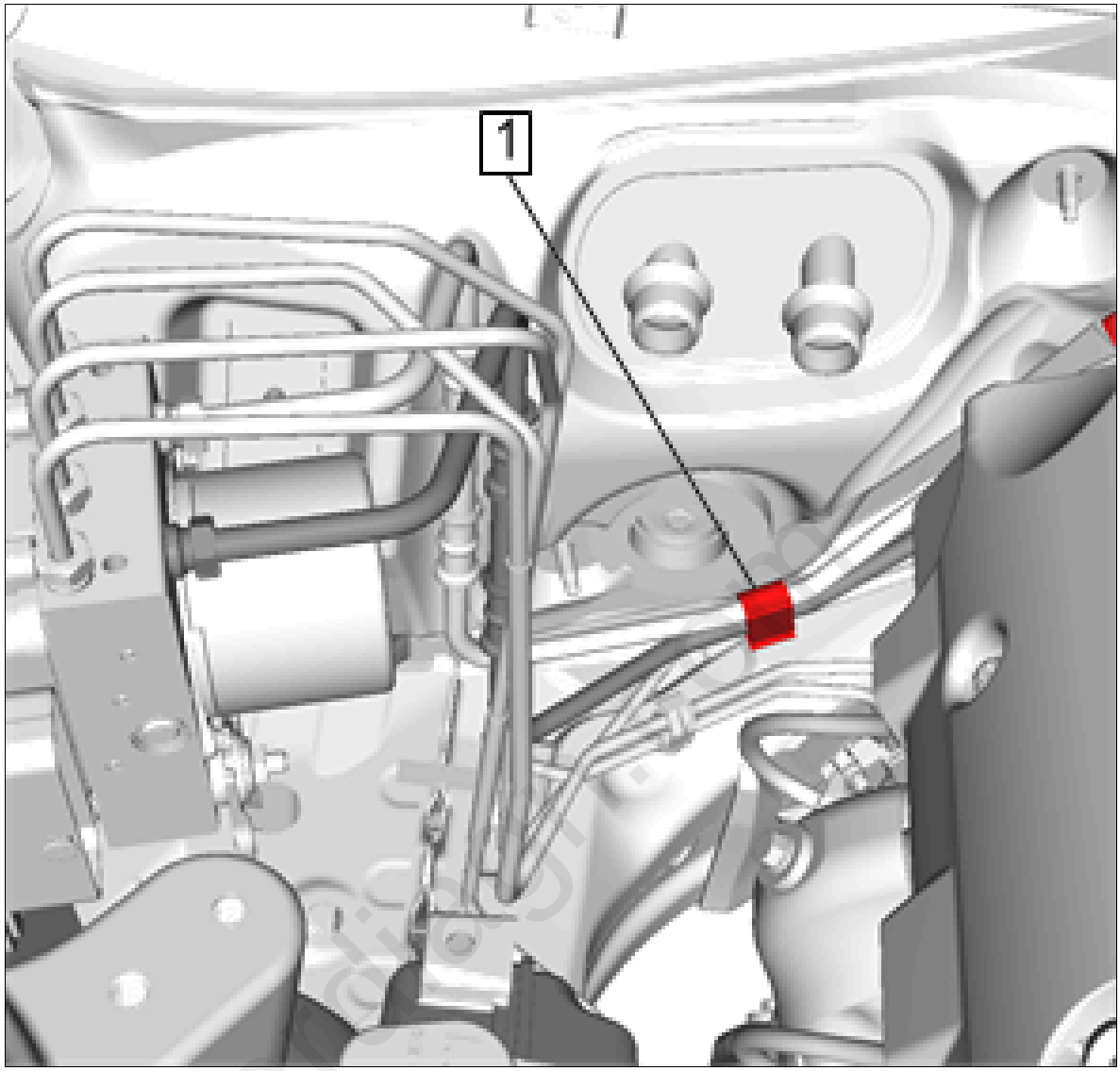


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Refer to Fastener Caution .*

2. Install Brake Pipe Fitting (1) and tighten 32 N.m (24 lb ft)

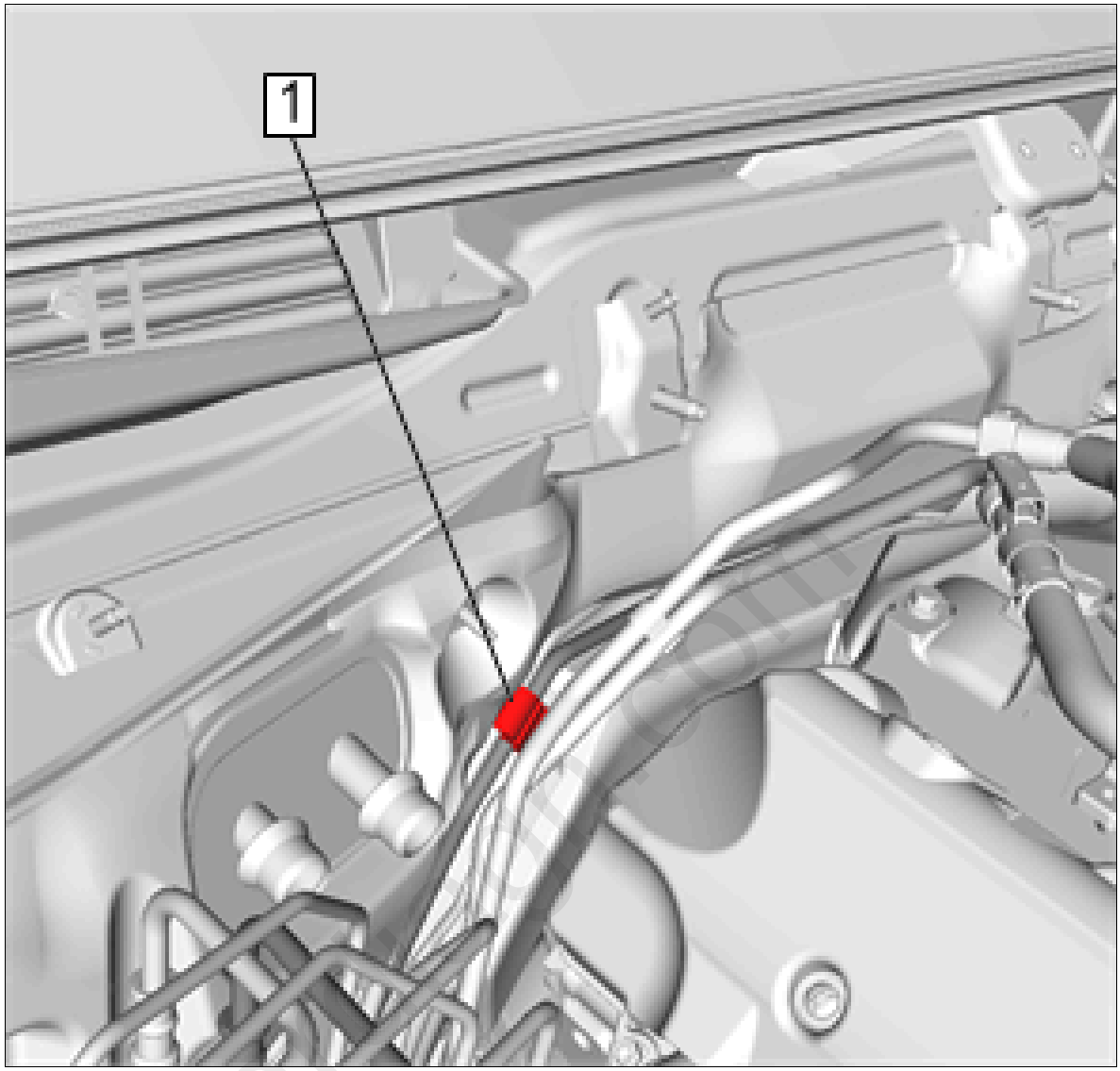
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

3. Install Retainer (1).

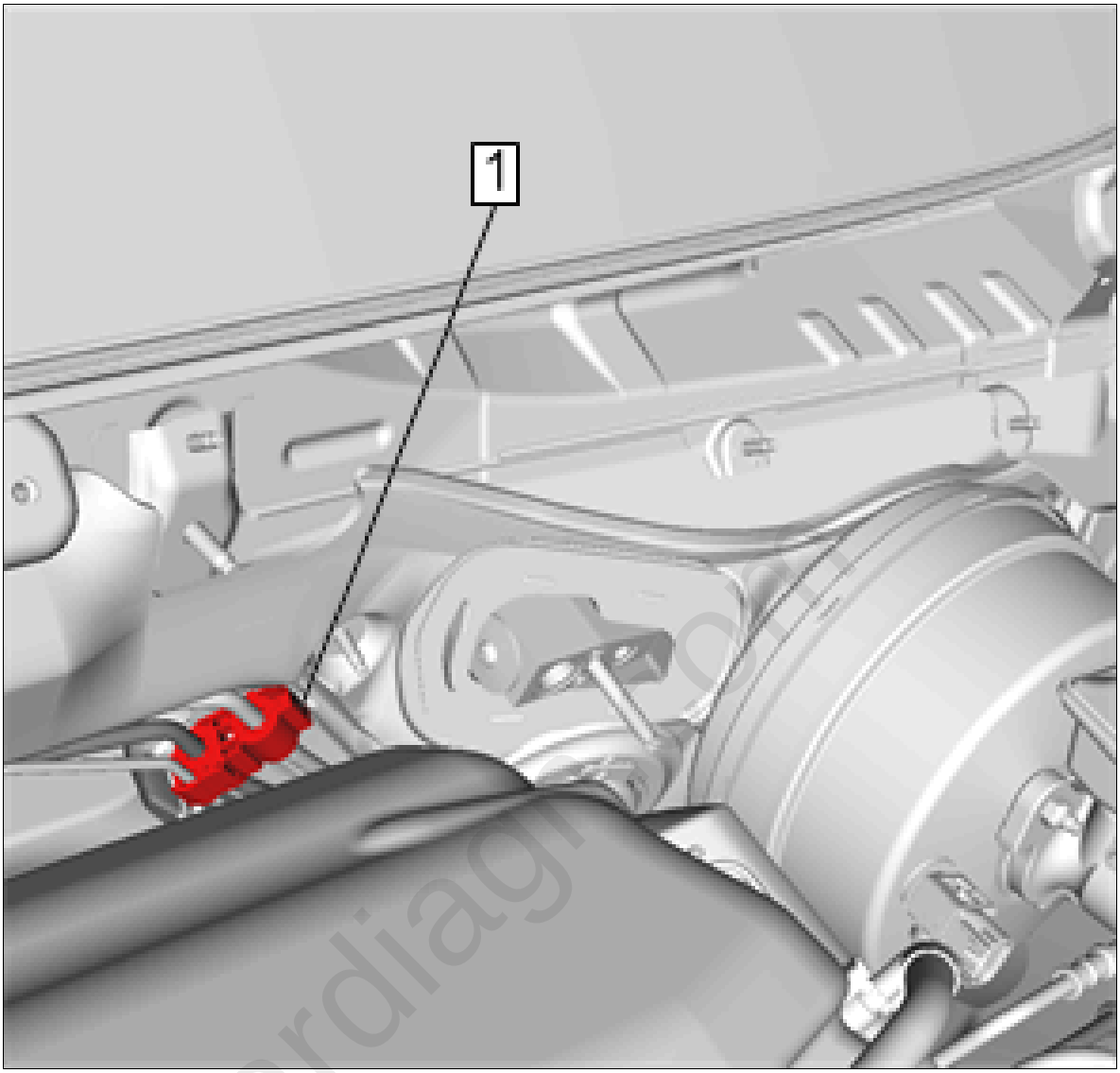
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Install Retainer (1).

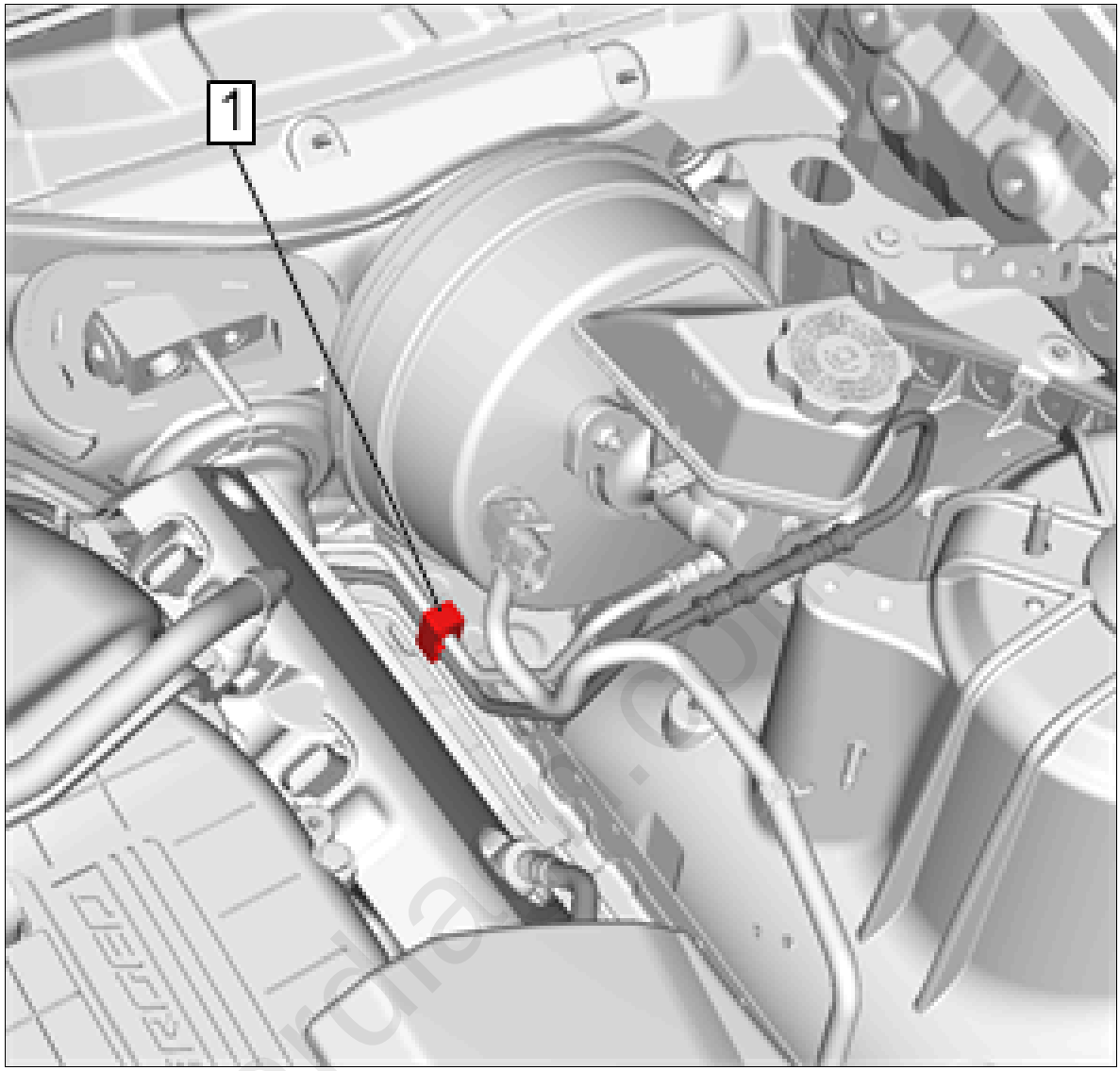
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Install Retainer (1).

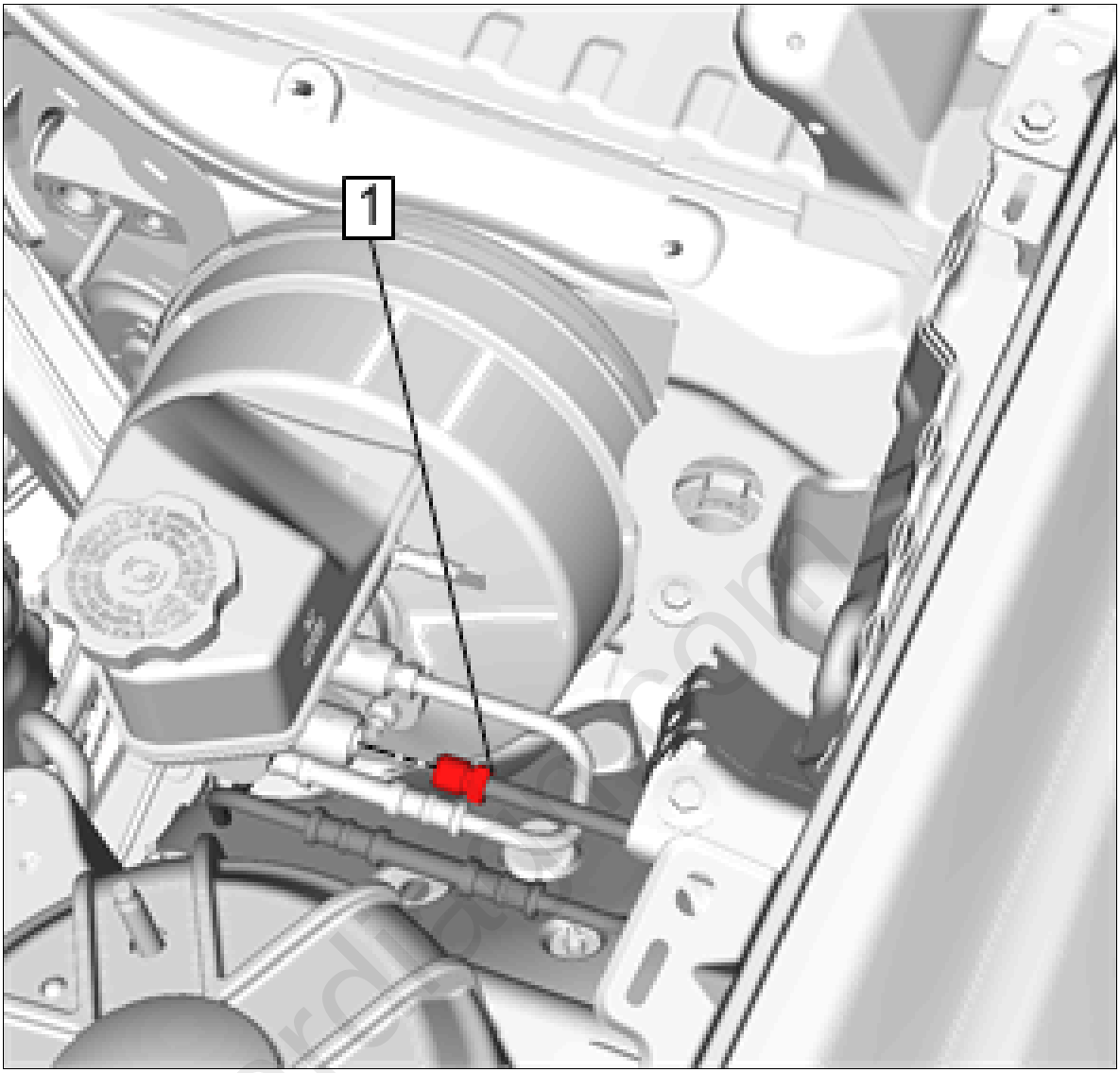
Fig 5: Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Install Retainer (1).

Fig 6: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

7. Install Brake Pipe Fitting (1) and tighten to 30 N.m (22 lb ft)
8. Install Upper Intermediate Steering Shaft at Mid Intermediate Steering Shaft - Upper Intermediate Steering Shaft Replacement (Without Rolloboot, On/After VIN 1G1FB1RSXG0140963)Upper Intermediate Steering Shaft Replacement (With Rolloboot, Before VIN 1G1FB1RSXG0140963)
9. Install Heater Outlet Hose at Heater Core - Heater Outlet Hose Replacement (LT1)
10. Install Heater Inlet Hose at Heater Core - Heater Inlet Hose Replacement (LT1)
11. Install Air Conditioning Evaporator Hose Assembly at Thermal Expansion Valve - Air Conditioning Evaporator Hose Assembly Replacement (LT1)
12. Remove Front End Sheet Metal Diagonal Brace - Left Side - Front End Sheet Metal Diagonal Brace Replacement - Left Side
13. Install Plenum Front Panel Replacement .

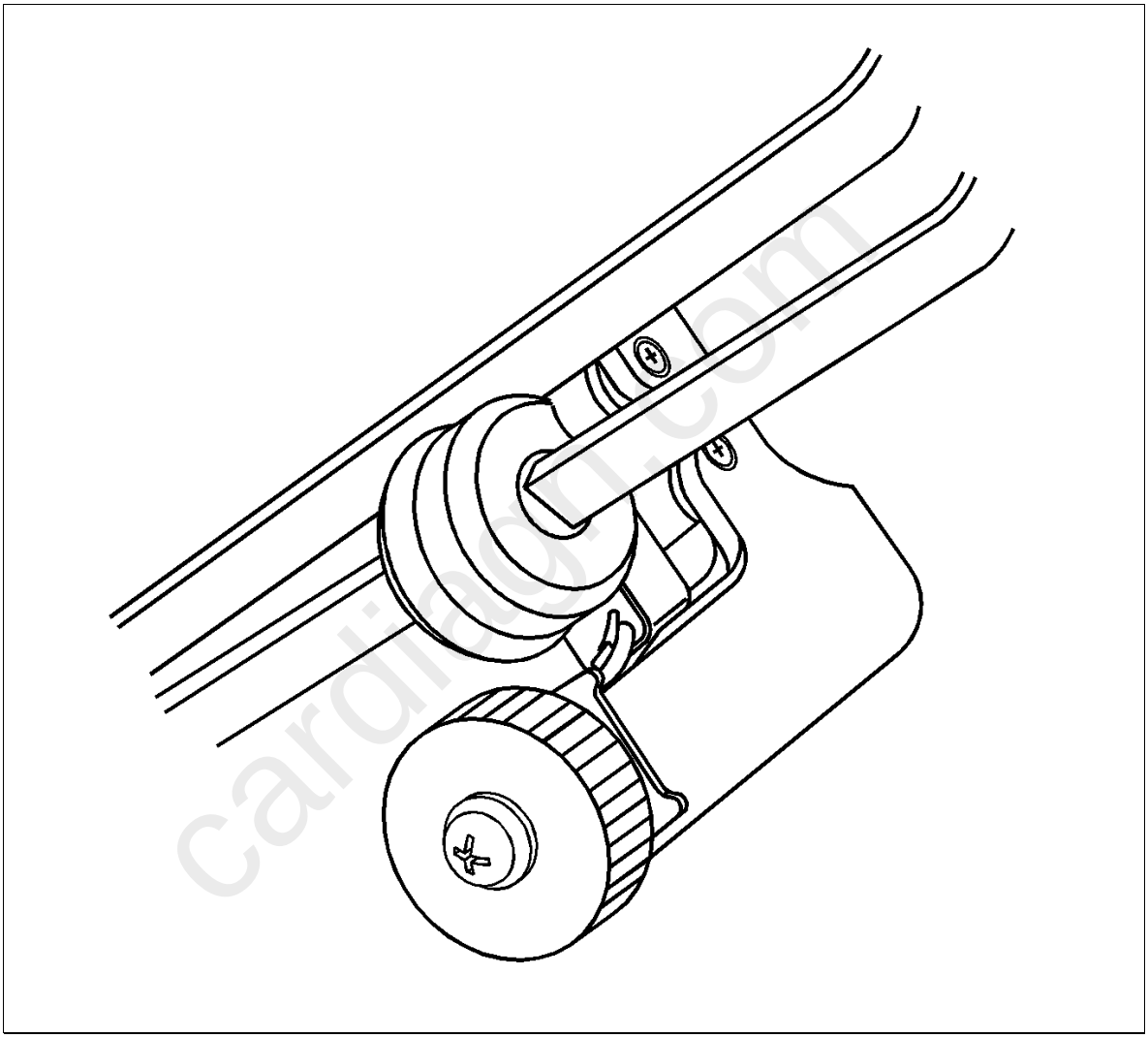
REPAIR INSTRUCTIONS > BRAKE PIPE REPLACEMENT

Special Tools

CH-45405 Brake Pipe Flaring Tool Kit

For equivalent regional tools, refer to Special Tools .

Fig 1: Sectioning Brake Pipe Using Pipe Cutter



Courtesy of GENERAL MOTORS COMPANY

WARNING:

Refer to Brake Fluid Irritant Warning .

WARNING:

Always use double walled steel brake pipe when replacing brake pipes. The use of any other pipe is not recommended and may cause brake system failure. Carefully route and retain replacement brake pipes. Always use the correct fasteners and the original location for replacement brake pipes. Failure to properly route and retain brake pipes may cause damage to the brake pipes and cause brake system failure.

CAUTION:

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

NOTE:

When servicing the brake pipes, note the following:

1. *If sectioning the brake pipe, use replacement pipe of the same type and outside diameter.*
2. *Use fittings of the appropriate size and type.*
3. *Only create flares of the same type or design as originally equipped on the vehicle.*

1. Inspect the area of brake pipe to be repaired or replaced.
2. Release the brake pipe to be replaced from the retainers, as required.
3. Select an appropriate location to section the brake pipe, if necessary.
    1. Allow adequate clearance in order to maneuver the **CH-45405** Brake Pipe Flaring Tool Kit.
    2. Avoid sectioning the brake pipe at bends or mounting points.
4. Using a string or wire, measure the length of the pipe to be replaced including all pipe bends.
5. Add to the measurement taken the appropriate additional length required for each flare to be created.

    Specification

    1. 6.35 mm (0.250 in) for 4.76 mm (3/16 in) diameter pipe
    2. 9.50 mm (0.374 in) for 6.35 mm (1/4 in) diameter pipe
    3. 12.67 mm (0.499 in) for 7.94 mm (5/16 in) diameter pipe

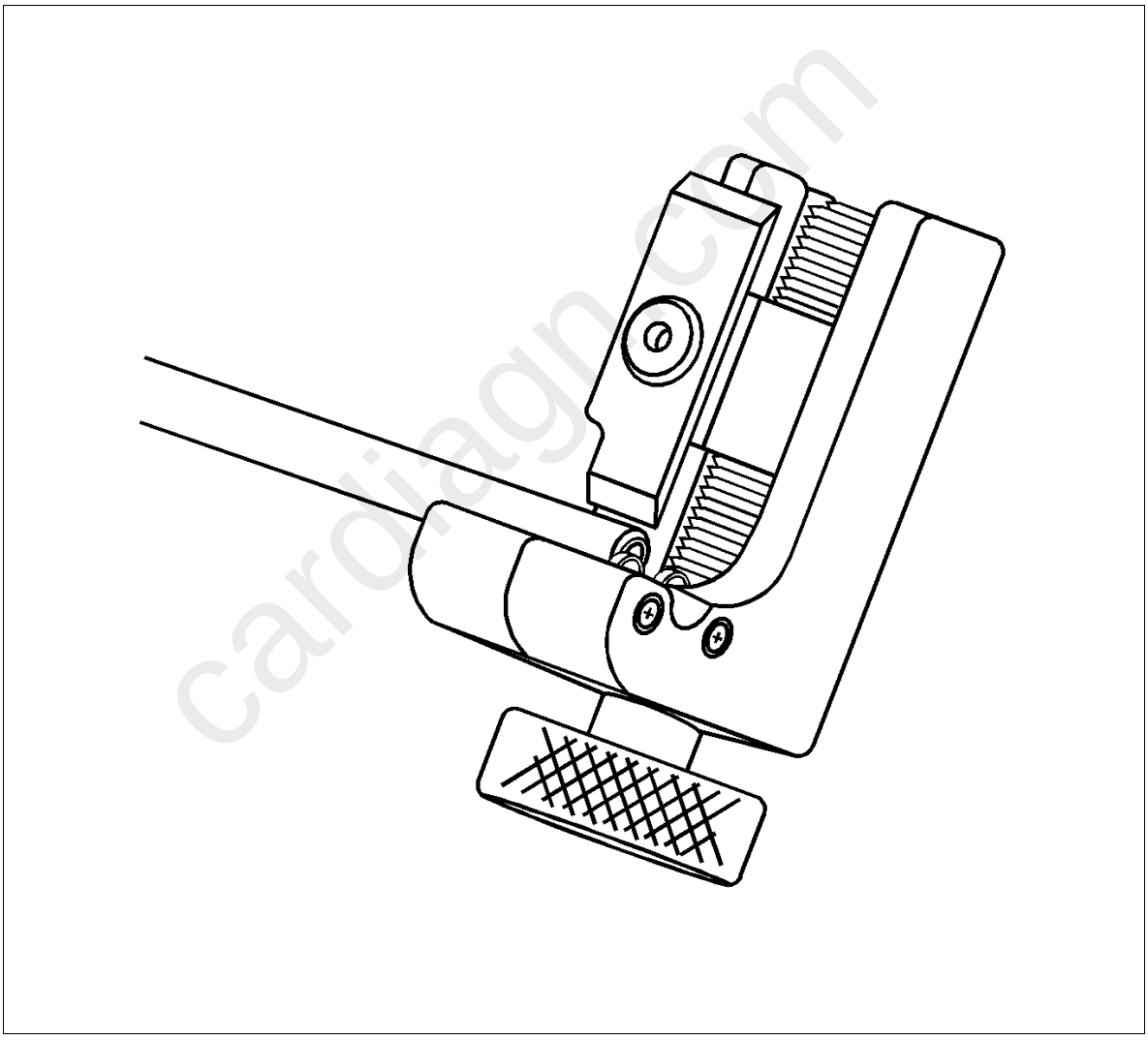
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NOTE:

Ensure that the brake pipe end to be flared is cut at a square, 90 degree angle to the pipe length.

6. Using the pipe cutter included in the **CH-45405** Brake Pipe Flaring Tool Kit, carefully cut the brake pipe squarely to the measured length.
7. Remove the sectioned brake pipe from the vehicle.
8. Select the appropriate size of brake pipe and tube nuts, as necessary. The brake pipe outside diameter determines brake pipe size.

   Fig 2: Stripping Nylon Coating From Brake Pipe Ends



Courtesy of GENERAL MOTORS COMPANY

9. Strip the nylon coating from the brake pipe end to be flared, if necessary.
   1. Select the appropriate blade on the coating stripping tool included in the **CH-45405** Brake Pipe Flaring Tool Kit, by unthreading the blade block from the stripping tool and installing the block with the desired blade facing the tool rollers.

Specification

1. 6.35 mm (0.250 in) blade for 4.76 mm (3/16 in) diameter pipe
2. 9.50 mm (0.374 in) blade for 6.35 mm (1/4 in) and 7.94 mm (5/16 in) diameter pipe

2. Insert the brake pipe end to be flared into the stripping tool to the depth of the ledge on the tool rollers.
3. While holding the brake pipe firmly against the stripping tool roller ledges, rotate the thumbwheel of the tool until the blade contacts the brake pipe coated surface.

> *NOTE:*
>
> *Do not gouge the metal surface of the brake pipe.*

4. Rotate the stripping tool in a clockwise direction, ensuring that the brake pipe end remains against the tool roller ledges.
5. After each successive revolution of the stripping tool, carefully rotate the thumbwheel of the tool clockwise, in order to continue stripping the coating from the brake pipe until the metal pipe surface is exposed.
6. Loosen the thumbwheel of the tool and remove the brake pipe.

> *NOTE:*
>
> *Ensure that all loose remnants of the nylon coating have been removed from the brake pipe.*

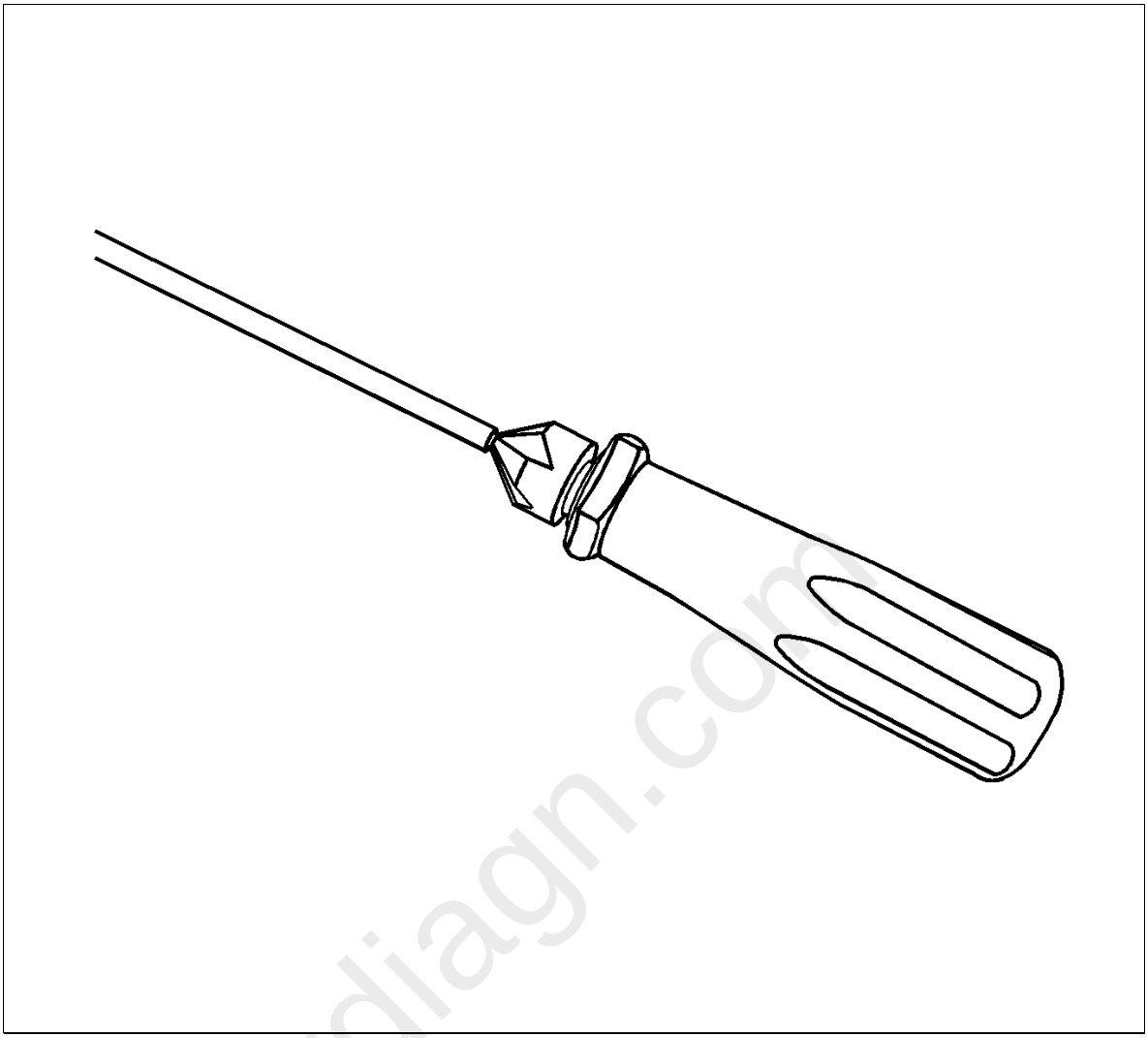
7. Inspect the stripped end of the brake pipe to ensure that the proper amount of coating has been removed.

Specification

1. 6.35 mm (0.250 in) for 4.76 mm (3/16 in) diameter pipe
2. 9.50 mm (0.374 in) for 6.35 mm (1/4 in) and 7.94 mm (5/16 in) diameter pipe

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Fig 3: Chamfering Pipe Using De-Burring Tool

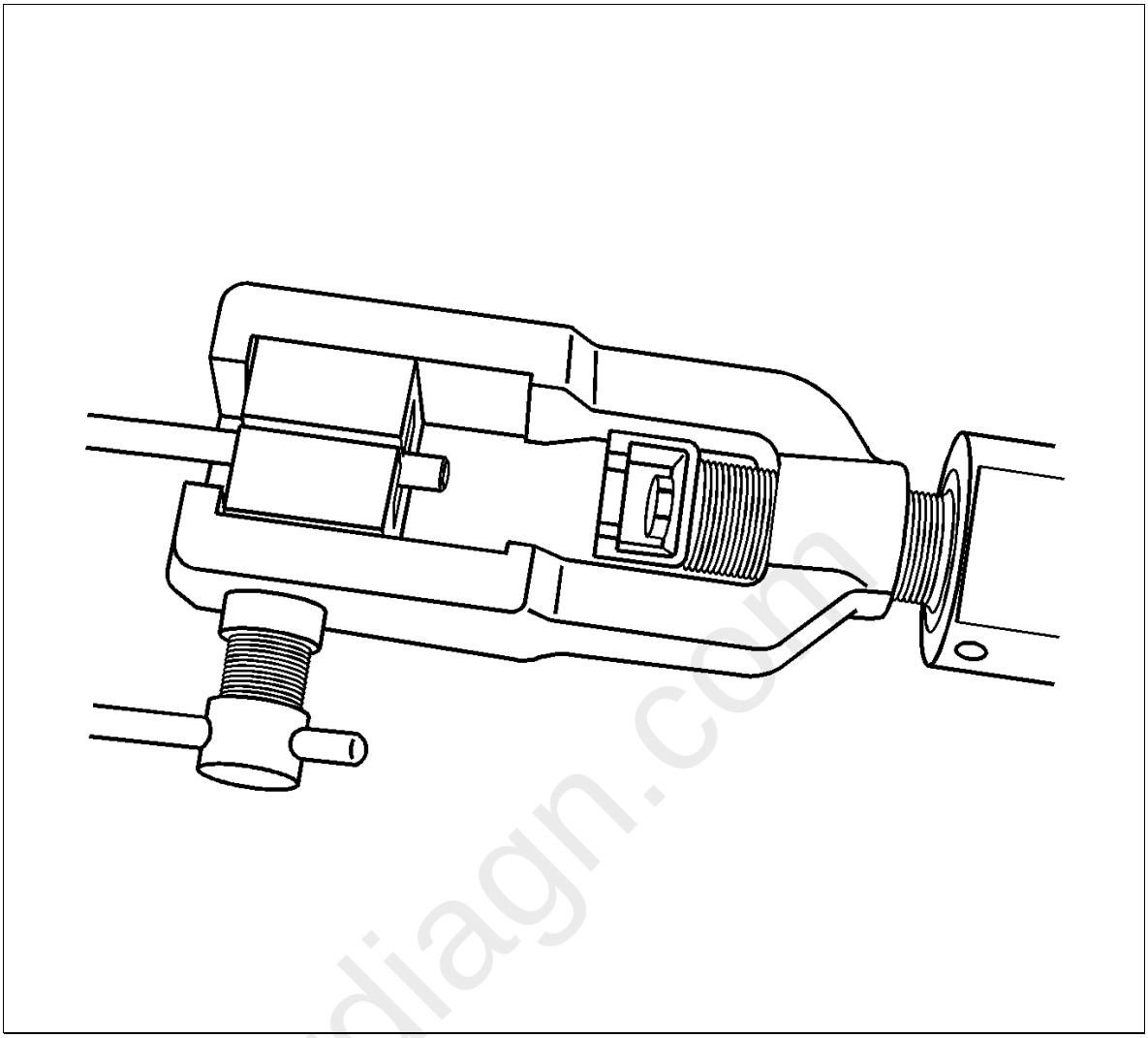


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10. Chamfer the inside and outside diameter of the pipe with the de-burring tool included in the **CH-45405** Brake Pipe Flaring Tool Kit.
11. Install the tube nuts on the brake pipe, noting their orientation.
12. Clean the brake pipe and the **CH-45405** Brake Pipe Flaring Tool Kit of lubricant, contaminants, and debris.

Fig 4: Die Halves Into Die Cage

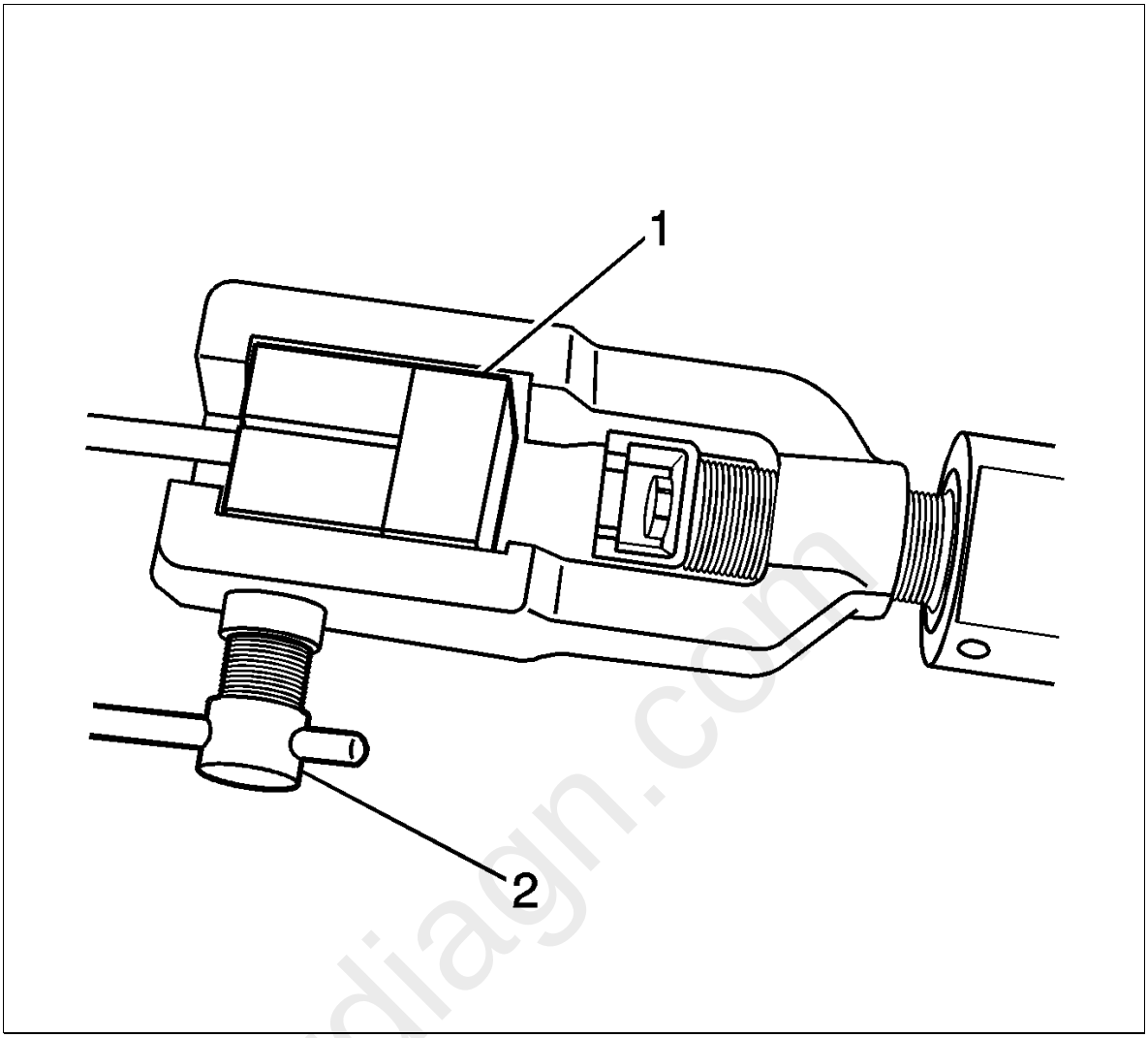


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13. Loosen the die clamping screw of the **CH-45405** Brake Pipe Flaring Tool Kit.
14. Select the corresponding die set and install the die halves into the die cage with the full, flat face of one die facing the clamping screw, and the counterbores of both dies facing the forming ram.

Fig 5: Clamping Screw & Unused Die

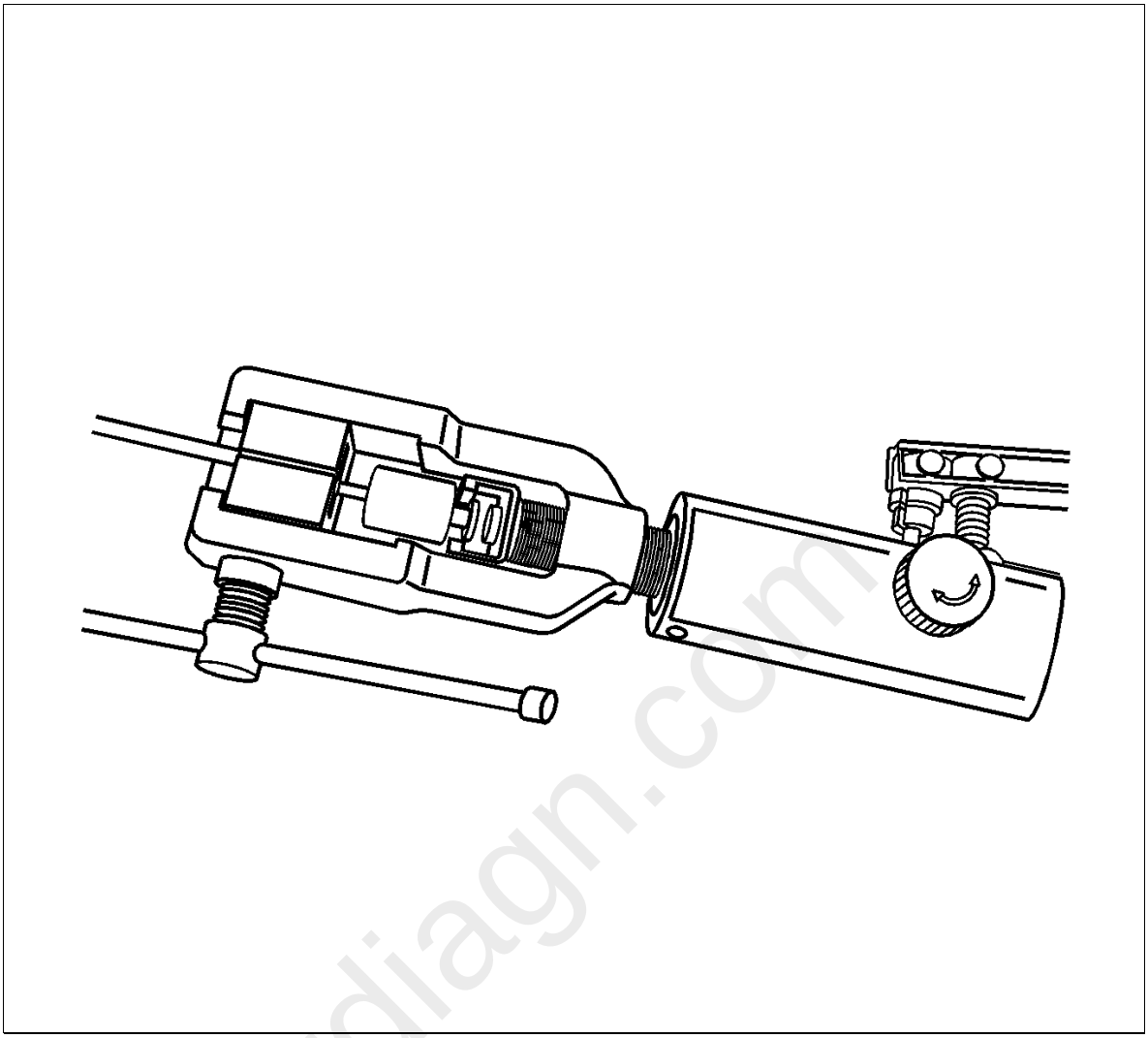


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15. Place the flat face of an unused die (1) against the die halves in the clamping cage and hold firmly against the counterbored face of the dies.
16. Insert the prepared end of the pipe to be flared through the back of the dies until the pipe is seated against the flat surface of the unused die (1).
17. Remove the unused die (1).
18. Ensure that the rear of both dies are seated firmly against the enclosed end of the die cage.
19. Firmly hand tighten the clamping screw (2) against the dies.

Fig 6: Appropriate Forming Mandrel

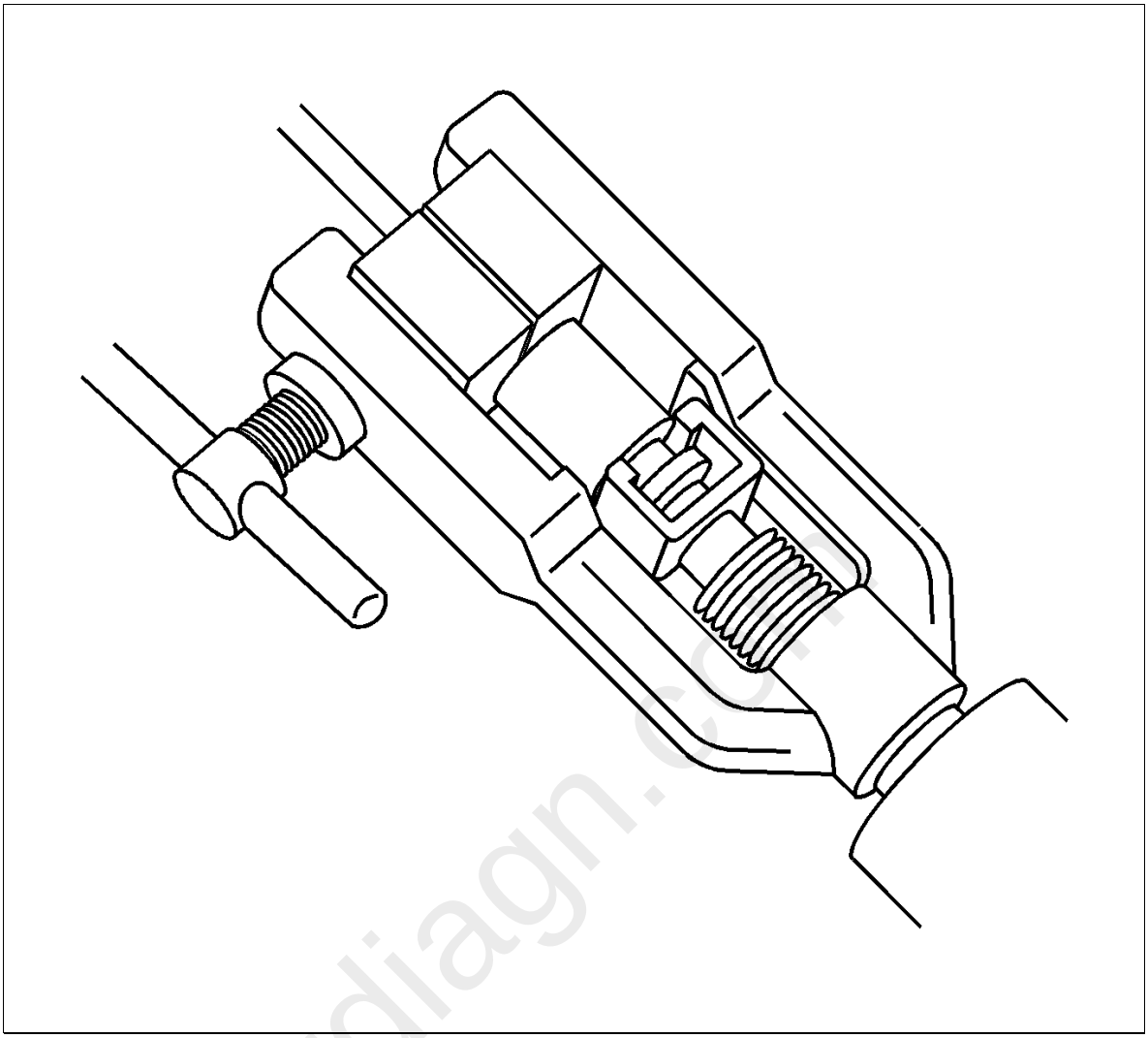


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20. Select the appropriate forming mandrel and place into the forming ram.
21. Rotate the hydraulic fluid control valve clockwise to the closed position.
22. Rotate the body of the **CH-45405** Brake Pipe Flaring Tool Kit until it bottoms against the die cage.

Fig 7: Forming Mandrel Against Clamping Dies Using Pipe Flaring Tool



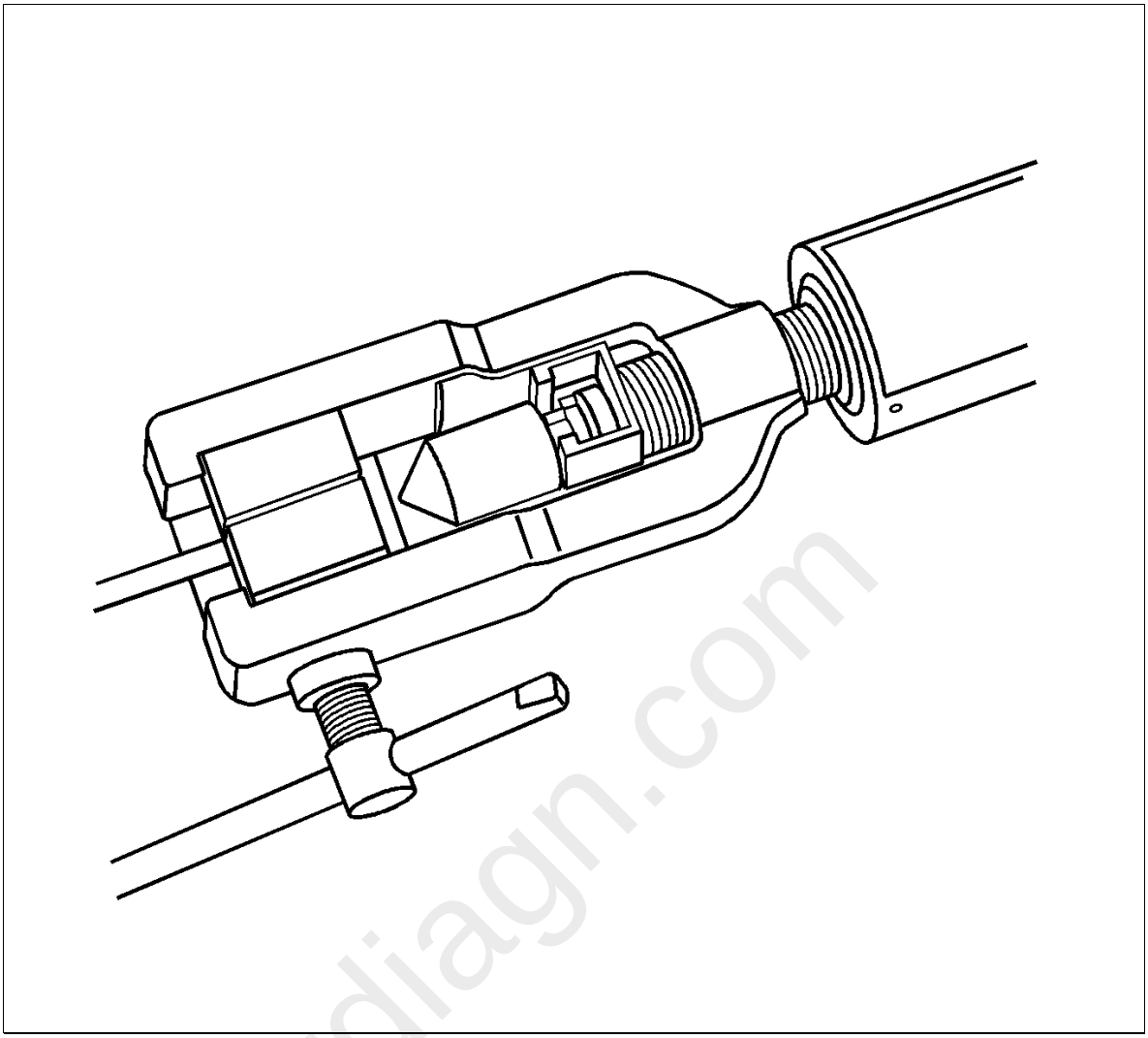
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23. While guiding the forming mandrel into the exposed end of pipe to be flared, operate the lever of the **CH-45405** Pipe Flaring Tool Kit until the forming mandrel bottoms against the clamping dies.

24. Rotate the hydraulic fluid control valve counterclockwise to the open position to allow the hydraulic forming ram to retract.

Fig 8: Pipe Flaring Tool

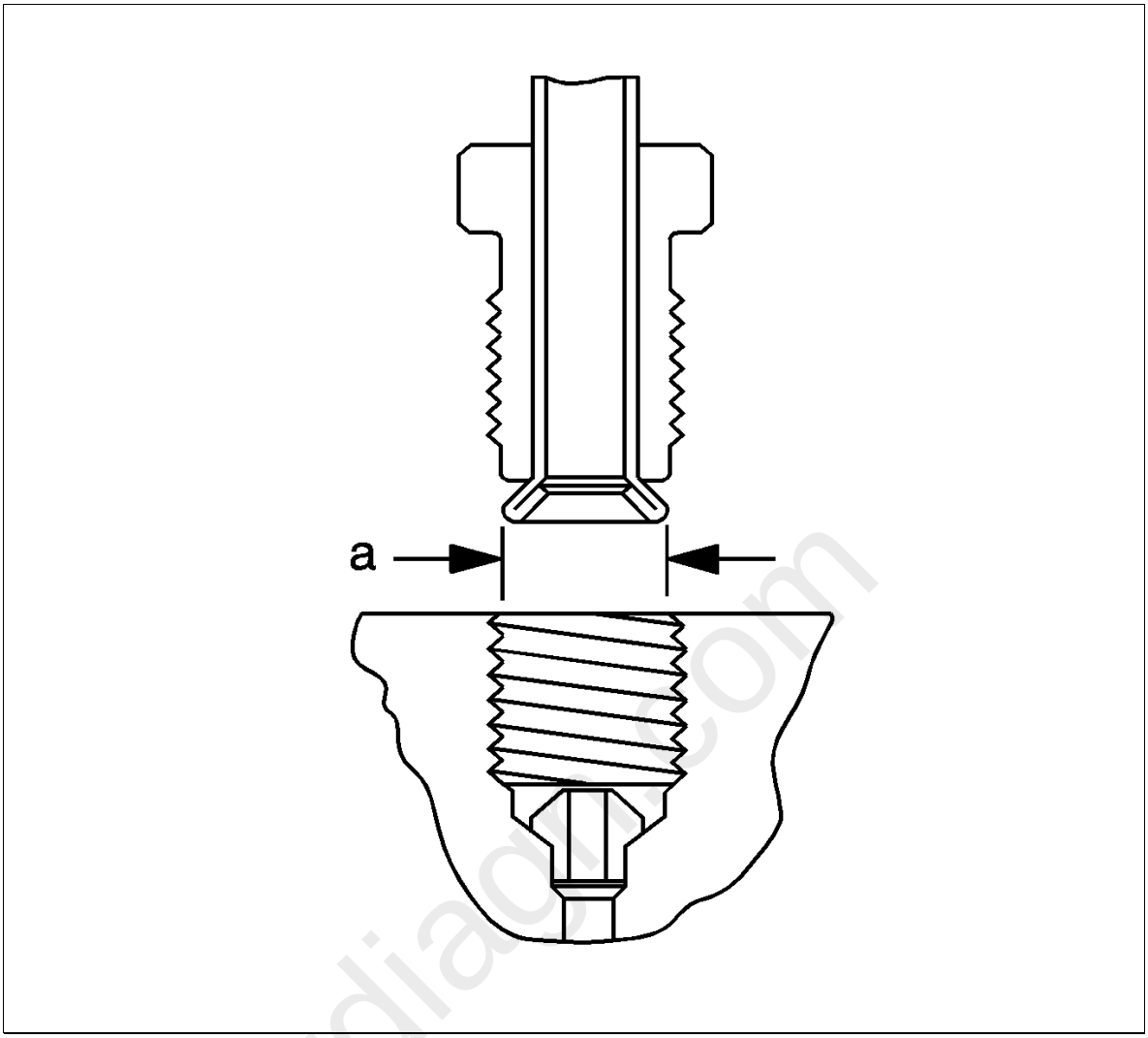


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25. Insert the finishing cone into the forming ram.
26. Rotate the hydraulic fluid control valve clockwise to the closed position.
27. Rotate the body of the **CH-45405** Brake Pipe Flaring Tool Kit until it bottoms against the die cage.
28. While guiding the finishing cone into the exposed end of pipe to be flared, operate the lever of the **CH-45405** Brake Pipe Flaring Tool Kit until the finishing cone bottoms against the dies.
29. Rotate the hydraulic fluid control valve counterclockwise to the open position to allow the hydraulic forming ram to retract.
30. Loosen the die clamping screw and remove the dies and pipe.
31. If necessary, lightly tap the dies until the die halves separate.

Fig 9: Correct Brake Pipe Flare Shape & Diameter



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32. Inspect the brake pipe flare for correct shape and diameter (a).

    Specification

    1. 6.74-7.10 mm (0.265-0.279 in) flare diameter for 4.76 mm (3/16 in) diameter pipe
    2. 8.57-9.27 mm (0.344-0.358 in) flare diameter for 6.35 mm (1/4 in) diameter pipe
    3. 10.42-10.79 mm (0.410-0.425 in) flare diameter for 7.94 mm (5/16 in) diameter pipe

33. If necessary, using the removed section of brake pipe as a template, shape the new pipe with a suitable brake pipe bending tool.

> *NOTE:*
>
> *When installing the pipe, maintain a clearance of 19 mm (3/4 in) from all moving or vibrating components.*

34. Install the pipe to the vehicle with the appropriate brake pipe unions, as required.
35. If previously released, secure the brake pipe to the retainers.
36. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) .
37. With the aid of an assistant, inspect the brake pipe flares for leaks by starting the engine and applying the brakes.

REPAIR INSTRUCTIONS > FRONT BRAKE HOSE REPLACEMENT (J55, J6G) > REMOVAL PROCEDURE

WARNING:

Brake Dust Warning

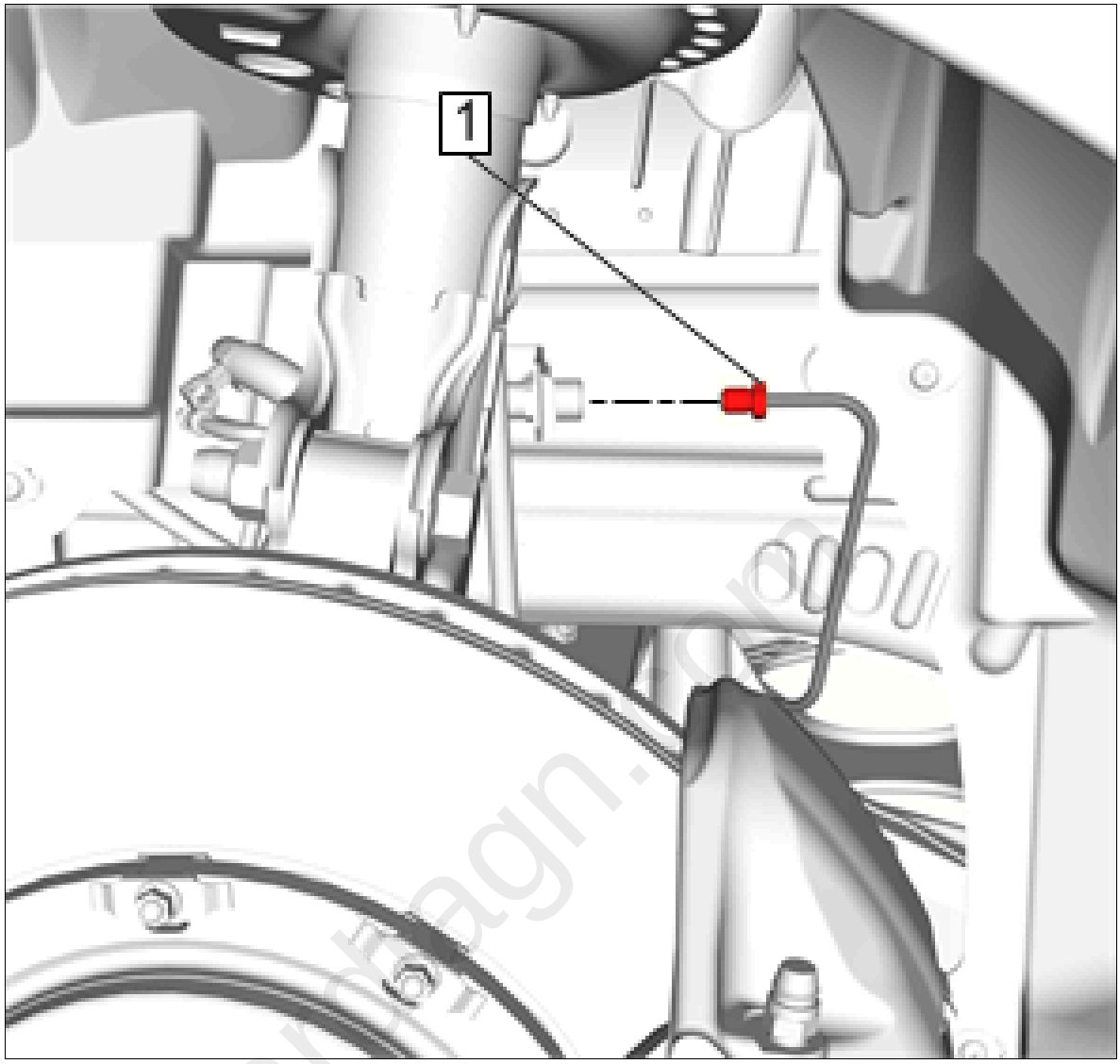
WARNING:

Brake Fluid Irritant Warning

1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Remove the tire and wheel assembly. Tire and Wheel Removal and Installation
3. Remove Front Wheelhouse Splash Shield Replacement .

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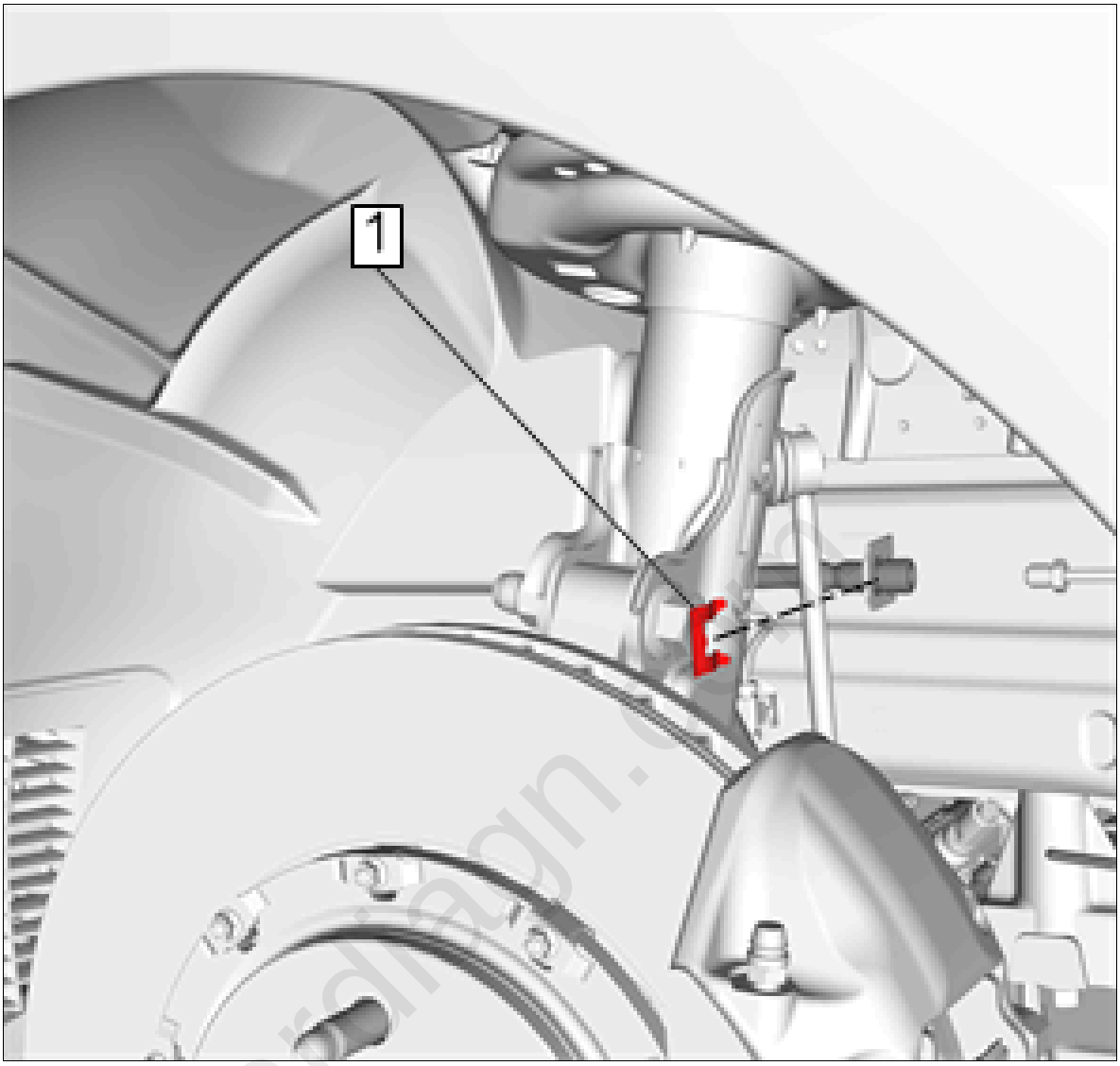
Fig 1: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Brake Pipe Fitting (1).
5. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

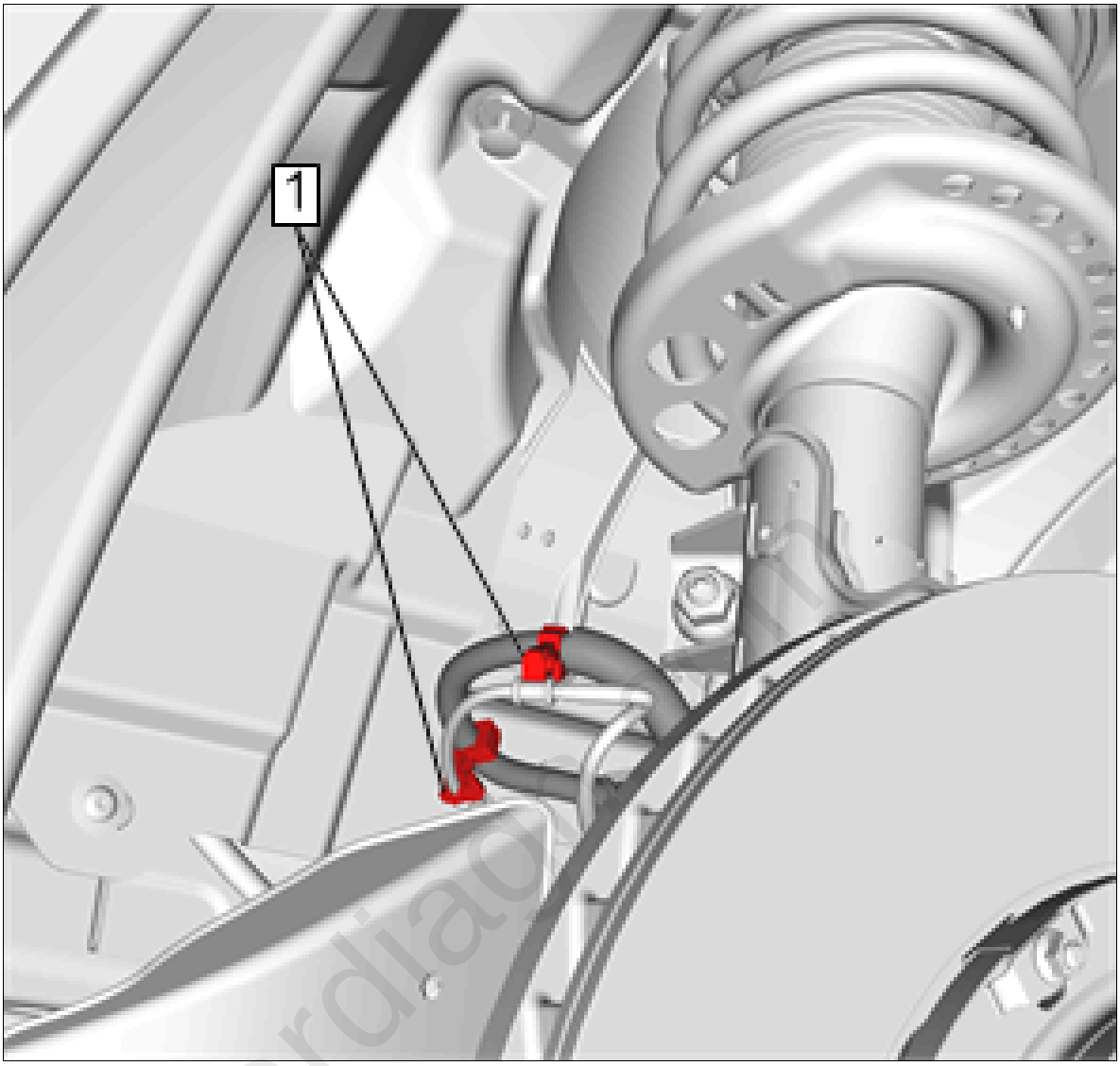
Fig 2: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Remove Brake Hose Retainer (1).

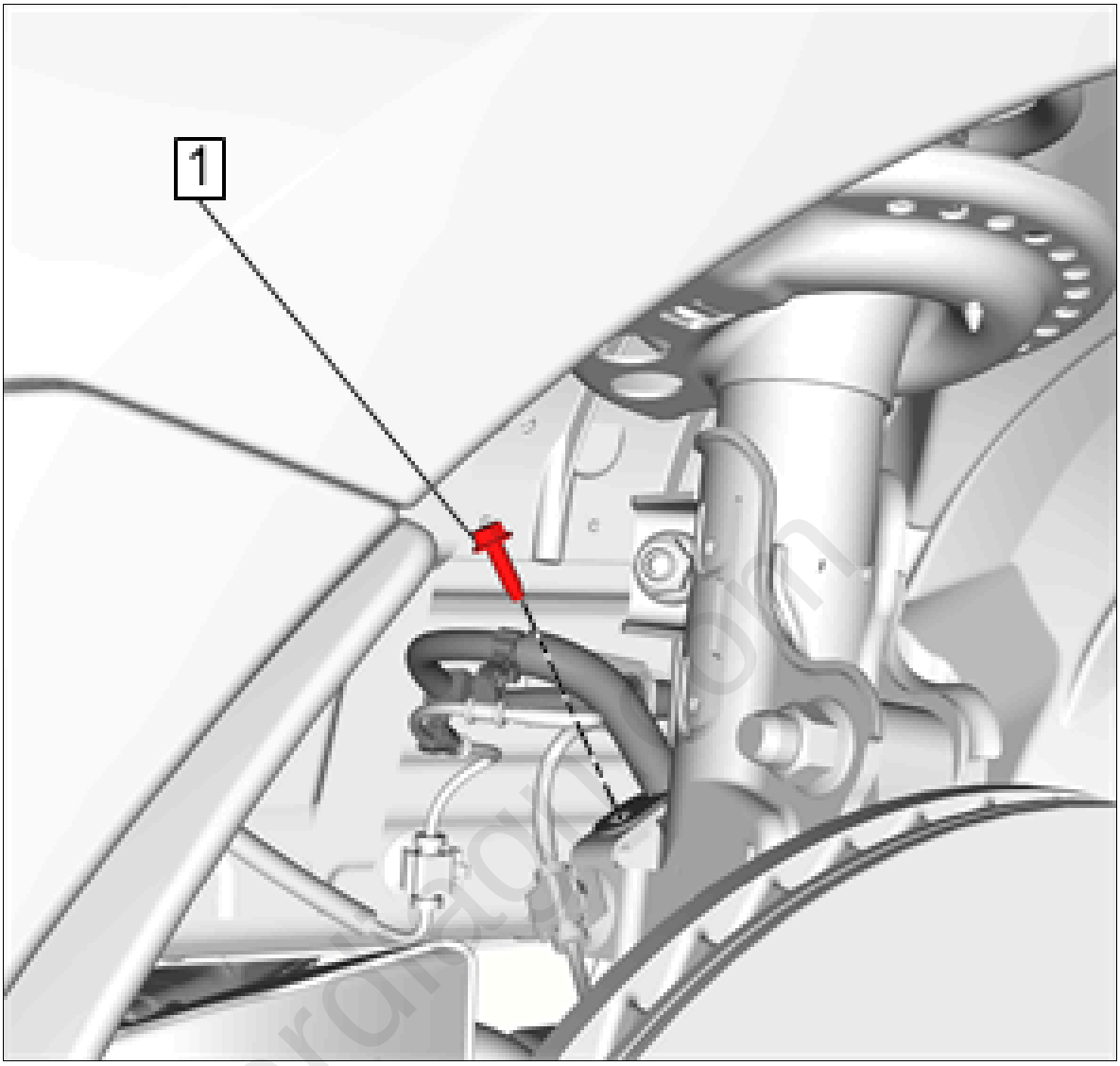
Fig 3: Wheel Speed Sensor Harness Clip



Courtesy of GENERAL MOTORS COMPANY

7. Release Wheel Speed Sensor Harness Clip (1) (Qty: 2) at Brake Hose.

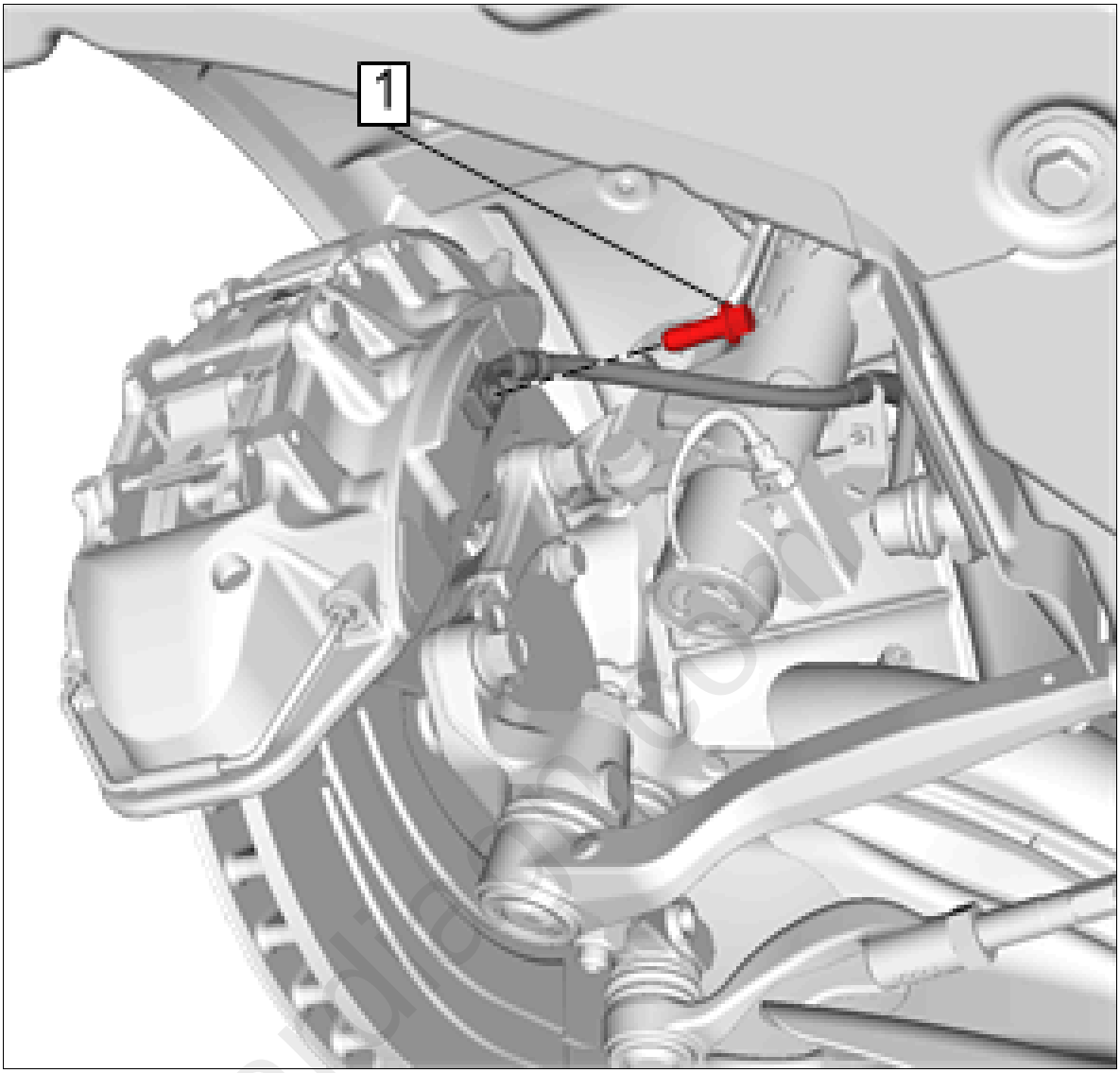
Fig 4: Brake Hose Clamp Bolt



Courtesy of GENERAL MOTORS COMPANY

8. Remove Bolt (1).

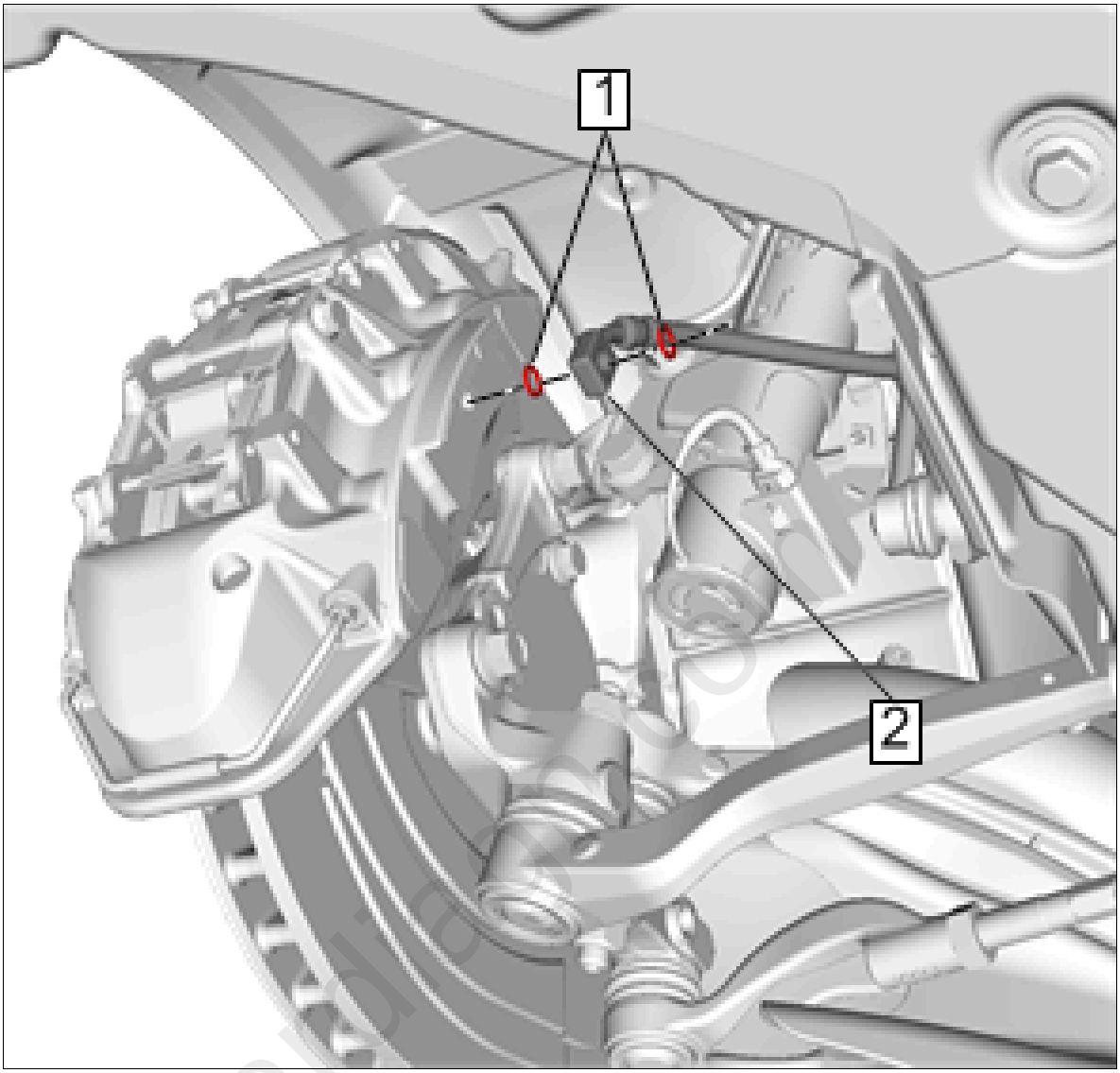
Fig 5: Brake Hose Fitting Bolt



Courtesy of GENERAL MOTORS COMPANY

9. Remove Brake Hose Fitting Bolt (1).

Fig 6: Brake Hose Fitting Gaskets



Courtesy of GENERAL MOTORS COMPANY

NOTE:

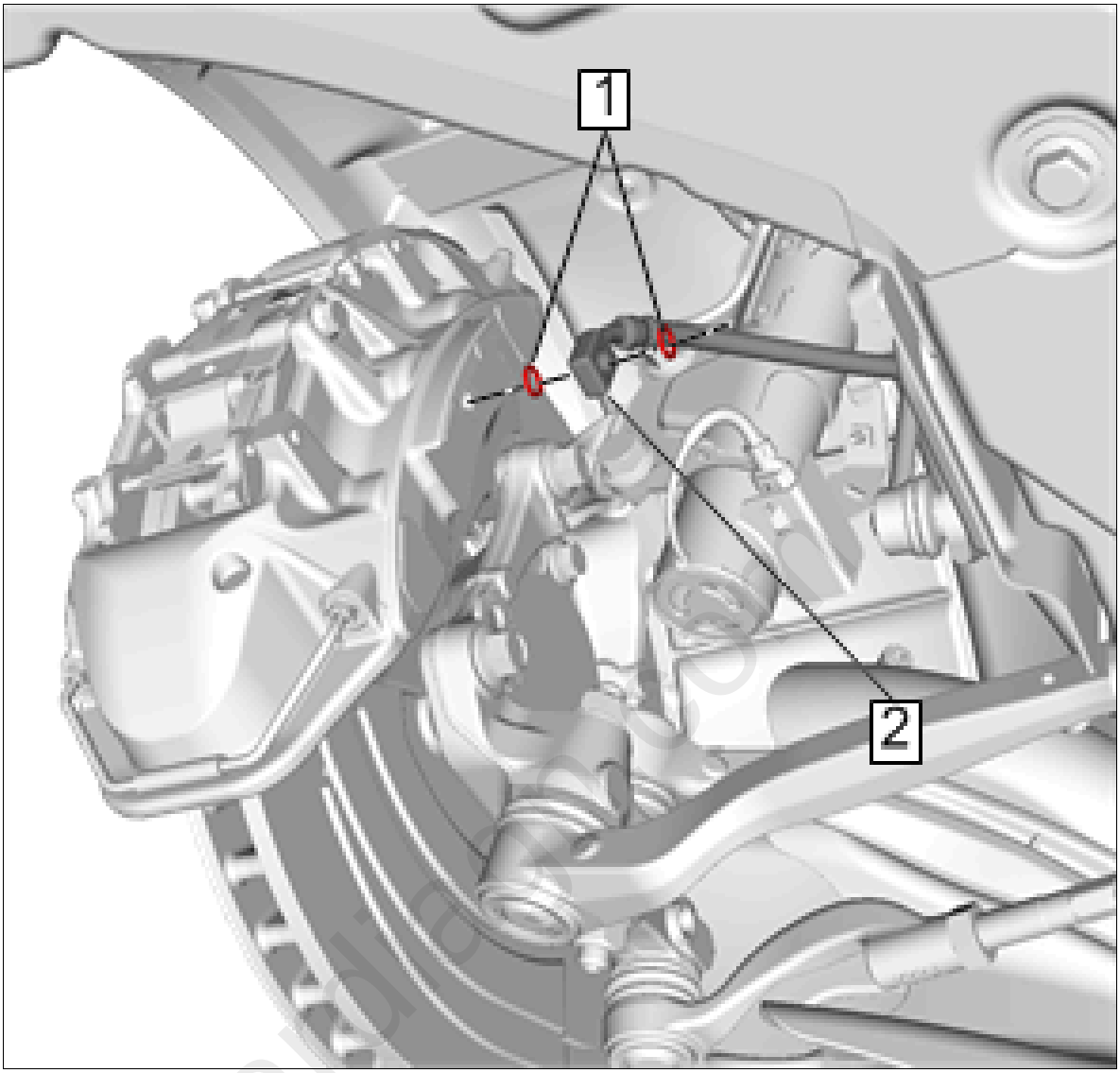
Do not reuse the brake hose fitting gaskets.

10. Remove Brake Hose Fitting Gasket (1) (Qty: 2) at Front Brake Hose (2) and DISCARD
11. Remove Front Brake Hose.

REPAIR INSTRUCTIONS > FRONT BRAKE HOSE REPLACEMENT (J55, J6G) > INSTALLATION PROCEDURE

1. Install Front Brake Hose.

Fig 1: Brake Hose Fitting Gaskets



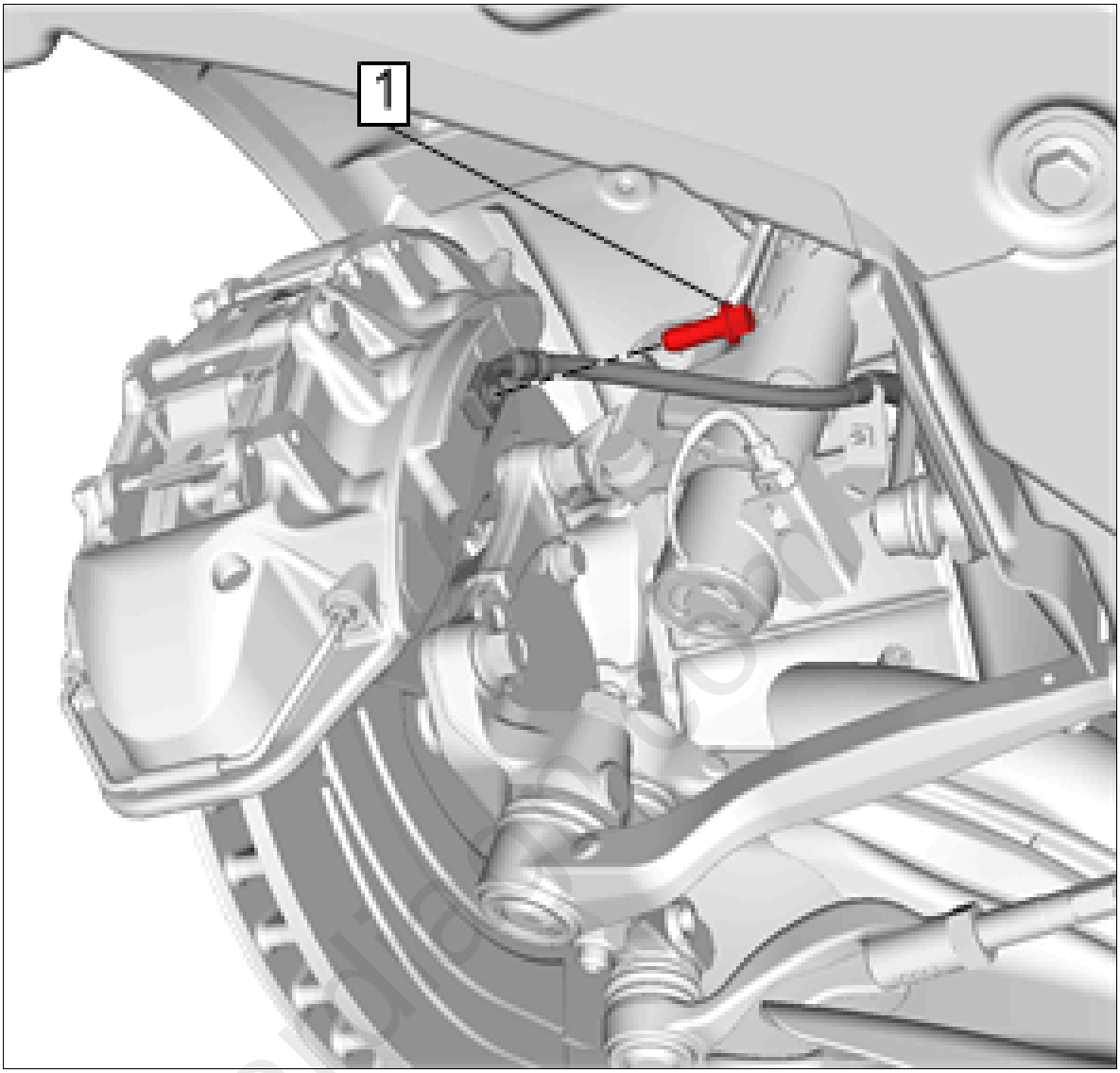
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Install NEW brake hose fitting gaskets.

2. Install Brake Hose Fitting Gasket (1) (Qty: 2) at Front Brake Hose.

Fig 2: Brake Hose Fitting Bolt

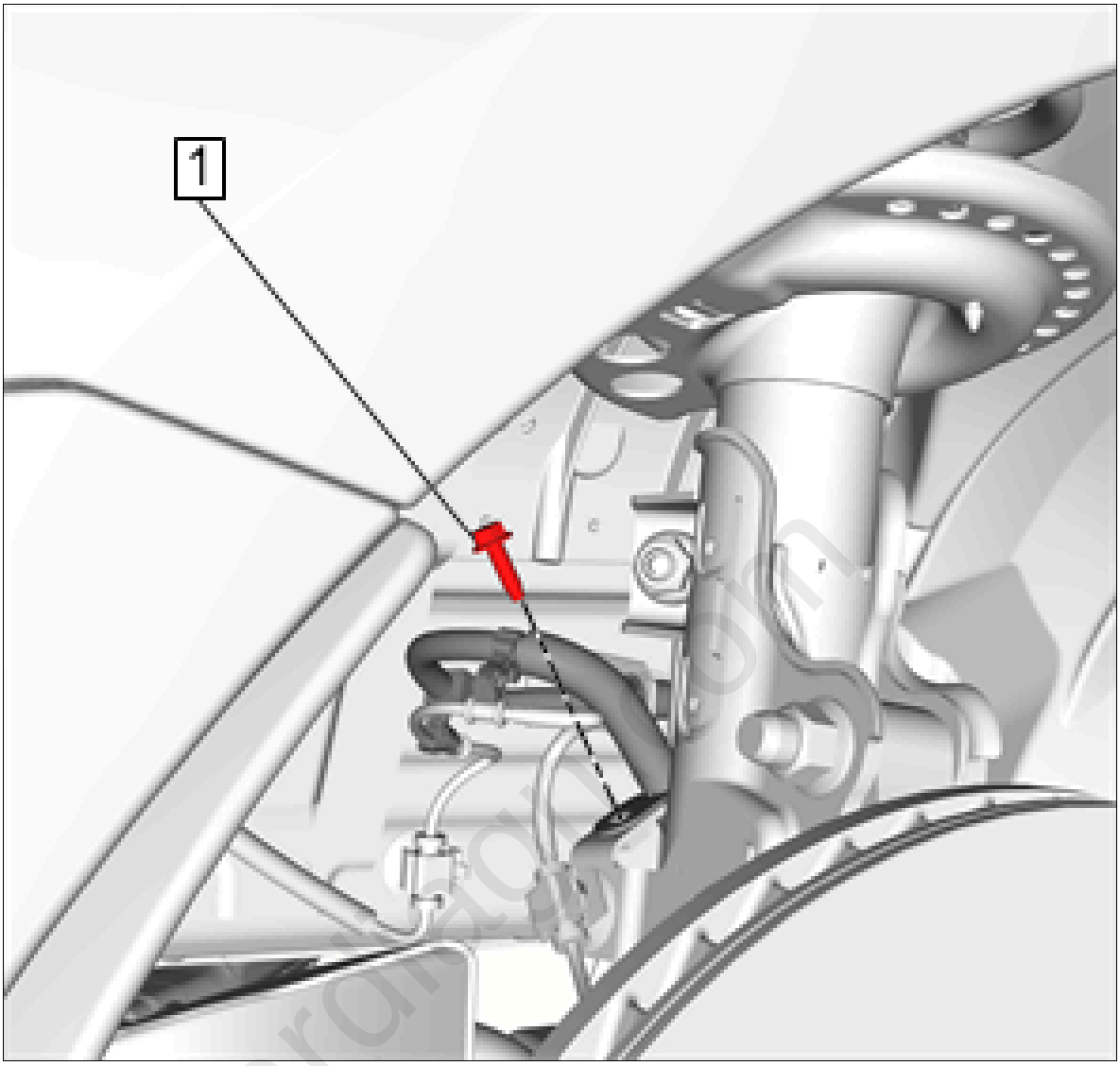


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Fastener Caution*

3. Install Brake Hose Fitting Bolt (1) and tighten to 40 N.m (30 lb ft).

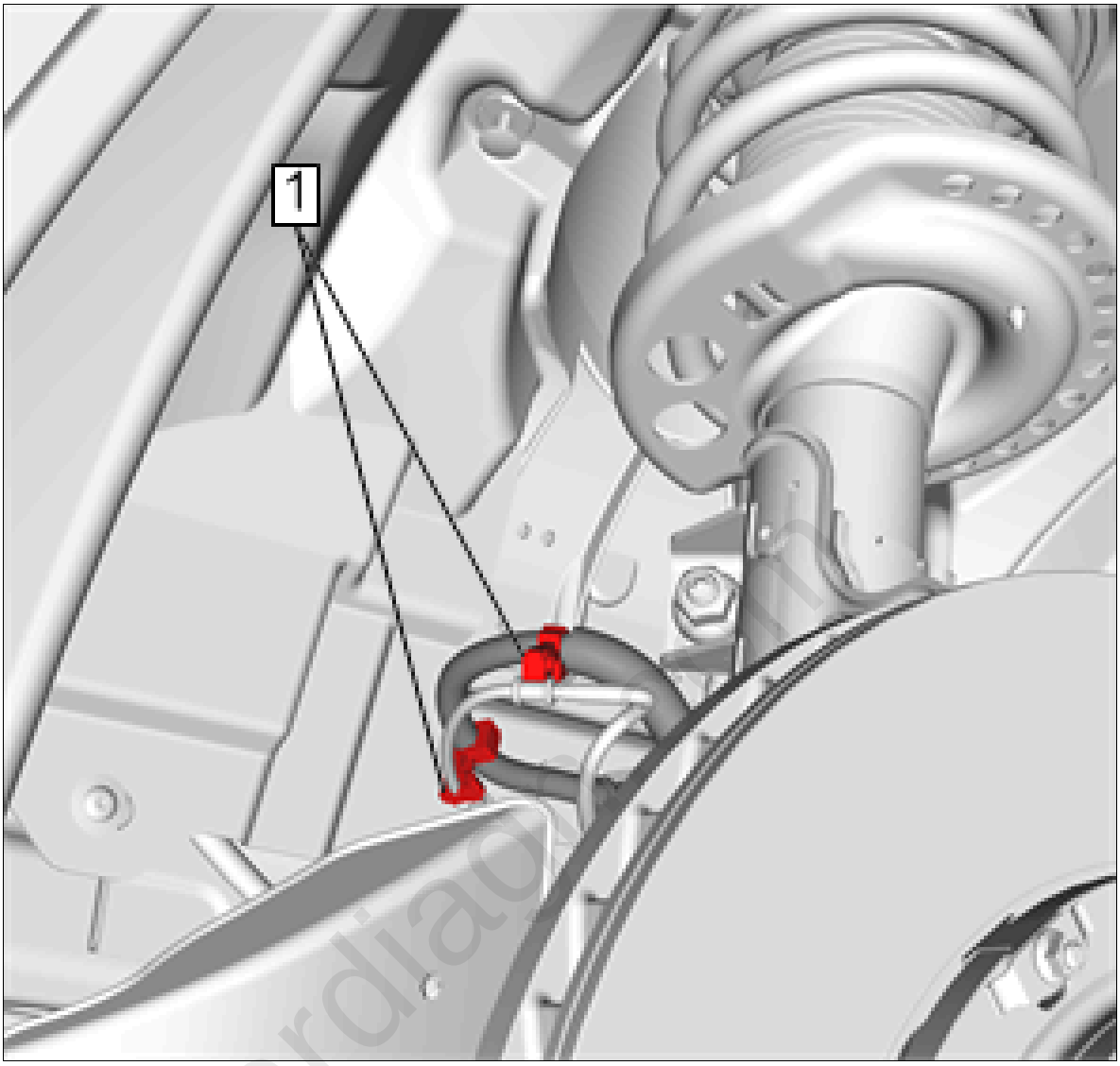
Fig 3: Brake Hose Clamp Bolt



Courtesy of GENERAL MOTORS COMPANY

4. Install Bolt (1) and tighten to 10 N.m (89 lb in).

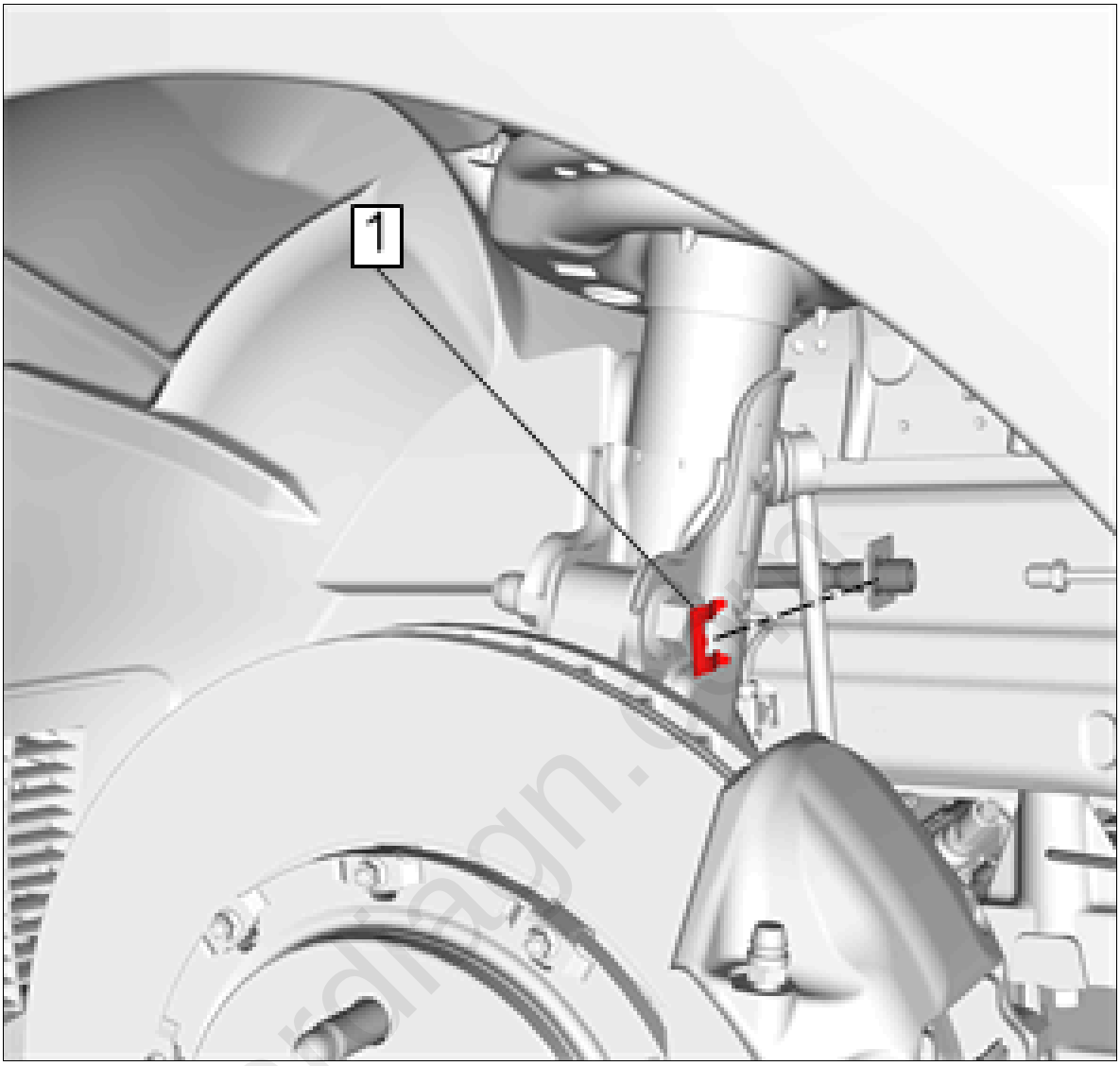
Fig 4: Wheel Speed Sensor Harness Clip



Courtesy of GENERAL MOTORS COMPANY

5. Secure Wheel Speed Sensor Harness Clip (1) (Qty: 2) at Brake Hose.

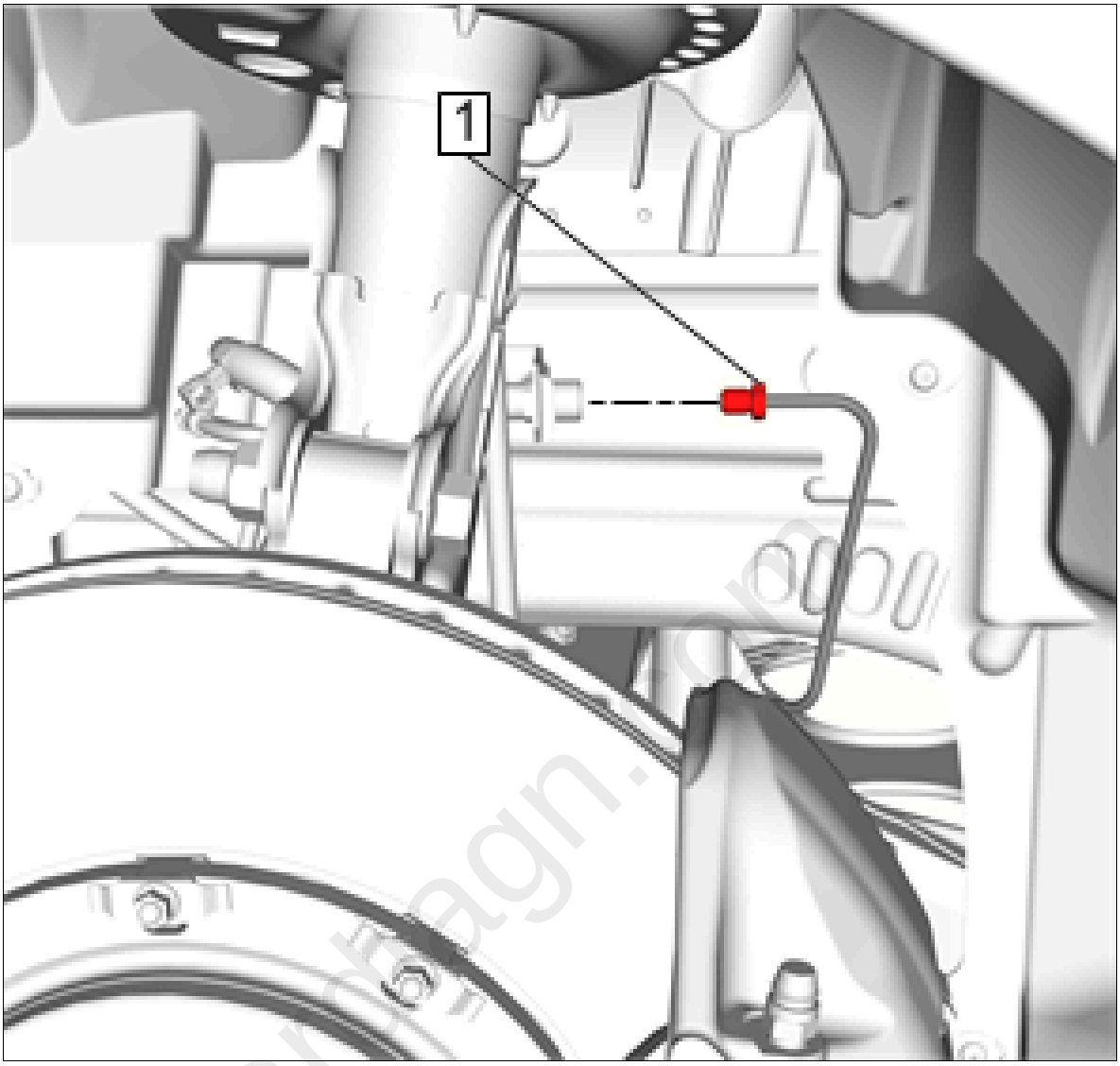
Fig 5: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Install Brake Hose Retainer (1).

Fig 6: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

7. Install Brake Pipe Fitting (1) and tighten to 18 N.m (13 lb ft).
8. Bleed the brake system. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G)
9. Install Front Wheelhouse Splash Shield Replacement .
10. Install the tire and wheel assembly. Tire and Wheel Removal and Installation .

REPAIR INSTRUCTIONS > FRONT BRAKE HOSE REPLACEMENT (JL9) > REMOVAL PROCEDURE

WARNING:

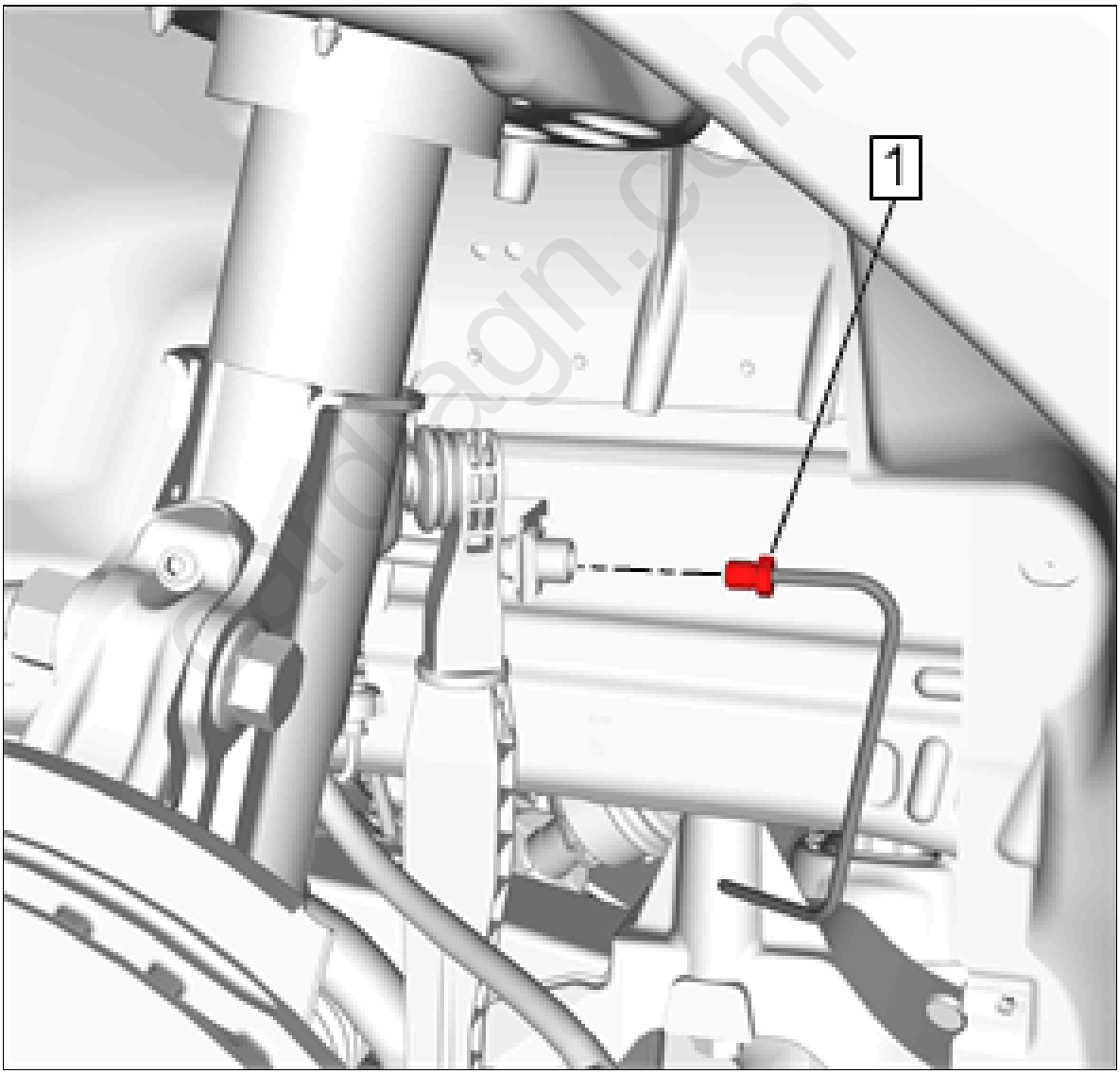
Brake Dust Warning

WARNING:

Brake Fluid Irritant Warning

1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Remove the tire and wheel assembly. Tire and Wheel Removal and Installation
3. Remove Front Wheelhouse Splash Shield Replacement .

   Fig 1: Brake Pipe Fitting

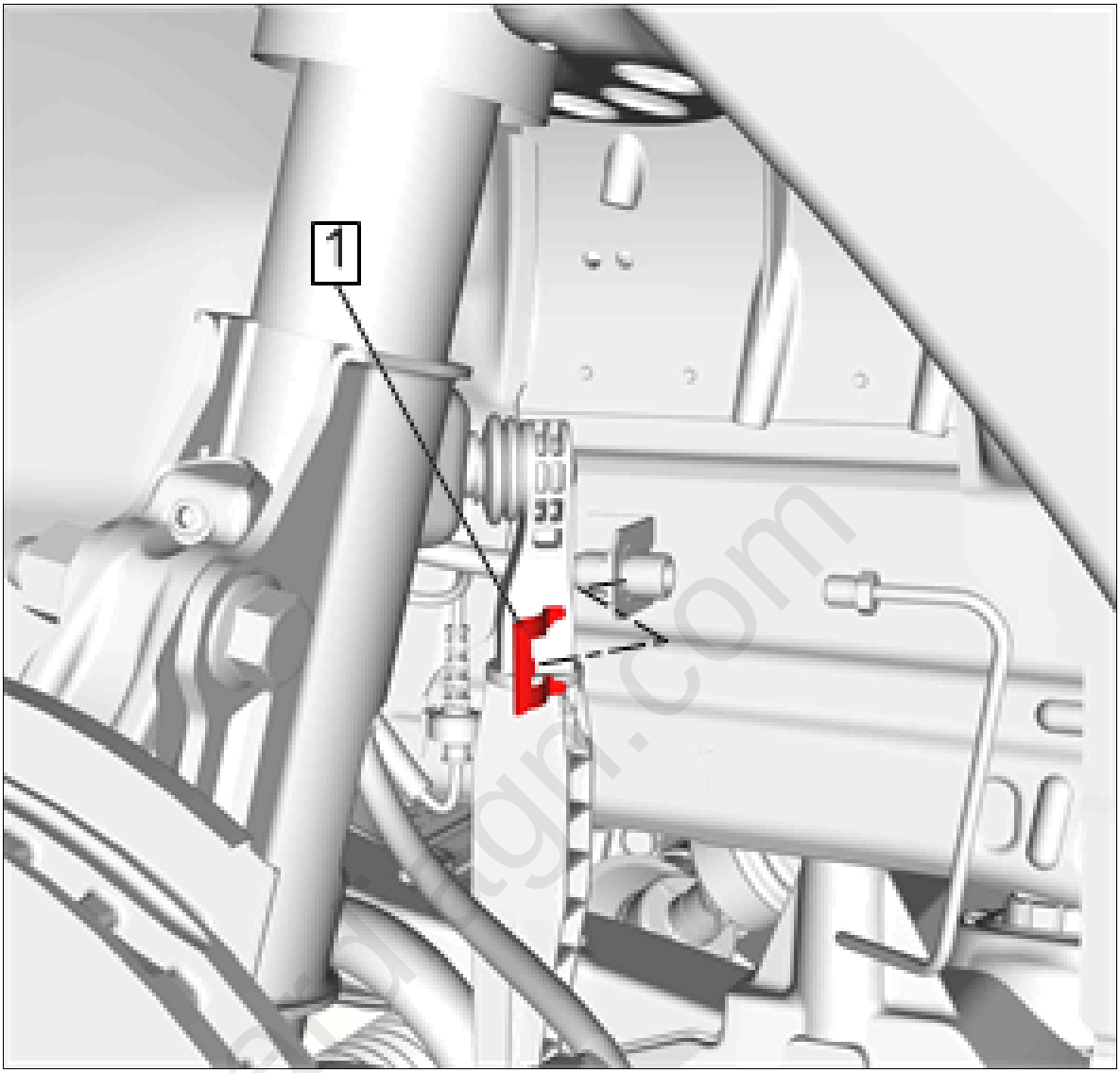


Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Brake Pipe Fitting (1).

5. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

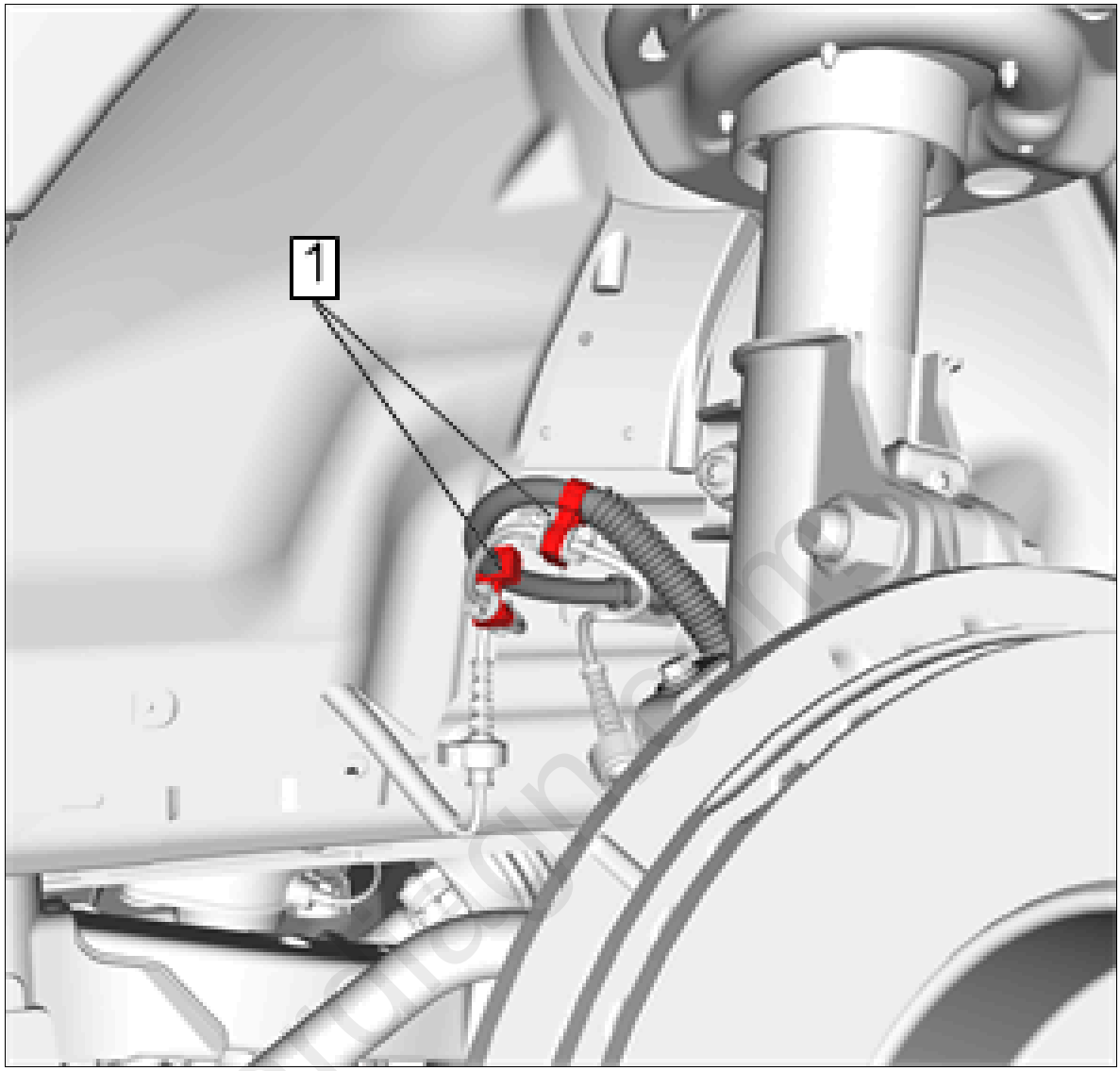
Fig 2: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Remove Brake Hose Retainer (1).

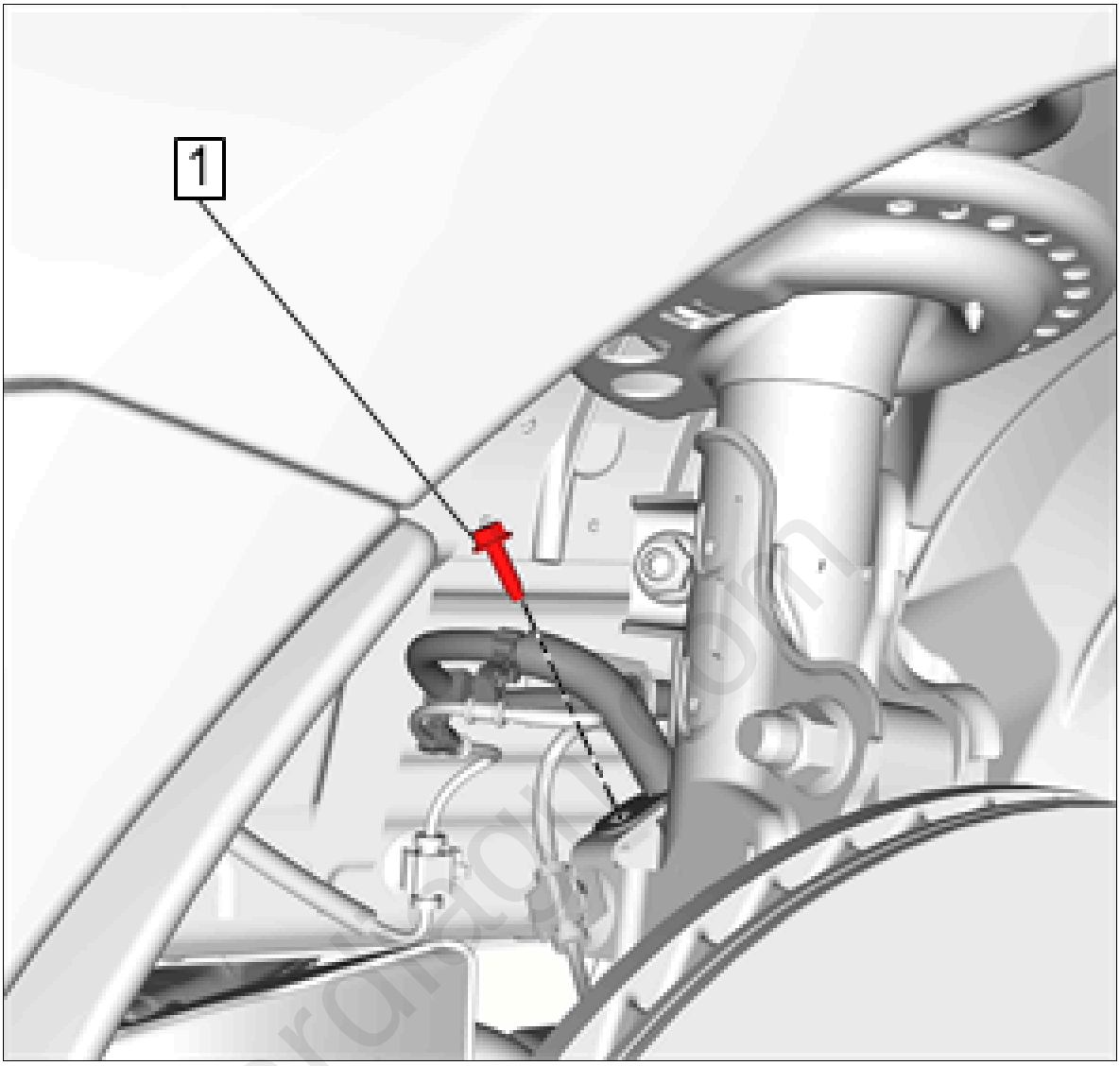
Fig 3: Wheel Speed Sensor Harness Clip



Courtesy of GENERAL MOTORS COMPANY

7. Release Wheel Speed Sensor Harness Clip (1) (Qty: 2) at Brake Hose.

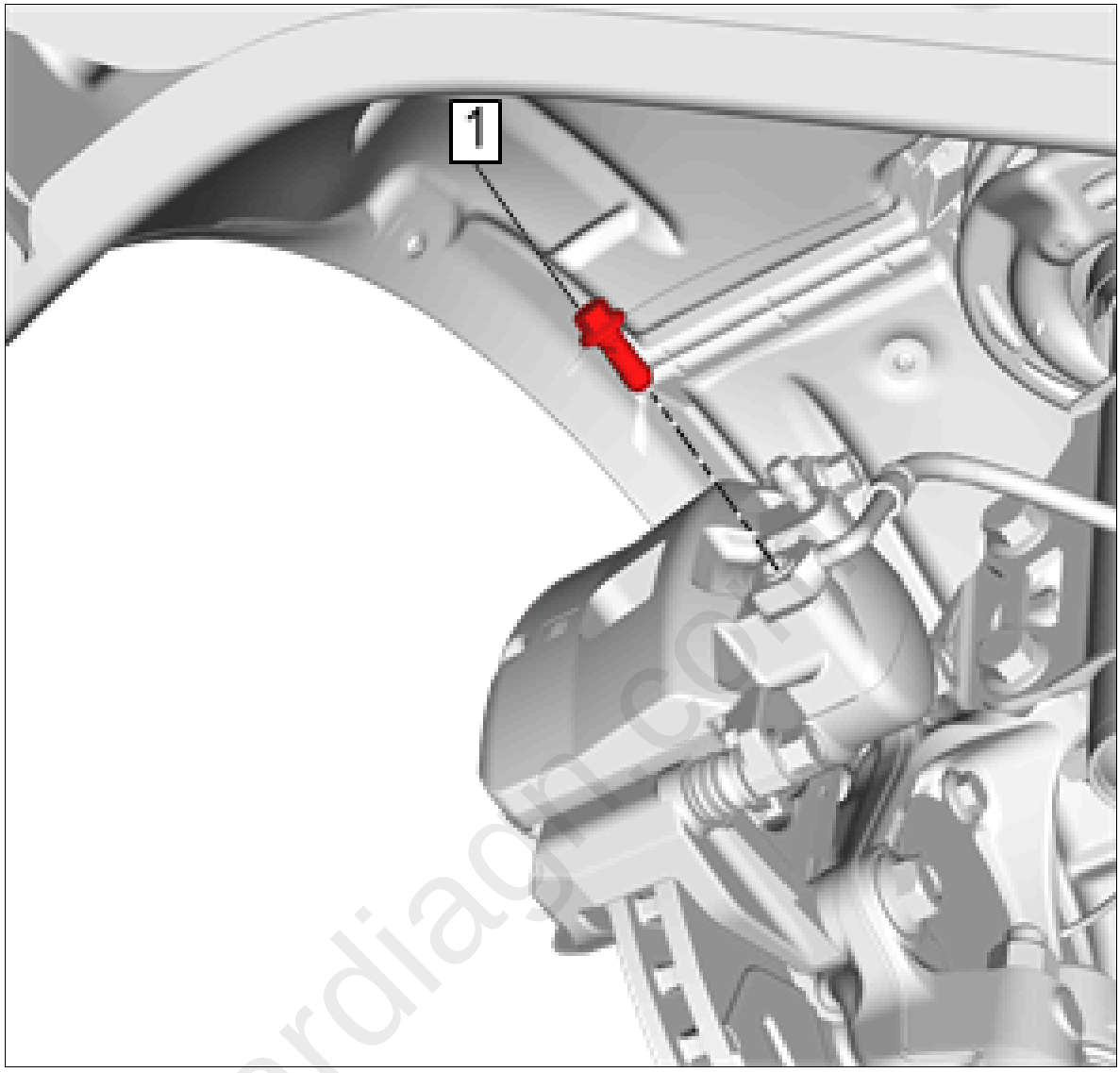
Fig 4: Brake Hose Clamp Bolt



Courtesy of GENERAL MOTORS COMPANY

8. Remove Bolt (1).

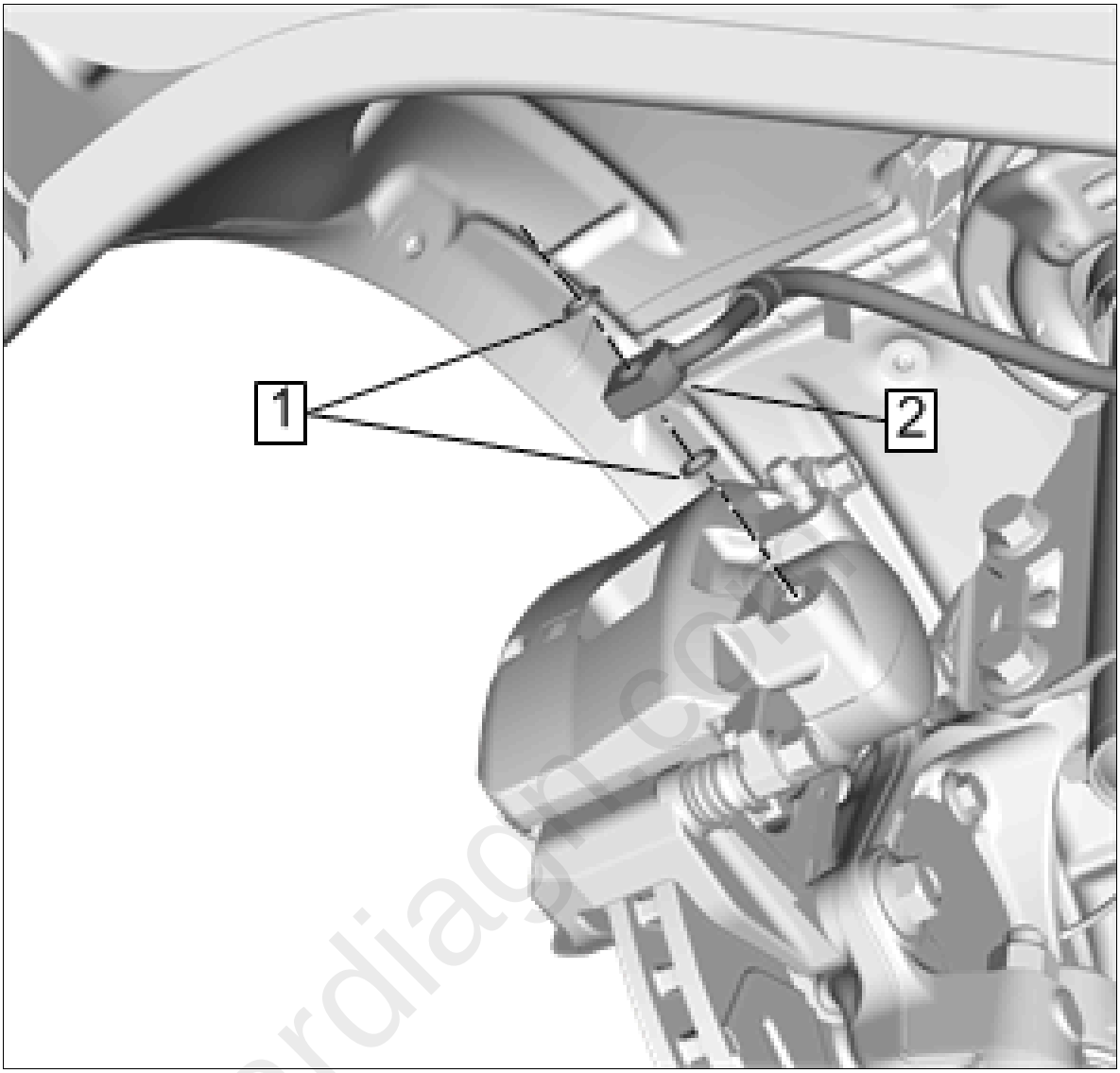
Fig 5: Brake Hose Fitting Bolt



Courtesy of GENERAL MOTORS COMPANY

9. Remove Brake Hose Fitting Bolt (1).

Fig 6: Brake Hose Fitting Gasket At Front Brake Hose



Courtesy of GENERAL MOTORS COMPANY

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NOTE:

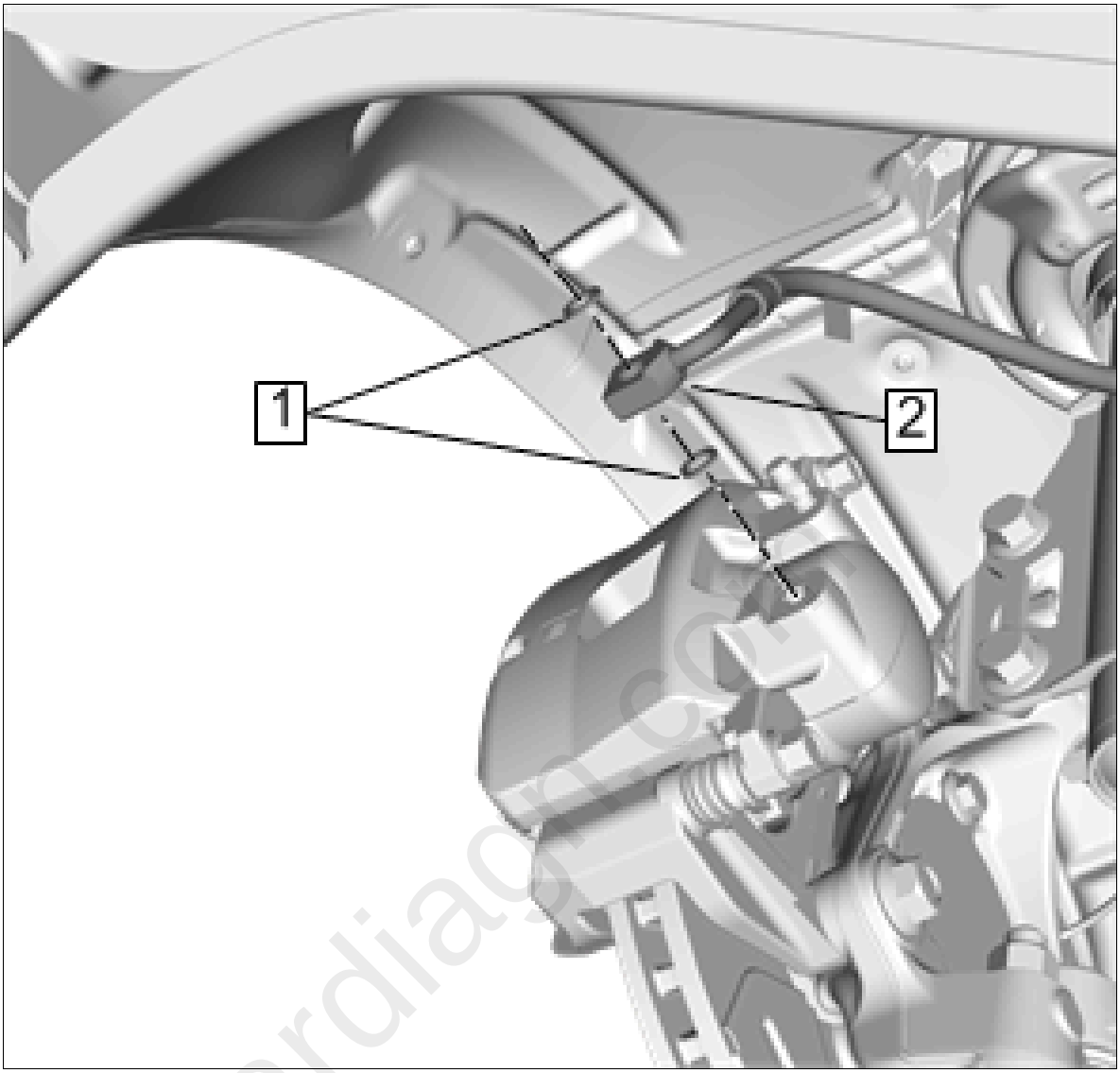
Do not reuse the brake hose fitting gaskets.

10. Remove Brake Hose Fitting Gasket (1) (Qty: 2) at Front Brake Hose (2) and DISCARD.
11. Remove Front Brake Hose.

REPAIR INSTRUCTIONS > FRONT BRAKE HOSE REPLACEMENT (JL9) > INSTALLATION PROCEDURE

1. Install Front Brake Hose.

Fig 1: Brake Hose Fitting Gasket At Front Brake Hose



Courtesy of GENERAL MOTORS COMPANY

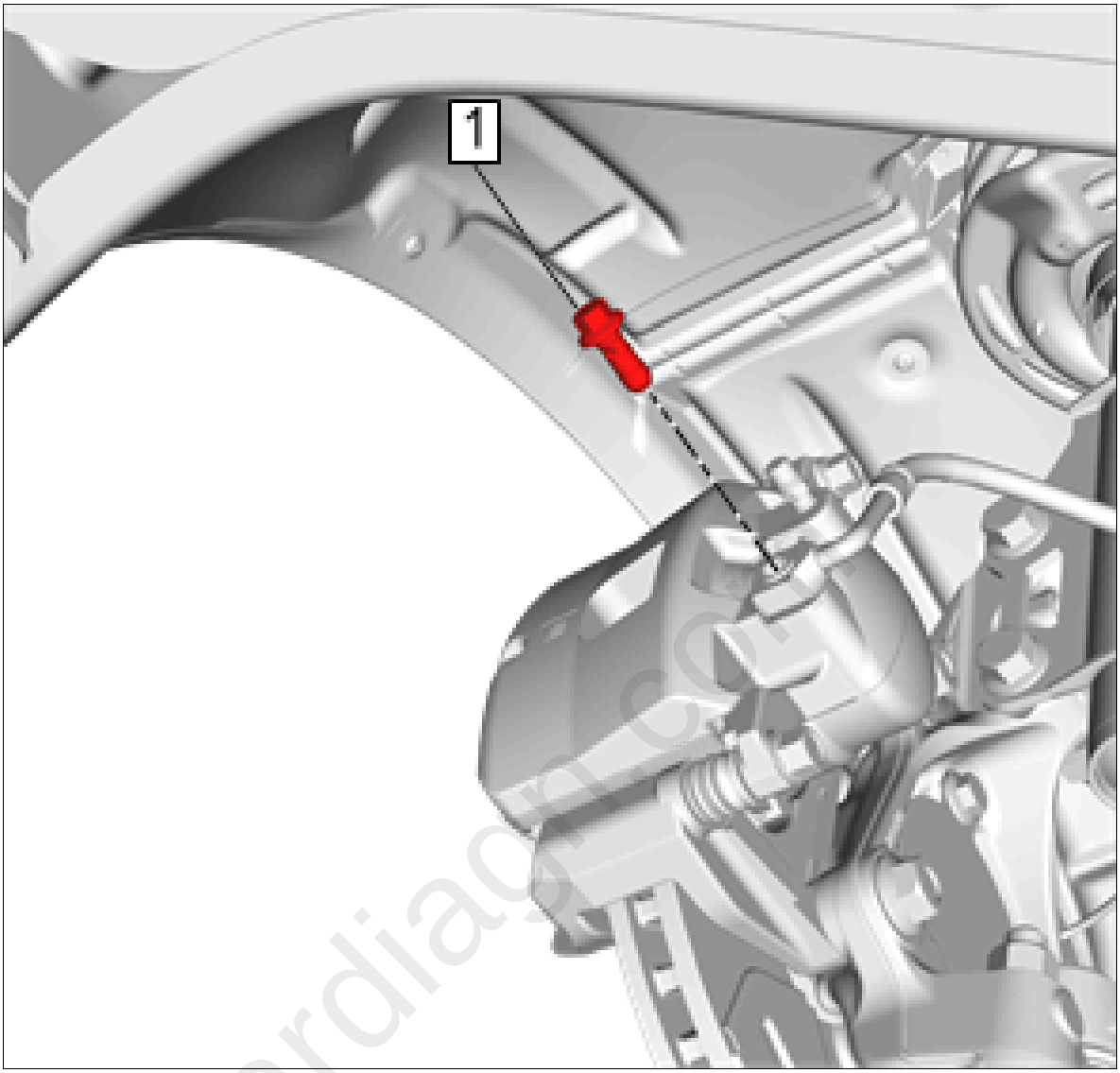
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NOTE:

Install NEW brake hose fitting gaskets.

2. Install Brake Hose Fitting Gasket (1) (Qty: 2) at Front Brake Hose (2).

Fig 2: Brake Hose Fitting Bolt



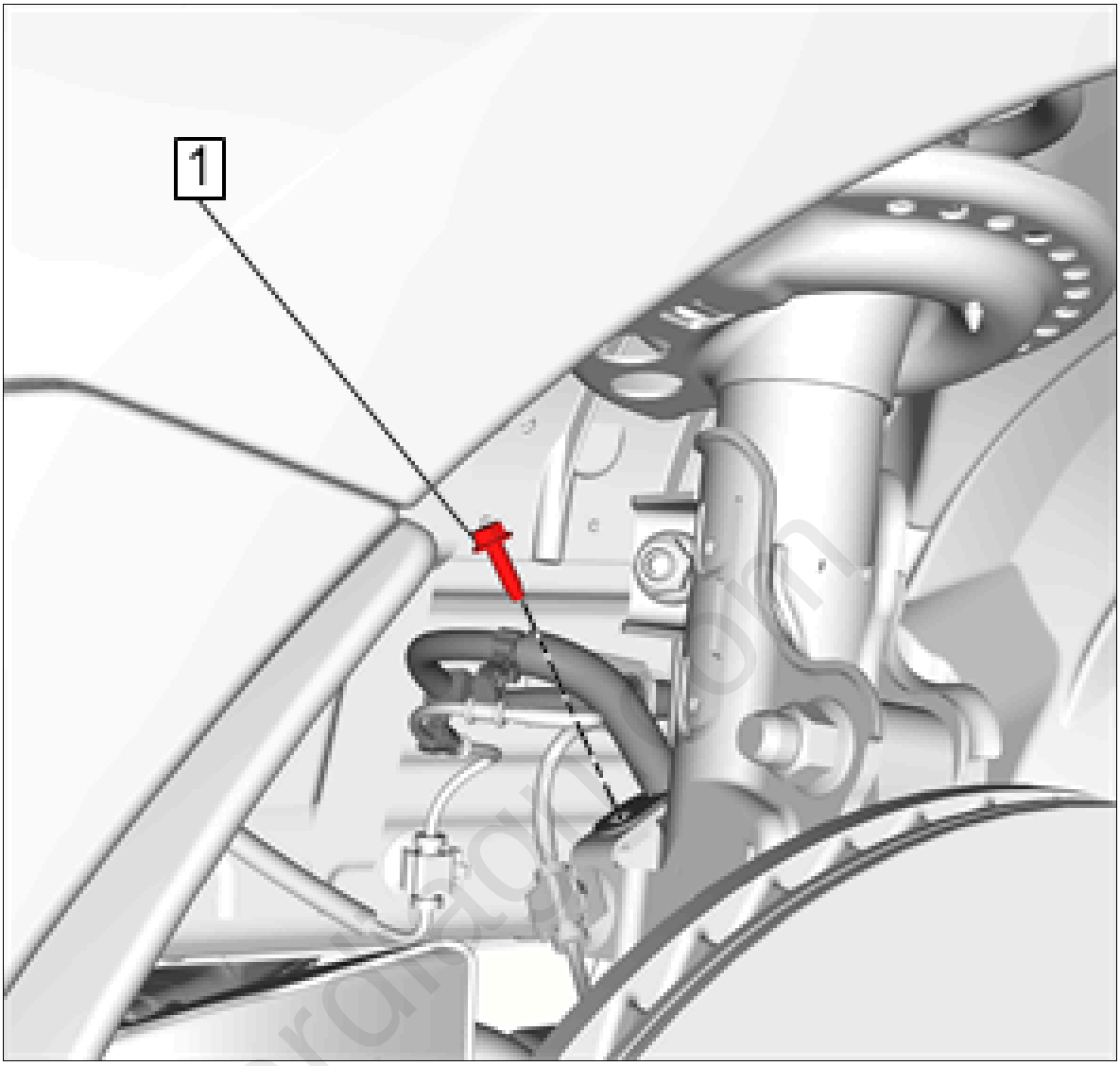
Courtesy of GENERAL MOTORS COMPANY

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> ⚠ *CAUTION:*
>
> *Fastener Caution*

3. Install Brake Hose Fitting Bolt (1) and tighten 40 N.m (30 lb ft).

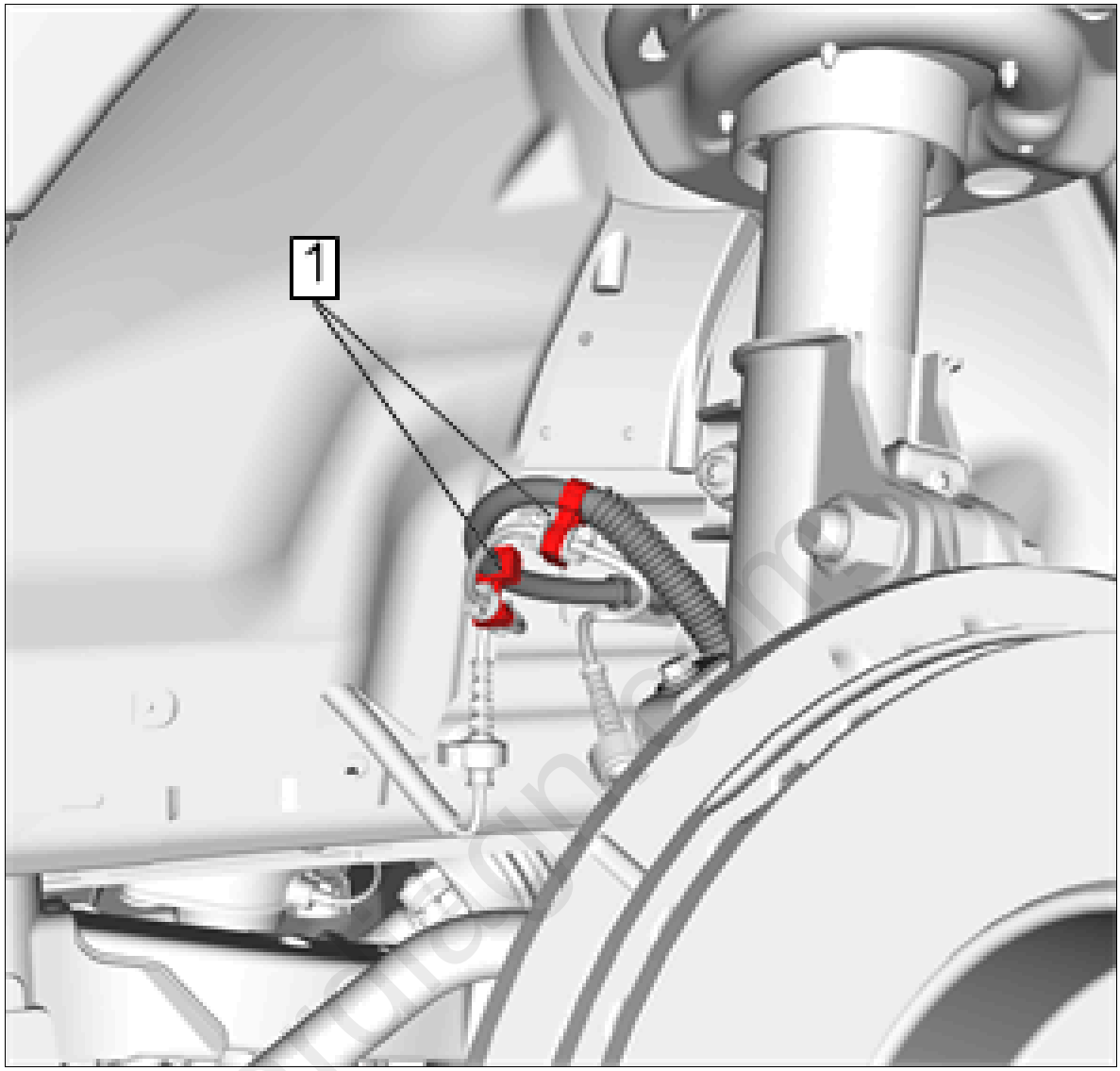
Fig 3: Brake Hose Clamp Bolt



Courtesy of GENERAL MOTORS COMPANY

4. Install Bolt (1) and tighten to 10 N.m (89 lb in).

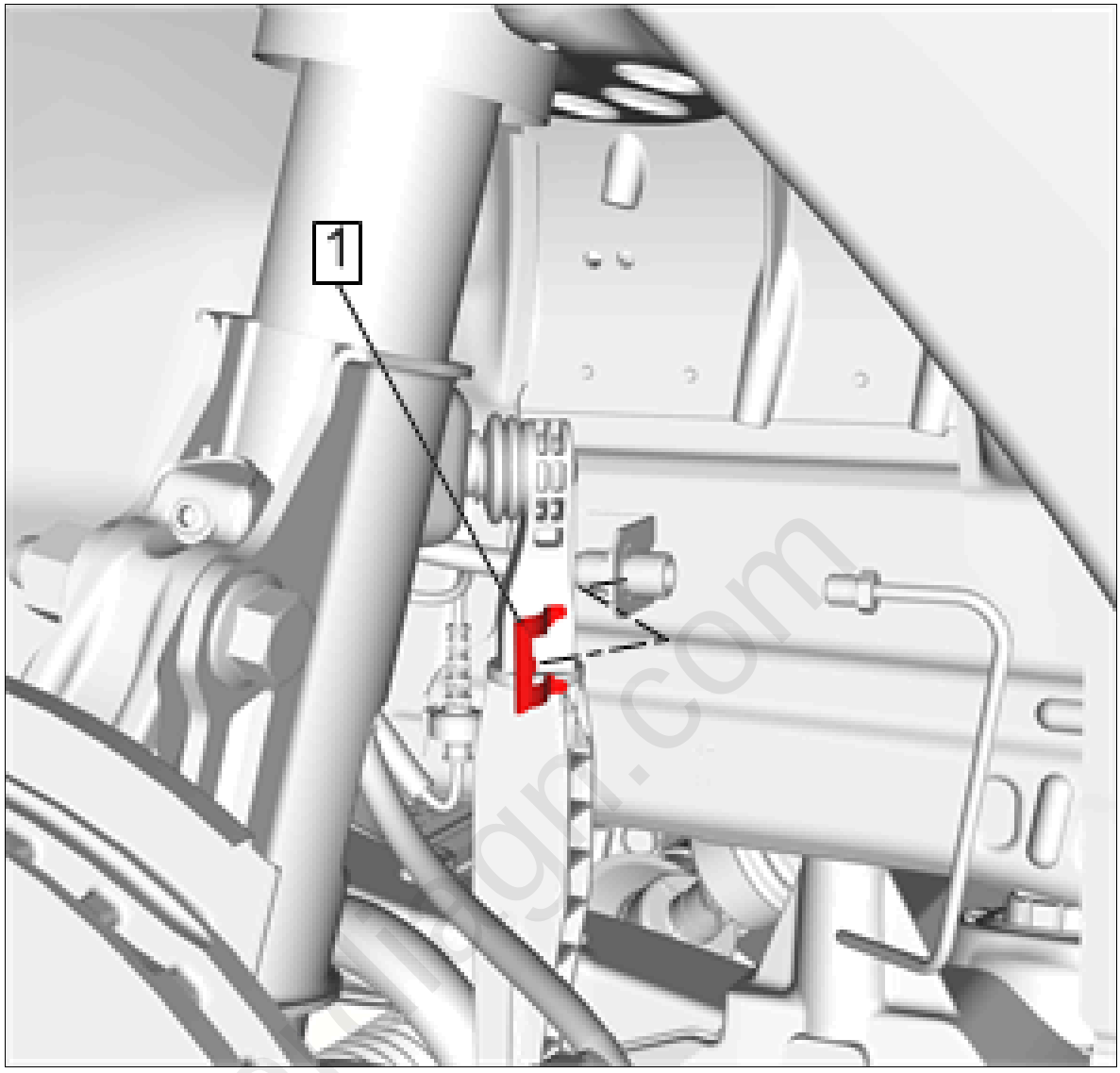
Fig 4: Wheel Speed Sensor Harness Clip



Courtesy of GENERAL MOTORS COMPANY

5. Secure Wheel Speed Sensor Harness Clip (1) (Qty: 2) at Brake Hose.

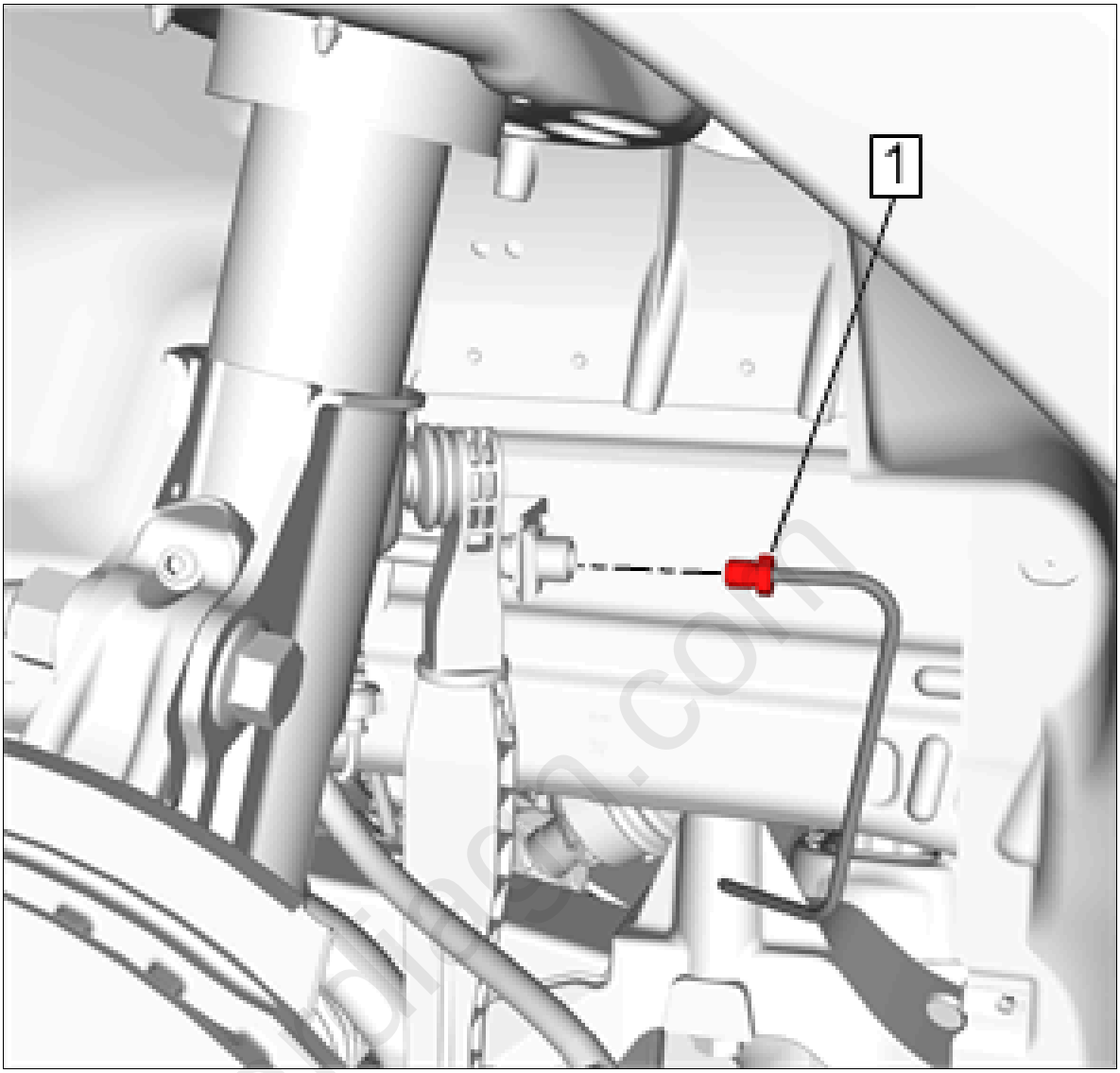
Fig 5: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Install Brake Hose Retainer (1).

Fig 6: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

7. Install Brake Pipe Fitting (1) and tighten to 18 N.m (13 lb ft).
8. Bleed the brake system. Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9)
9. Install Front Wheelhouse Splash Shield Replacement .
10. Install the tire and wheel assembly. Tire and Wheel Removal and Installation

REPAIR INSTRUCTIONS > REAR BRAKE HOSE REPLACEMENT (JL9, J55) > REMOVAL PROCEDURE

WARNING:

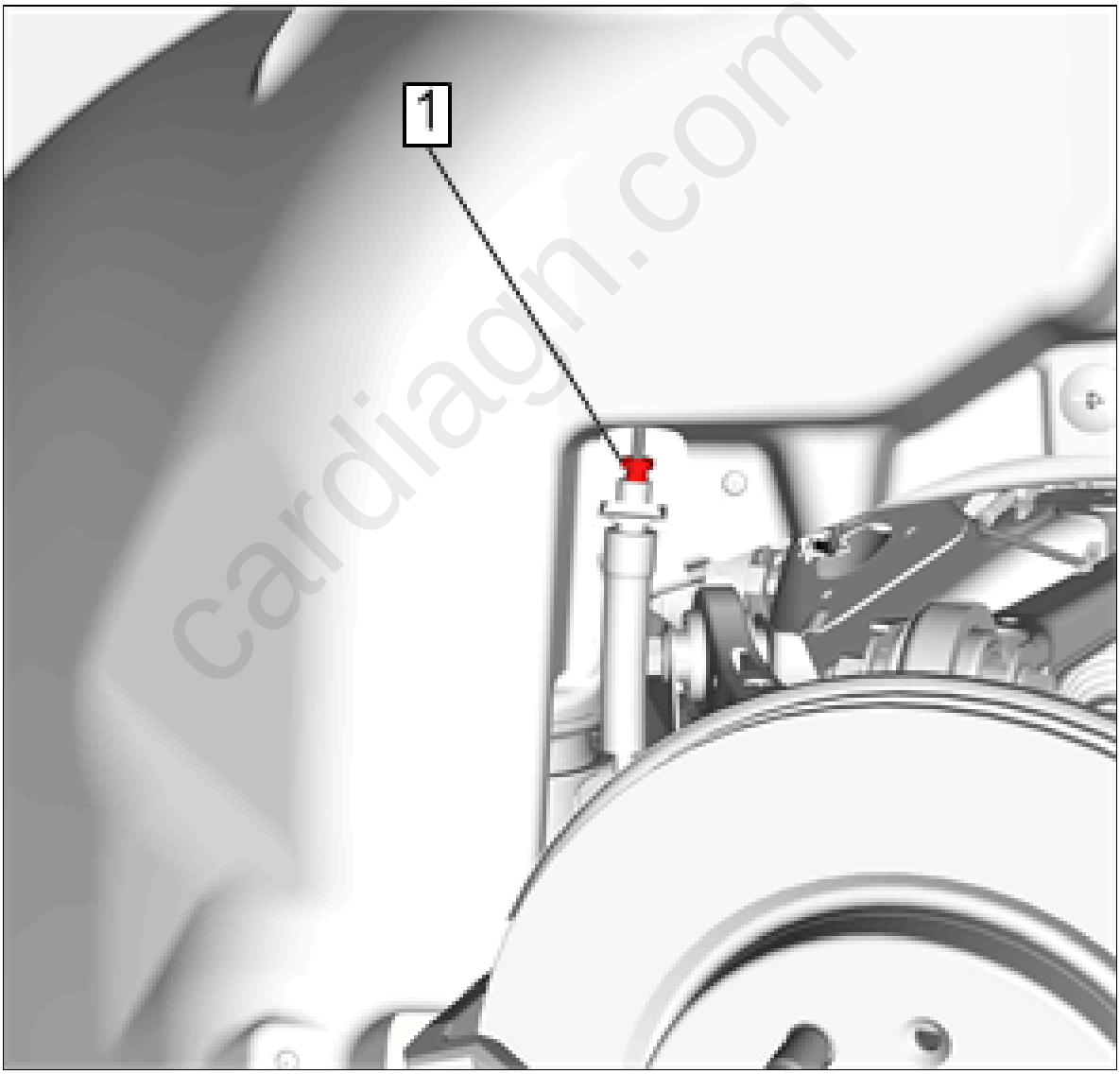
Brake Dust Warning

WARNING:

Brake Fluid Irritant Warning

1. Release the electronic parking brake.
2. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
3. Remove the tire and wheel assembly. Tire and Wheel Removal and Installation

   Fig 1: Brake Pipe Fitting



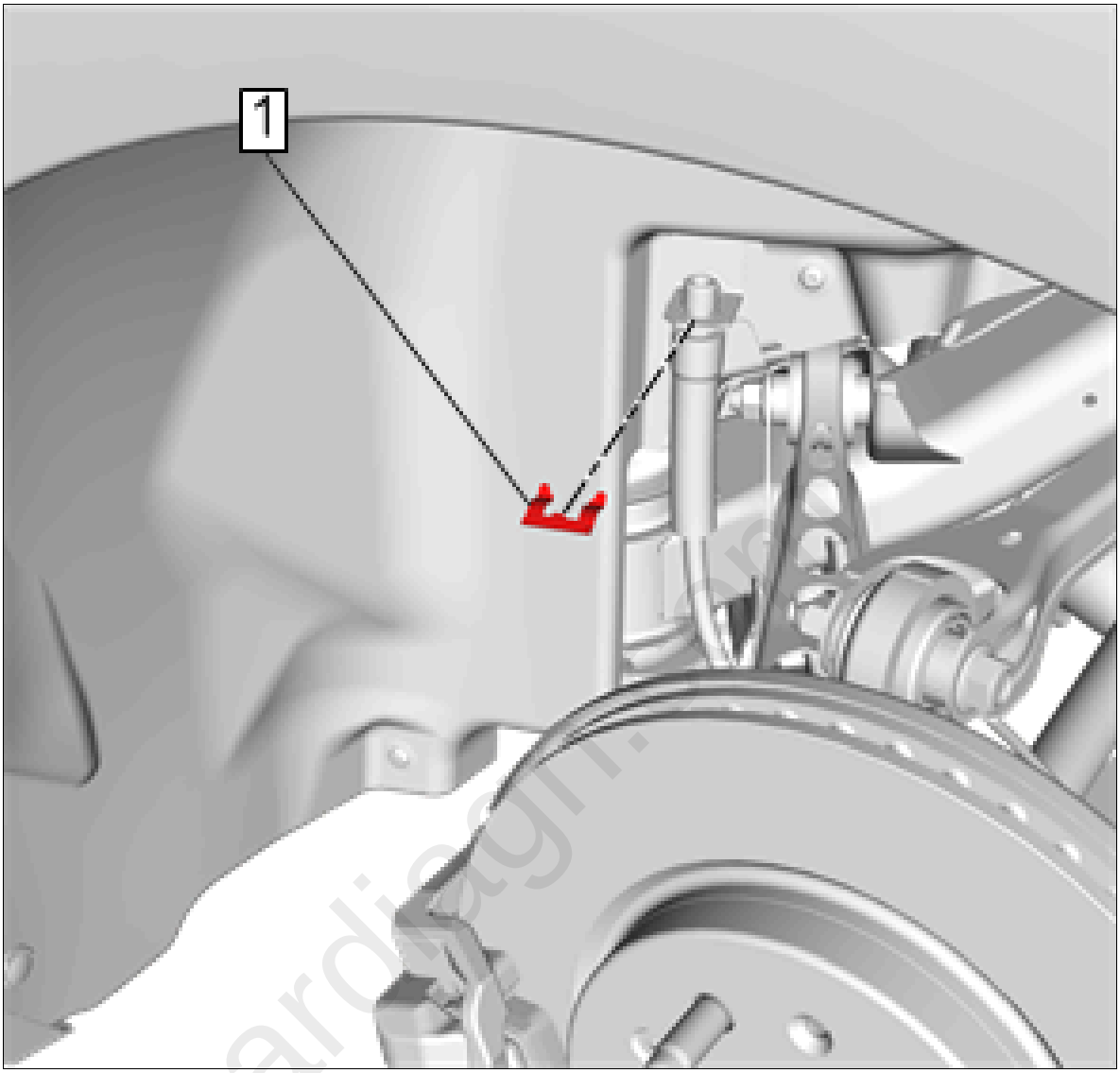
Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Brake Pipe Fitting (1).

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5. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

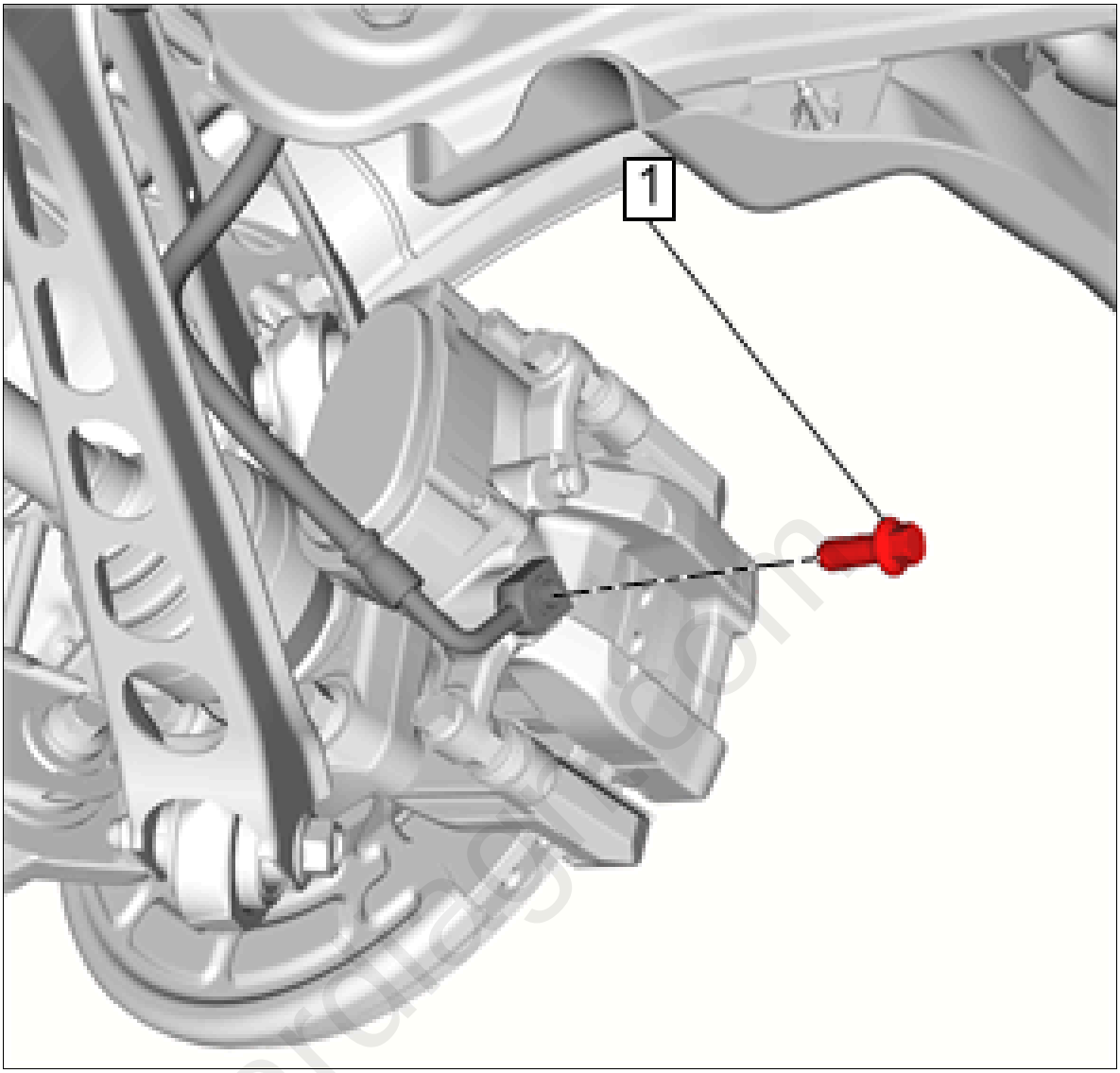
Fig 2: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Remove Brake Hose Retainer (1).

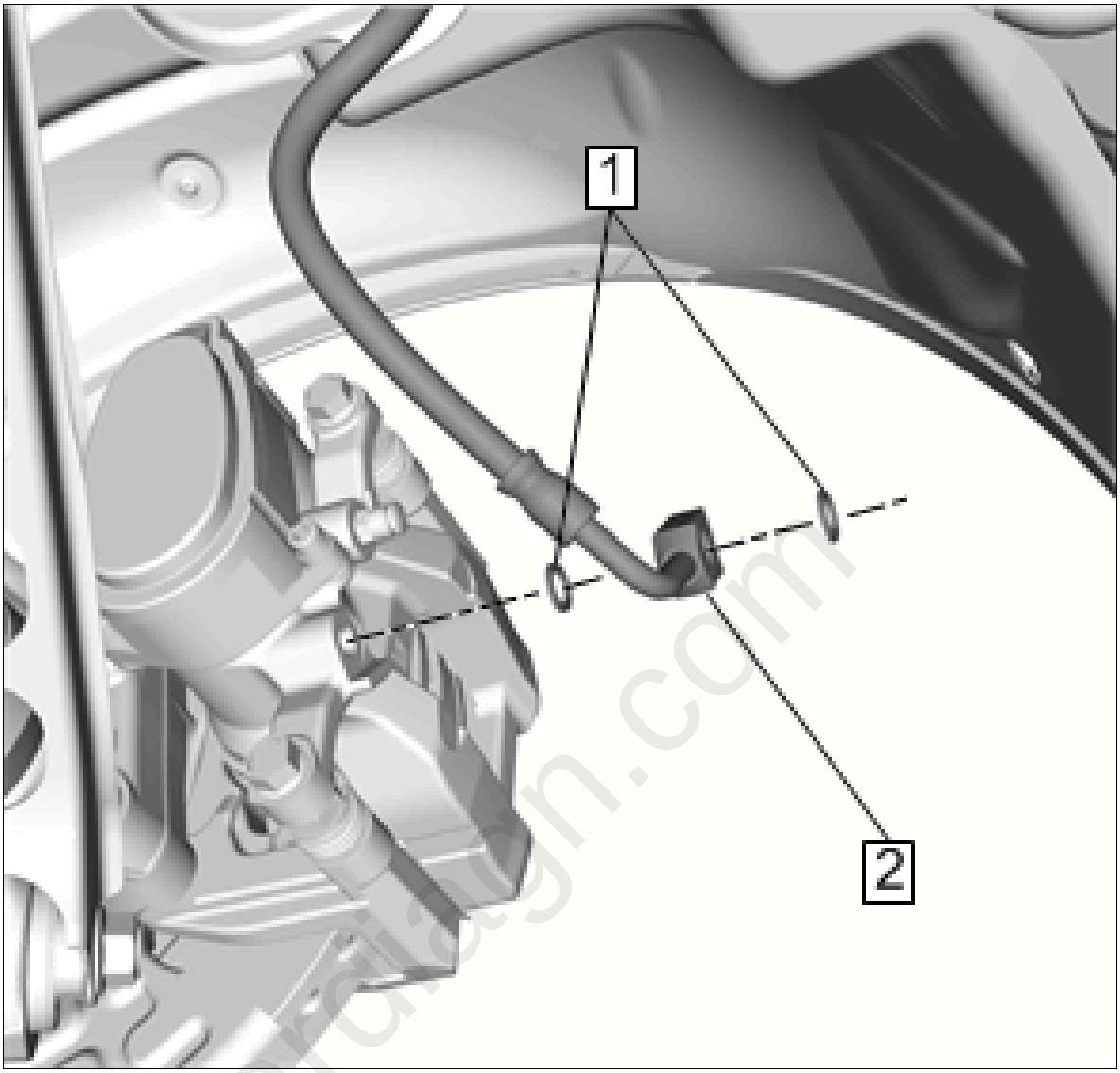
Fig 3: Brake Hose Fitting Bolt



Courtesy of GENERAL MOTORS COMPANY

7. Remove Brake Hose Fitting Bolt (1).

Fig 4: Brake Hose Fitting Gasket At Brake Hose Fitting



Courtesy of GENERAL MOTORS COMPANY

NOTE:

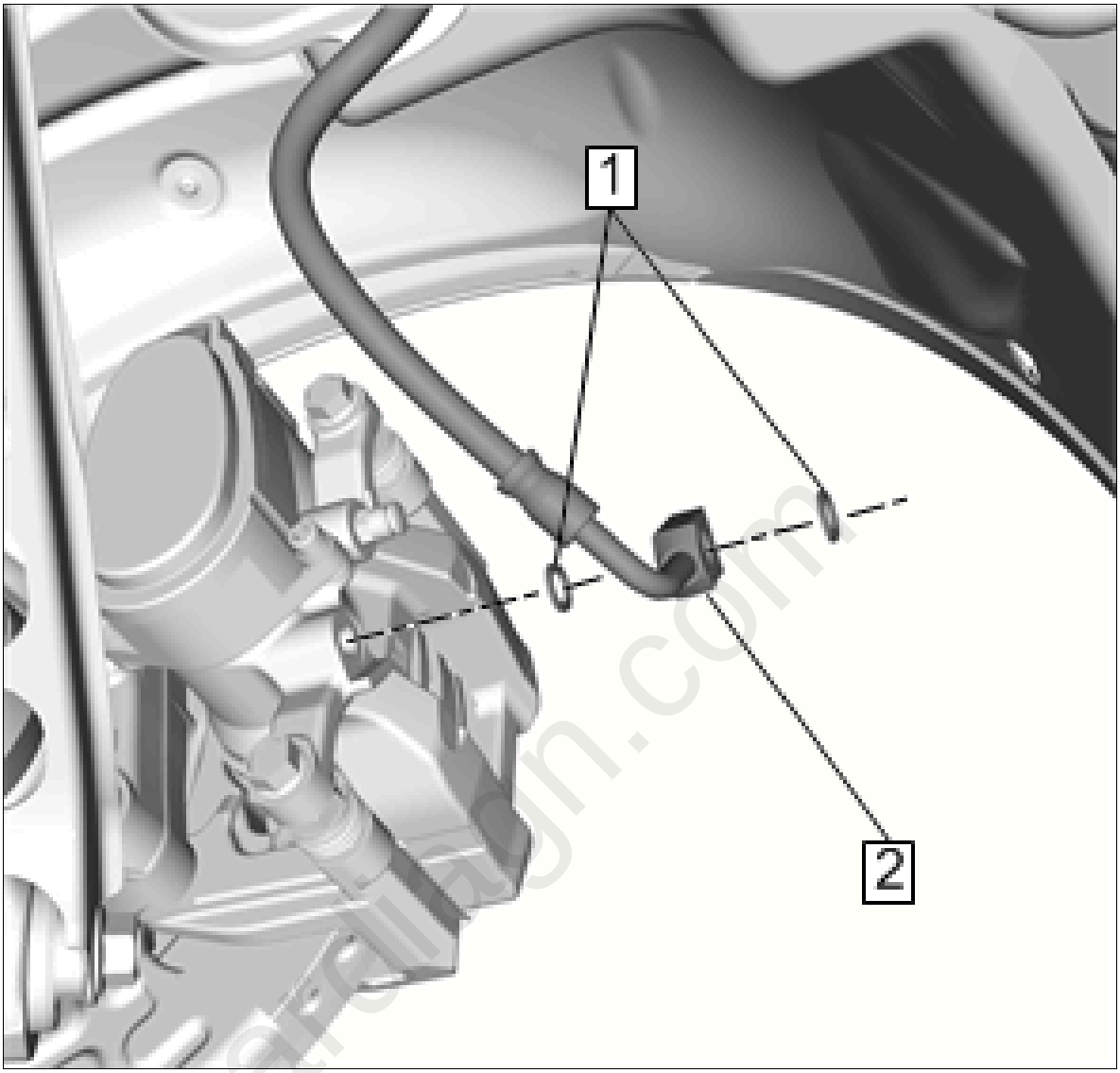
Do not reuse the brake hose fitting gaskets.

8. Remove Brake Hose Fitting Gasket (1) (Qty: 2) at Brake Hose Fitting (2) and DISCARD.
9. Plug the brake caliper inlet to prevent brake fluid loss and contamination.
10. Remove Brake Hose.

REPAIR INSTRUCTIONS > REAR BRAKE HOSE REPLACEMENT (JL9, J55) > INSTALLATION PROCEDURE

1. Install Brake Hose.

Fig 1: Brake Hose Fitting Gasket At Brake Hose Fitting

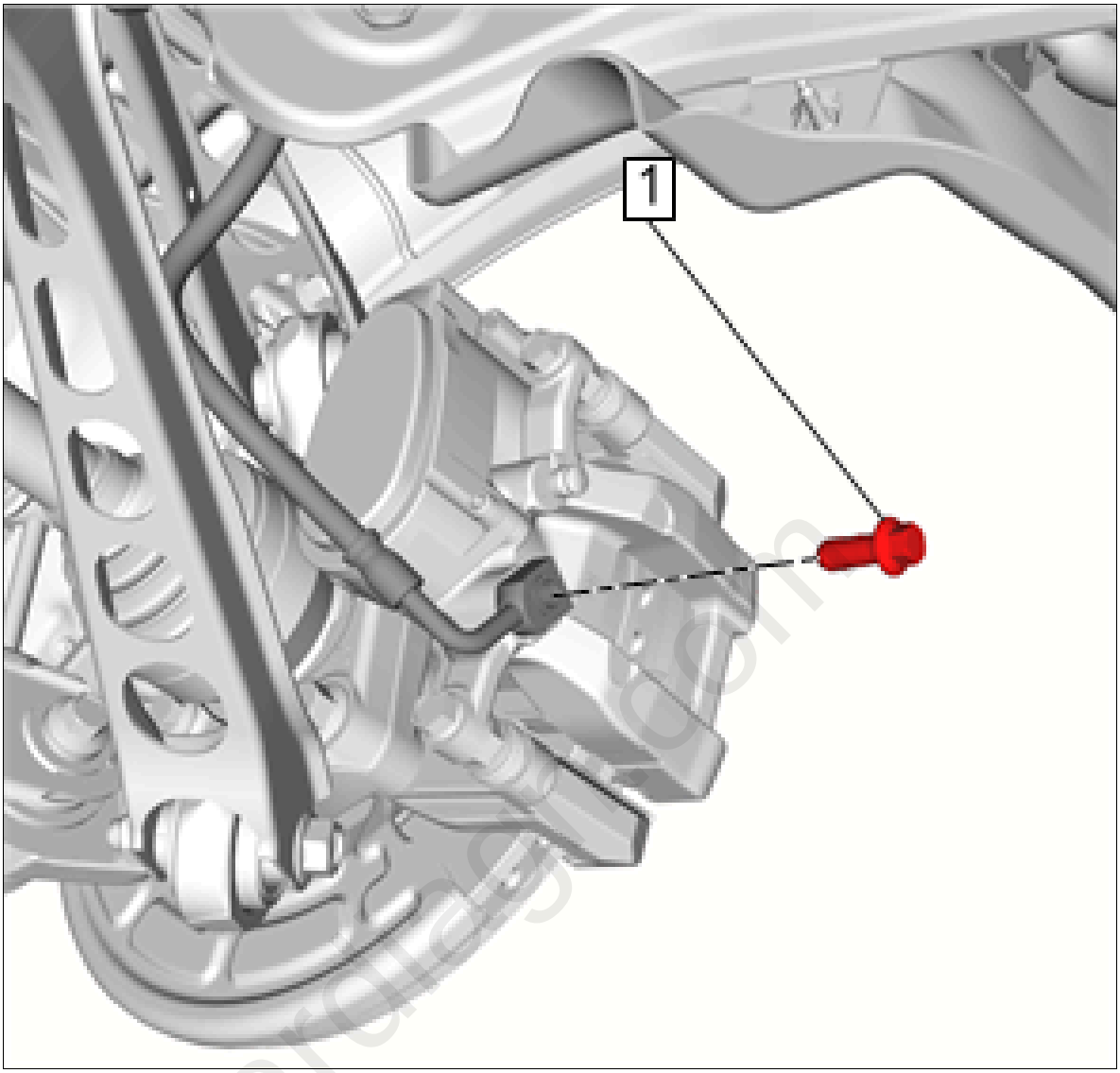


Courtesy of GENERAL MOTORS COMPANY

> *NOTE:*
>
> *Install NEW brake hose fitting gaskets.*

2. Install Brake Hose Fitting Gasket (1) (Qty: 2) at Brake Hose Fitting (2).

Fig 2: Brake Hose Fitting Bolt

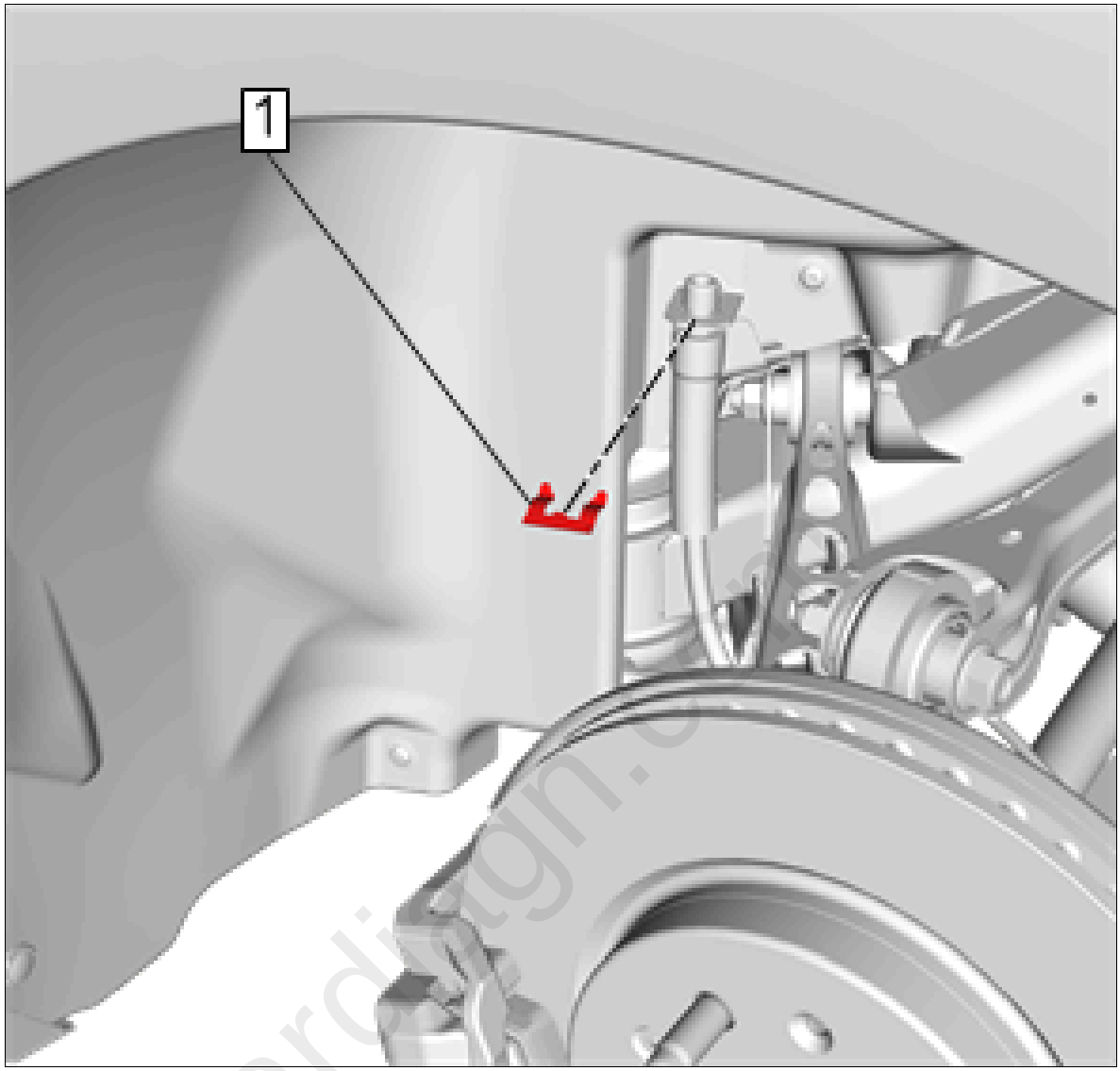


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Fastener Caution*

3. Install Brake Hose Fitting Bolt (1) and tighten to 40 N.m (30 lb ft).

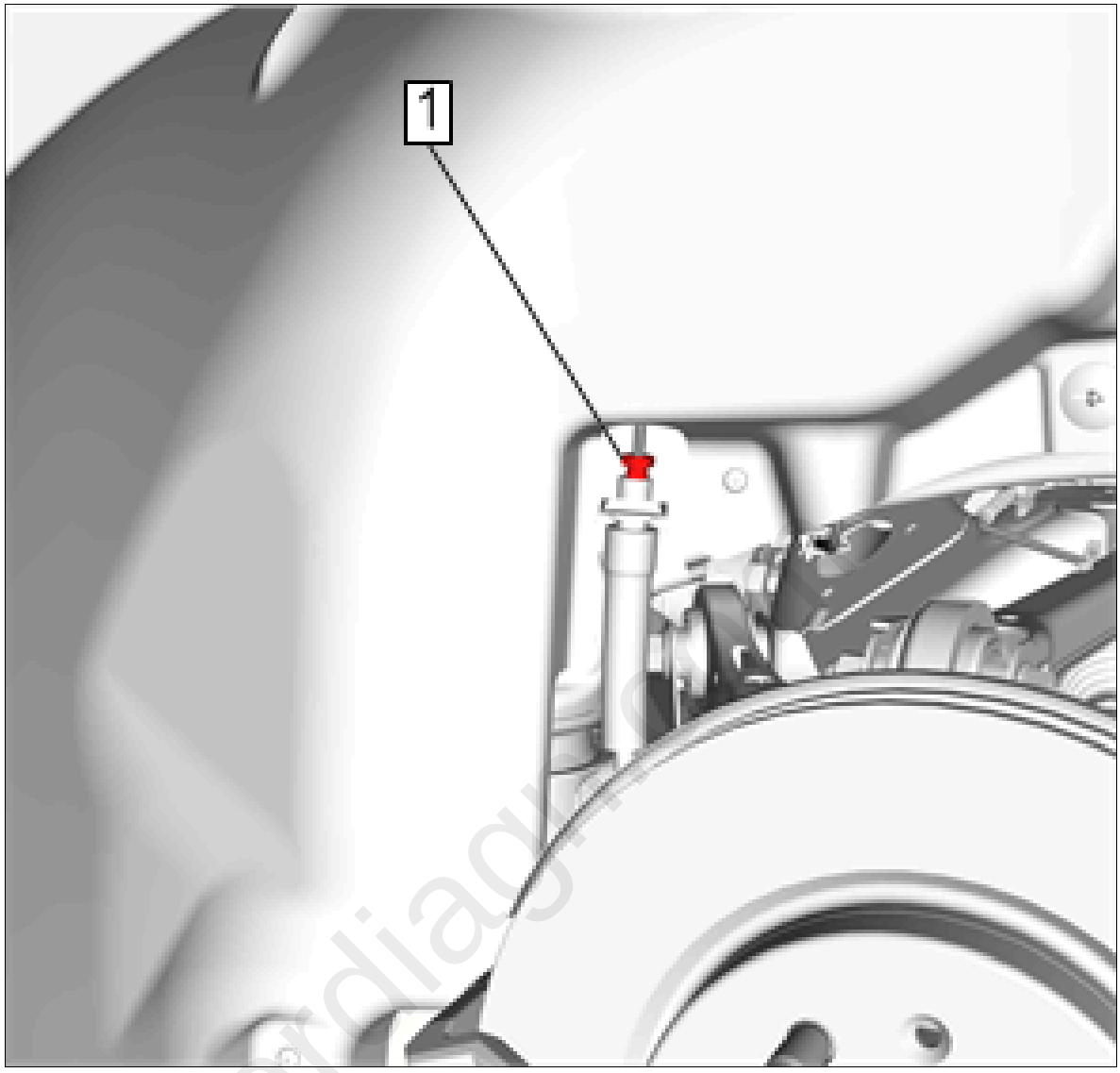
Fig 3: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Install Brake Hose Retainer (1).

Fig 4: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

5. Install Brake Pipe Fitting (1) and tighten to 18 N.m (13 lb ft).
6. Bleed the brake system. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9)
7. Install the tire and wheel assembly. Tire and Wheel Removal and Installation

REPAIR INSTRUCTIONS > REAR BRAKE HOSE REPLACEMENT (J6G) > REMOVAL PROCEDURE

WARNING:

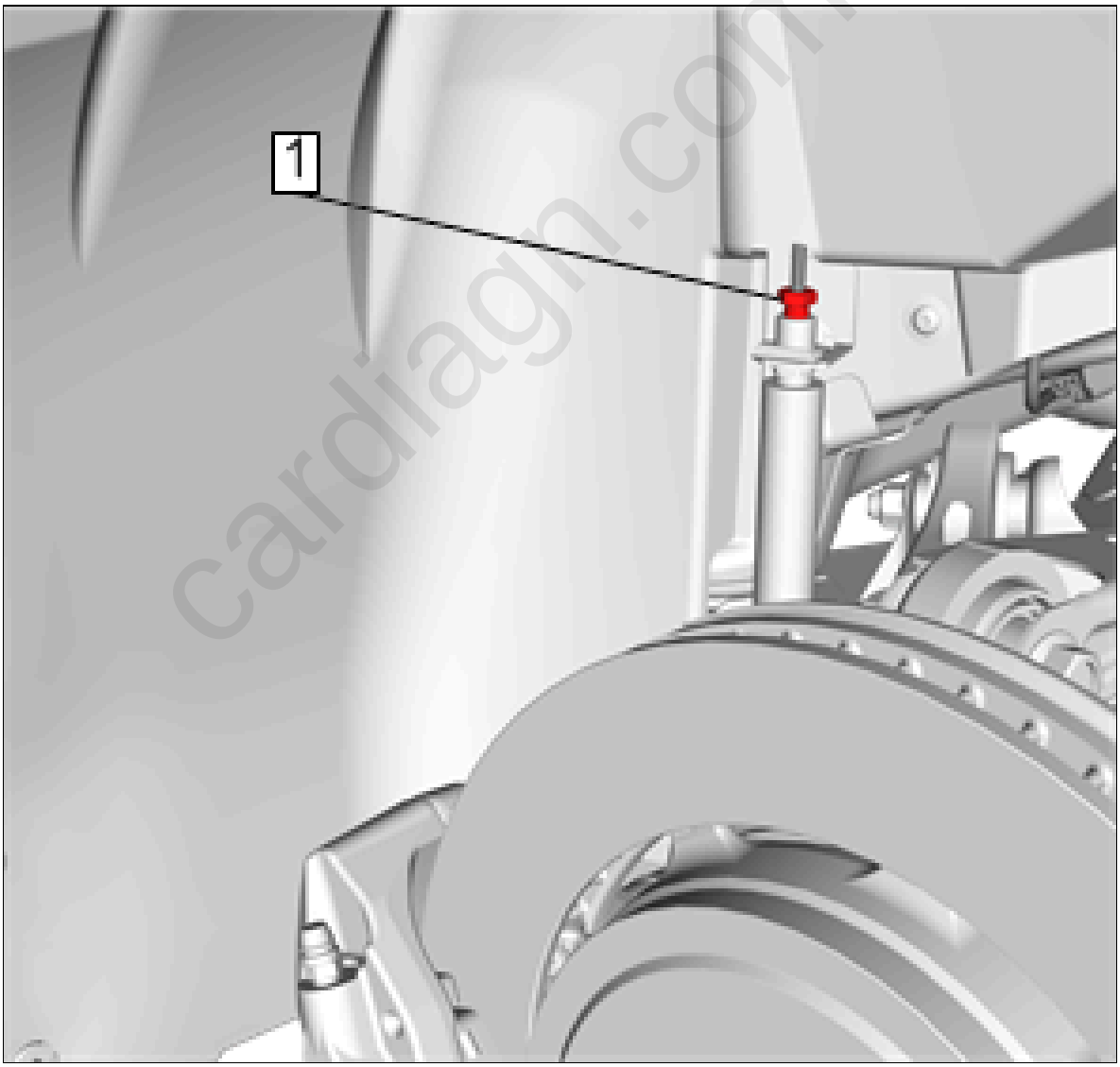
Brake Dust Warning

WARNING:

Brake Fluid Irritant Warning

1. Raise and support the vehicle. Lifting and Jacking the Vehicle (Base)Lifting and Jacking the Vehicle (HP)
2. Remove the tire and wheel assembly. Tire and Wheel Removal and Installation

Fig 1: Brake Pipe Fitting

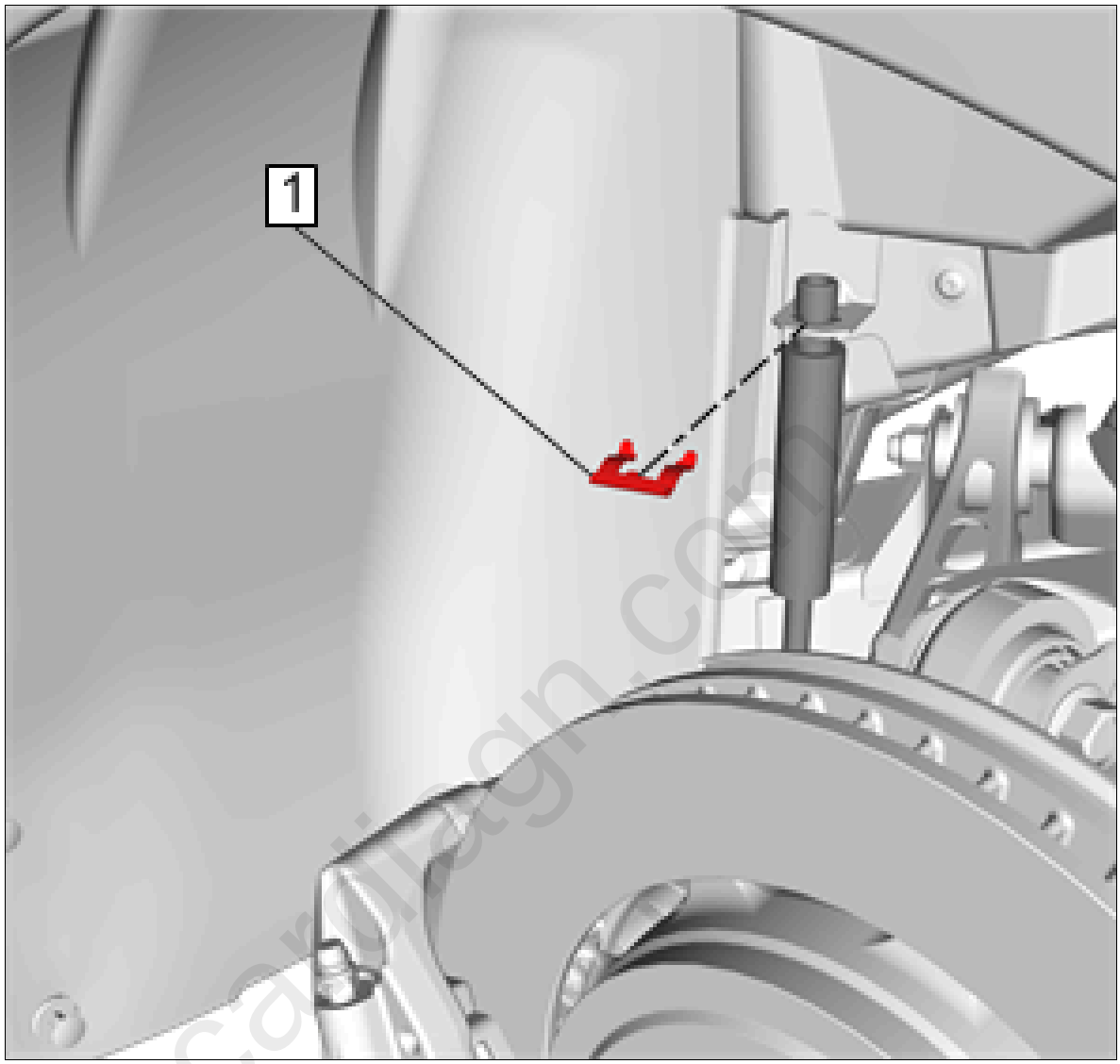


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Courtesy of GENERAL MOTORS COMPANY

3. Disconnect Brake Pipe Fitting (1).
4. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

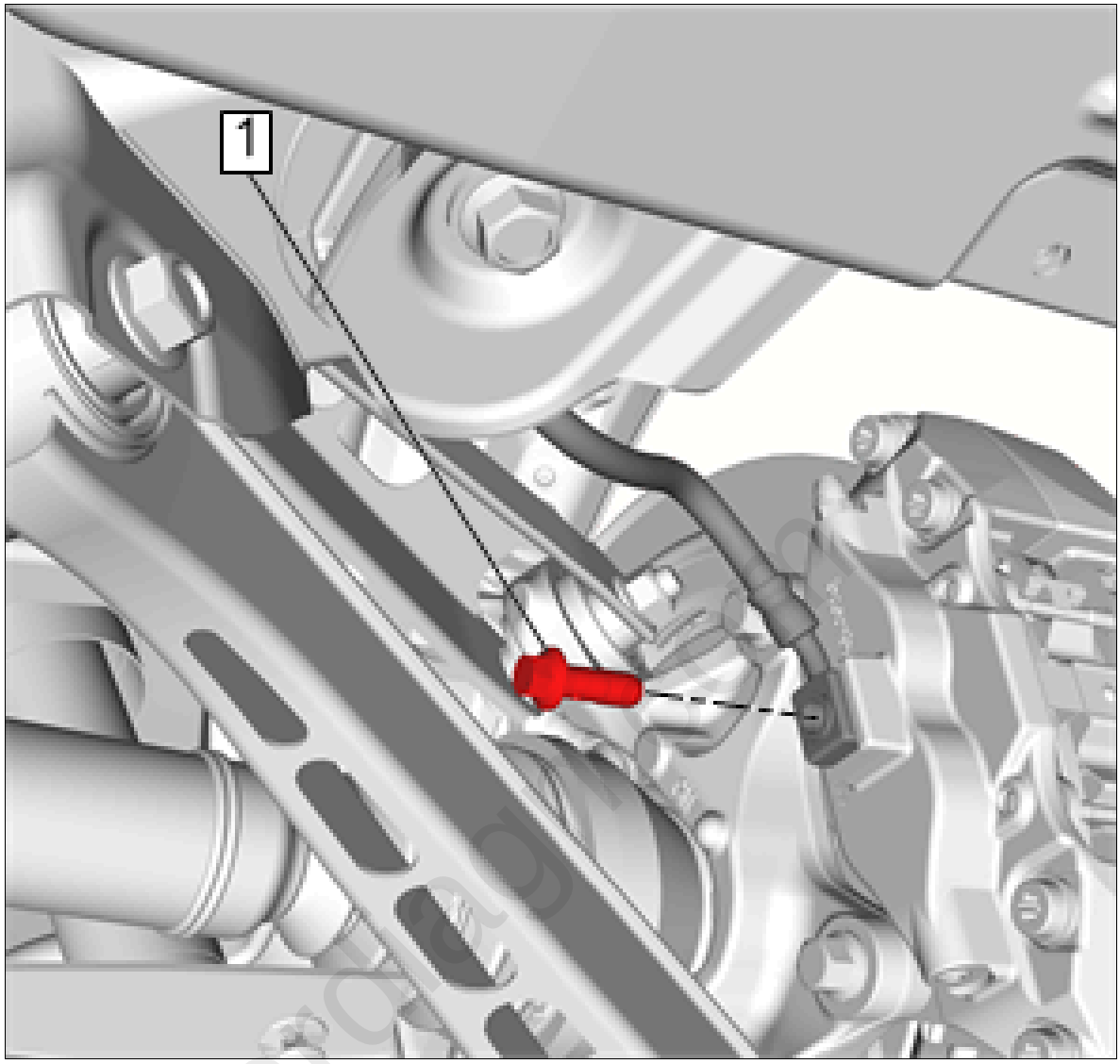
Fig 2: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Remove Brake Hose Retainer (1).

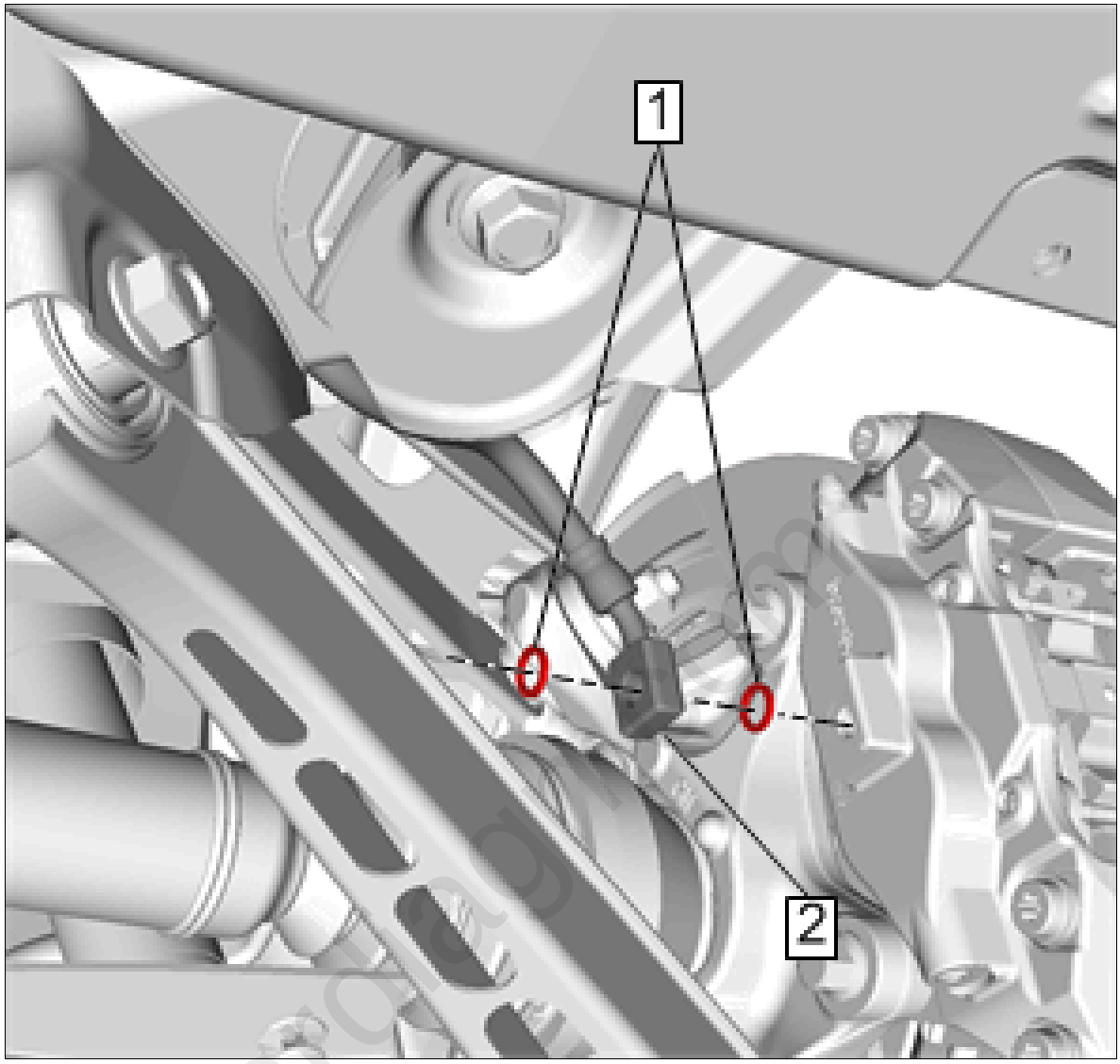
Fig 3: Brake Hose Fitting Bolt



Courtesy of GENERAL MOTORS COMPANY

6. Remove Brake Hose Fitting Bolt (1).

Fig 4: Brake Hose Fitting Gasket And Rear Brake Hose



Courtesy of GENERAL MOTORS COMPANY

NOTE:

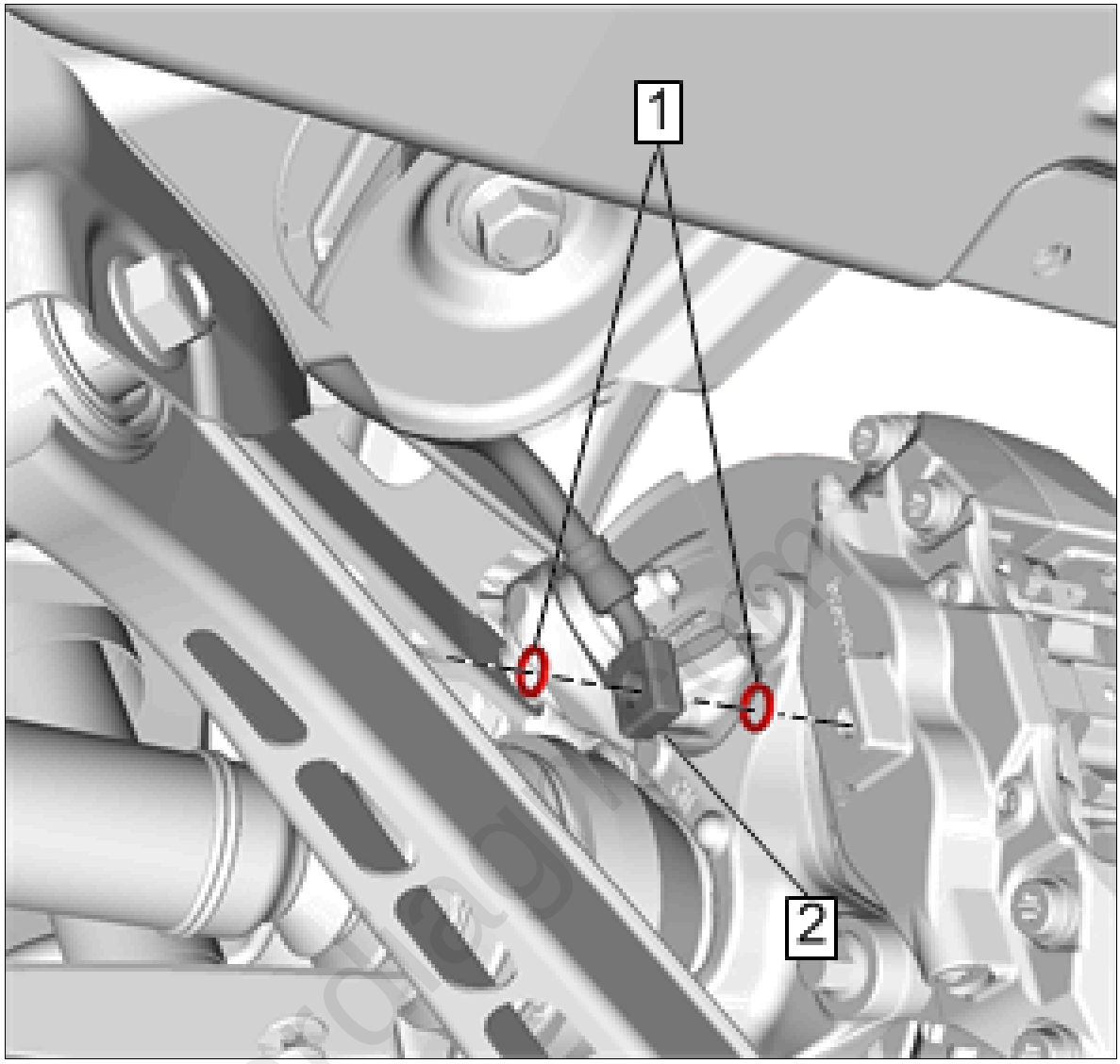
Do not reuse the brake hose fitting gaskets.

7. Remove Brake Hose Fitting Gasket (1) (Qty: 2) at Rear Brake Hose (2) and DISCARD.
8. Remove Rear Brake Hose.

REPAIR INSTRUCTIONS > REAR BRAKE HOSE REPLACEMENT (J6G) > INSTALLATION PROCEDURE

1. Install Rear Brake Hose.

Fig 1: Brake Hose Fitting Gasket And Rear Brake Hose



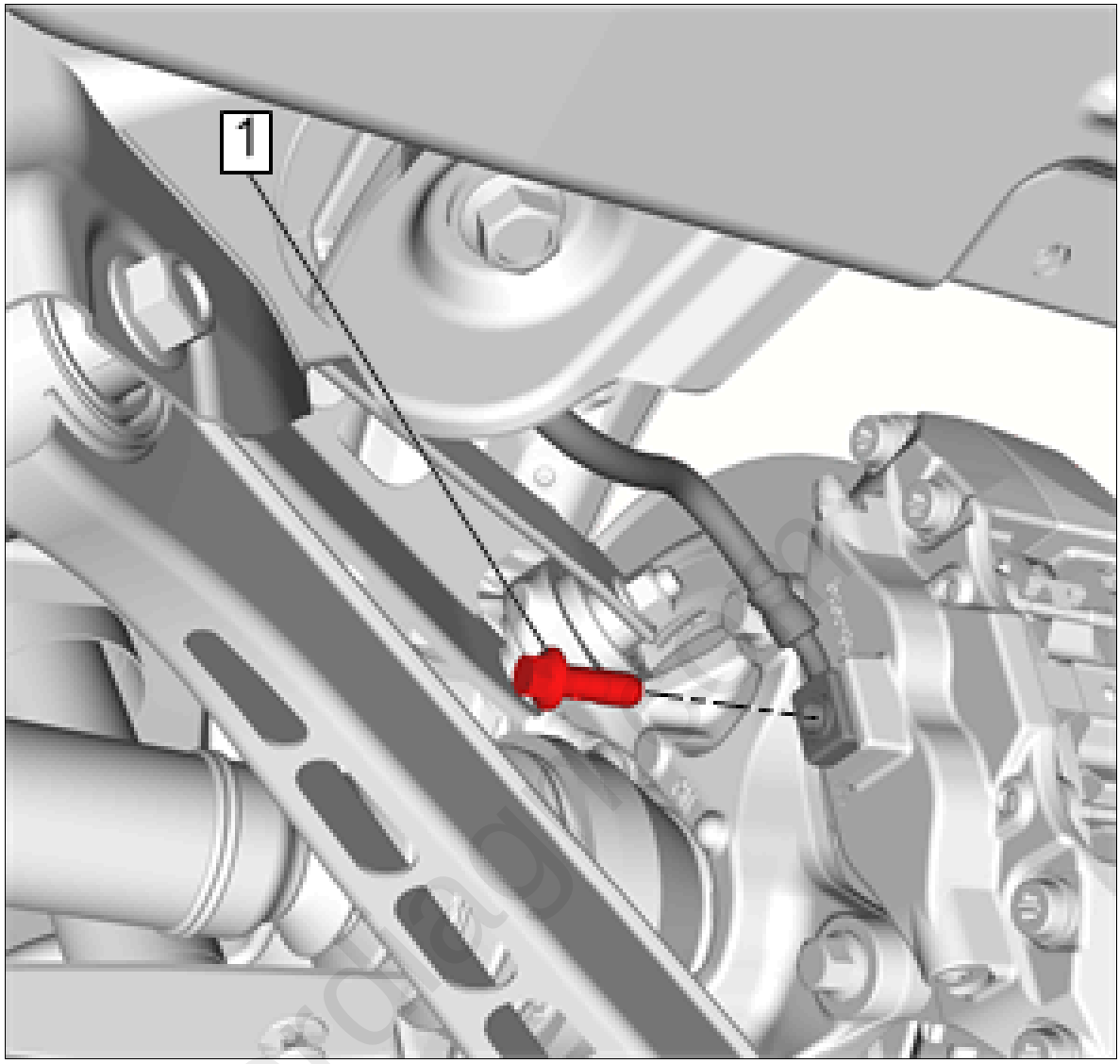
Courtesy of GENERAL MOTORS COMPANY

NOTE:

Install NEW brake hose fitting gaskets.

2. Install Brake Hose Fitting Gasket (1) (Qty: 2) at Rear Brake Hose (2).

Fig 2: Brake Hose Fitting Bolt

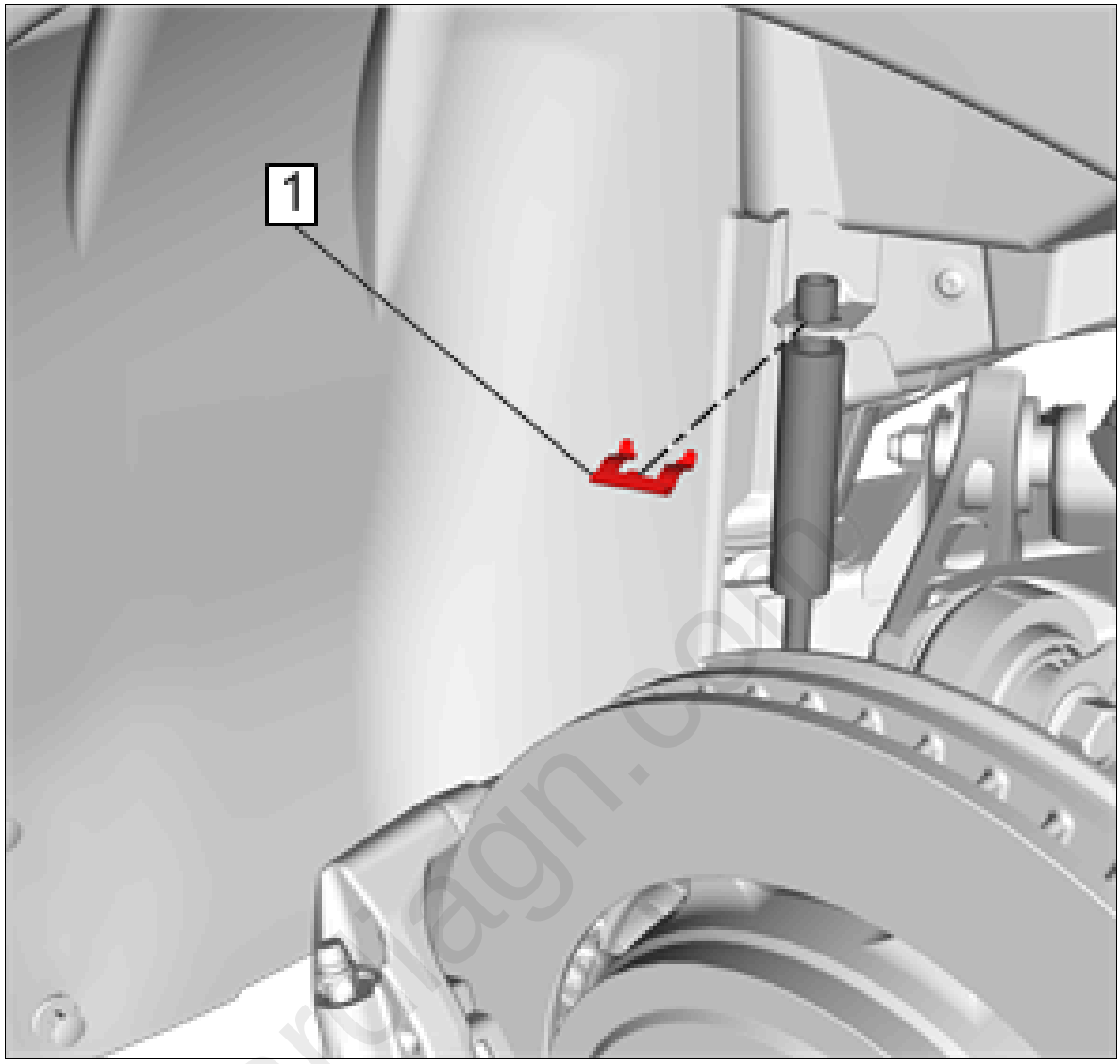


Courtesy of GENERAL MOTORS COMPANY

> ⚠ *CAUTION:*
>
> *Fastener Caution*

3. Install Brake Hose Fitting Bolt (1) and tighten to 40 N.m (30 lb ft).

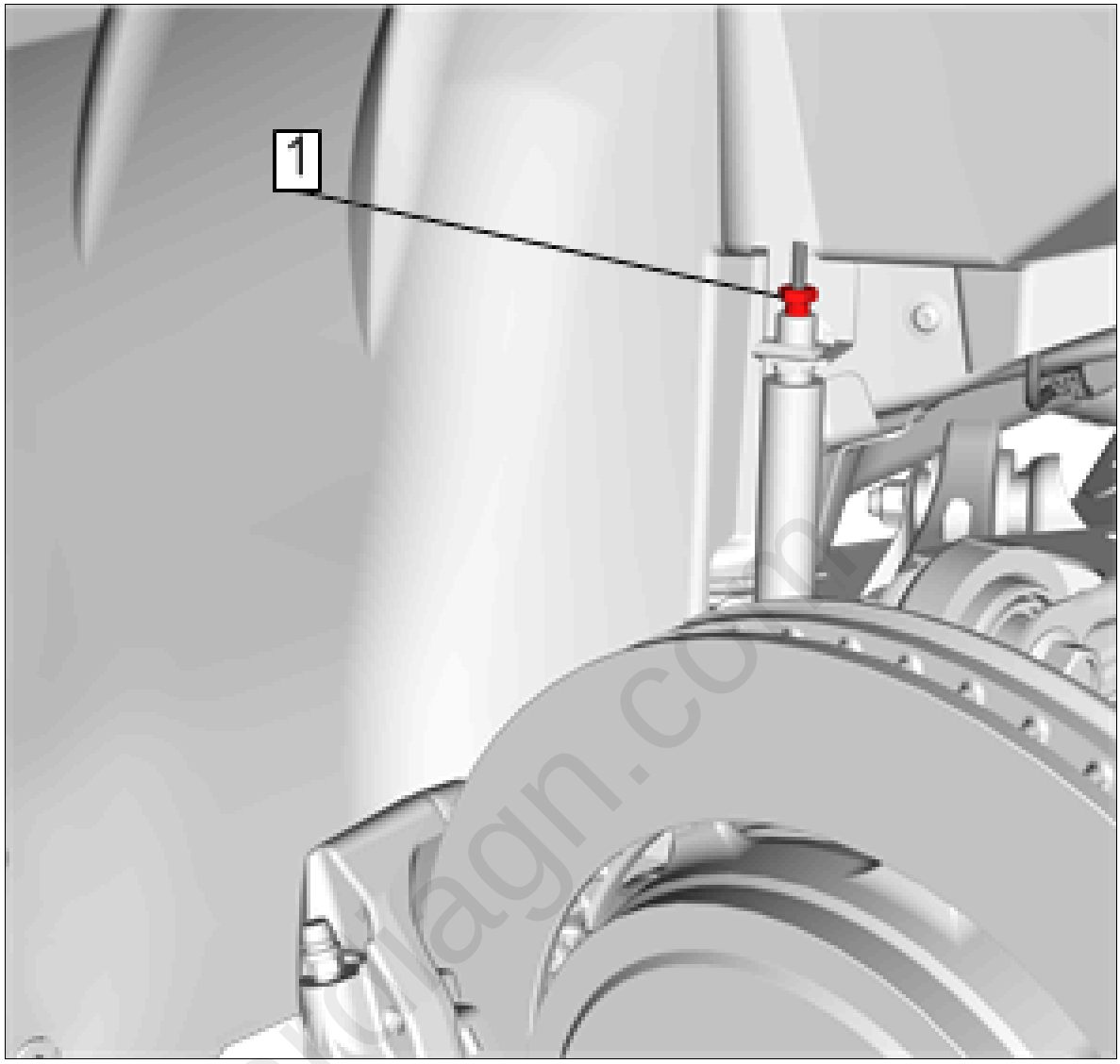
Fig 3: Brake Hose Retainer



Courtesy of GENERAL MOTORS COMPANY

4. Install Brake Hose Retainer (1).

Fig 4: Brake Pipe Fitting



Courtesy of GENERAL MOTORS COMPANY

5. Install Brake Pipe Fitting (1) and tighten to 18 N.m (13 lb ft).
6. Bleed the brake system. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G)
7. Install the tire and wheel assembly. Tire and Wheel Removal and Installation

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE SYSTEM BLEEDING (MANUAL J55, J6G)

WARNING:

Refer to Brake Fluid Irritant Warning .

CAUTION:

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

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:
    1. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add GM approved brake fluid from a clean, sealed brake fluid container.

       If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.
    2. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.
    3. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
    4. Reconnect the brake pipe to the master cylinder port and tighten securely.
    5. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
    6. Loosen the same brake pipe to purge air from the open port of the master cylinder.
    7. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
    8. Wait 15 seconds, then repeat steps 3.3-3.7 until all air is purged from the same port of the master cylinder.
    9. With the front brake pipe installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brake pipe from the master cylinder, then repeat steps 3.3-3.8.
    10. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.
4. Fill the brake master cylinder reservoir with GM approved brake fluid from a clean, sealed brake fluid container. Ensure that the brake master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to maintain the proper level.

   Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap

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and diaphragm.

5. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit, inboard (fixed caliper), bleeder valve.
6. Install a transparent hose over the end of the bleeder valve.
7. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.
8. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
9. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
10. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
11. Wait 15 seconds, then repeat steps 8-10 until all air is purged from the same wheel hydraulic circuit.
12. For fixed caliper models, repeat steps 5-11 for the outboard bleeder valve.
13. With the right rear wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely - after all air has been purged from the right rear hydraulic circuit - install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit, inner (fixed caliper), bleeder valve.
14. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
15. For fixed caliper models, repeat steps 5-11 for the outboard bleeder valve.
16. With the left front wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely, after all air has been purged from the left front hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit, inner (fixed caliper), bleeder valve.
17. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
18. For fixed caliper models, repeat steps 5-11 for the outboard bleeder valve.
19. With the left rear wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely, after all air has been purged from the left rear hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit, inner (fixed caliper), bleeder valve.
20. Install a transparent hose over the end of the bleeder valve, then repeat steps 7-11.
21. For fixed caliper models, repeat steps 5-11 for the outboard bleeder valve.
22. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves, or 8 bleeder valves (fixed caliper), are properly tightened.
23. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.
24. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.

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25. If the brake pedal feels spongy, repeat the bleeding procedure again. If the brake pedal still feels spongy after repeating the bleeding procedure, perform the following steps:
    1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection .
    2. Pressure bleed the hydraulic brake system in order to purge any air that may still be trapped in the system.
26. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

> *NOTE:*
>
> *DO NOT allow the vehicle to be driven until it is diagnosed and repaired.*

27. If the brake system warning lamp remains illuminated. Refer to Symptoms - Hydraulic Brakes .

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE SYSTEM BLEEDING (PRESSURE J55, J6G)

Special Tools

- **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent
- **J-35589-A** Master Cylinder Bleeder Adapter

> *WARNING:*
>
> *Refer to Brake Fluid Irritant Warning .*

> *CAUTION:*
>
> *Refer to Brake Fluid Effects on Paint and Electrical Components Caution .*

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brake pipes from the master cylinder, you must perform the following steps:
    1. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary, add GM approved brake fluid from a clean, sealed brake fluid container.

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If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.

2. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe from the front port of the brake master cylinder.
3. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder.
4. Reconnect the brake pipe to the master cylinder port and tighten securely.
5. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
6. Loosen the same brake pipe to purge air from the open port of the master cylinder.
7. Tighten the brake pipe, then have the assistant slowly release the brake pedal.
8. Wait 15 seconds, then repeat steps 3.3-3.7 until all air is purged from the same port of the master cylinder.
9. With the front brake pipe installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brake pipe from the master cylinder, then repeat steps 3.3-3.8.
10. After completing the final master cylinder port bleeding procedure, ensure that both of the brake pipe-to-master cylinder fittings are properly tightened.

4. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.

   Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.

5. Install the **J-35589-A** Master Cylinder Bleeder Adapter to the brake master cylinder reservoir.
6. Check the brake fluid level in the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent. Add GM approved brake fluid from a clean, sealed brake fluid container as necessary to bring the level to approximately the half-full point.
7. Connect the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent, to the **J-35589-A** Master Cylinder Bleeder Adapter.
8. Charge the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent, air tank to 175-205 kPa (25-30 psi).
9. Open the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent, fluid tank valve to allow pressurized brake fluid to enter the brake system.
10. Wait approximately 30 seconds, then inspect the entire hydraulic brake system in order to ensure that there are no existing external brake fluid leaks.

    Any brake fluid leaks identified require repair prior to completing this procedure.

11. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit, inboard (fixed caliper), bleeder valve.

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12. Install a transparent hose over the end of the bleeder valve.
13. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.
14. Loosen the bleeder valve to purge air from the wheel hydraulic circuit. Allow fluid to flow until air bubbles stop flowing from the bleeder, then tighten the bleeder valve.
15. For fixed caliper models, repeat steps 11-14 for the outboard bleeder valve.
16. With the right rear wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely, after all air has been purged from the right rear hydraulic circuit, install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit, inboard (fixed caliper), bleeder valve.
17. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
18. For fixed caliper models, repeat steps 11-14 for the outboard bleeder valve.
19. With the left front wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely, after all air has been purged from the left front hydraulic circuit, install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit, inner (fixed caliper), bleeder valve.
20. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
21. For fixed caliper models, repeat steps 11-14 for the outboard bleeder valve.
22. With the left rear wheel hydraulic circuit bleeder valve, or valves (fixed caliper), tightened securely, after all air has been purged from the left rear hydraulic circuit, install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit, inner (fixed caliper), bleeder valve.
23. Install a transparent hose over the end of the bleeder valve, then repeat steps 13-14.
24. For fixed caliper models, repeat steps 11-14 for the outboard bleeder valve.
25. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves, or 8 bleeder valves (fixed caliper), are properly tightened.
26. Close the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent, fluid tank valve, then disconnect the **J-29532** Diaphragm Type Brake Pressure Bleeder, or equivalent, from the **J-35589-A** Master Cylinder Bleeder Adapter.
27. Remove the **J-35589-A** Master Cylinder Bleeder Adapter from the brake master cylinder reservoir.
28. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.
29. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
30. If the brake pedal feels spongy perform the following steps:
    1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection .

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2. Using a scan tool, perform the antilock brake system automated bleeding procedure to remove any air that may have been trapped in the BPMV. Refer to Antilock Brake System Automated Bleed .

31. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

> *NOTE:*
>
> *DO NOT allow the vehicle to be driven until it is diagnosed and repaired.*

32. If the brake system warning lamp remains illuminated. Refer to Symptoms - Hydraulic Brakes .

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE SYSTEM BLEEDING (MANUAL JL9)

> *WARNING:*
>
> *Brake Fluid Irritant Warning*

> *CAUTION:*
>
> *Brake Fluid Effects on Paint and Electrical Components Caution*

> *CAUTION:*
>
> *Only use products that comply with GM specifications and check manufacturer information respectively. We recommend the use of GM genuine products. Instructions must be followed at all times. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.*

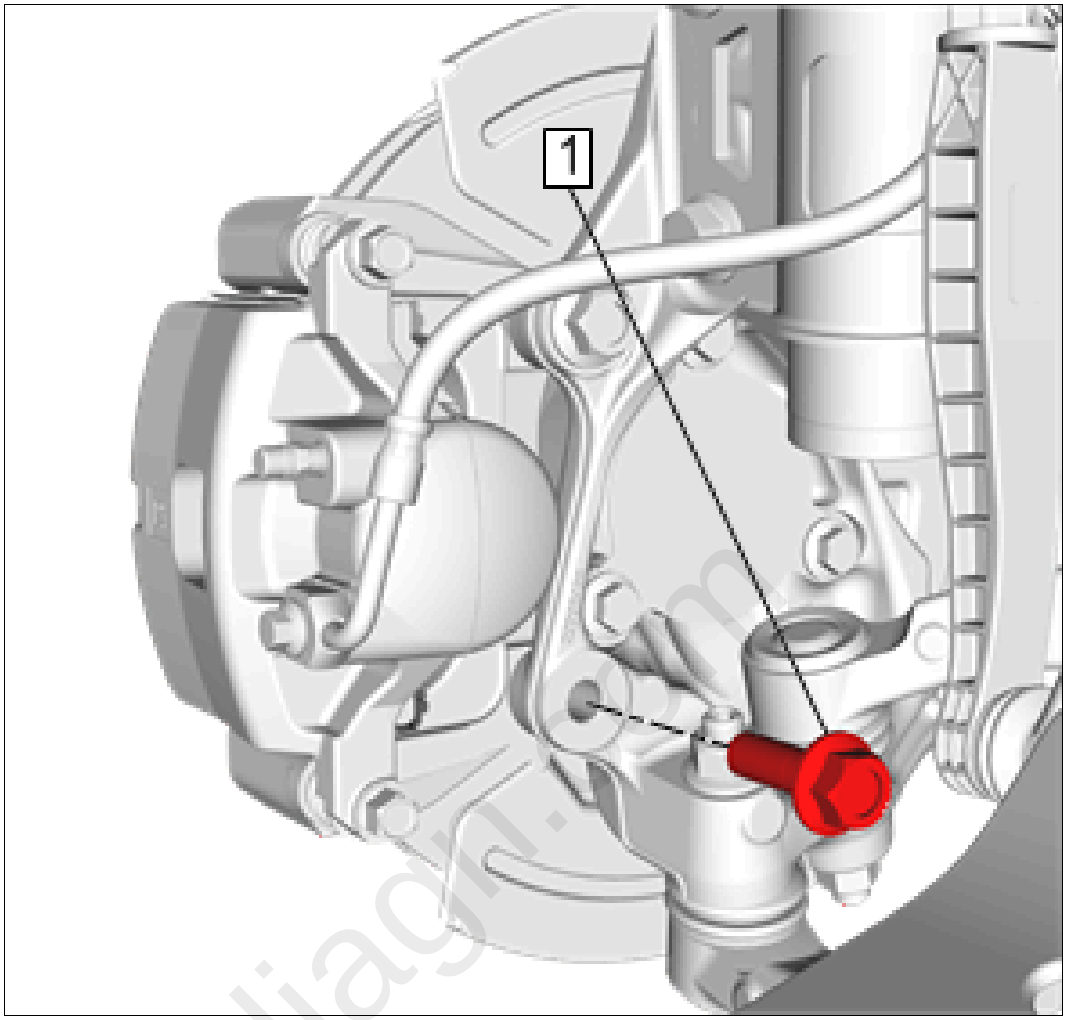
If hydraulic components were serviced on only one wheel hydraulic circuit, perform the following procedure.

Bleeding a Single Hydraulic Brake Circuit

1. If bleeding the left front or right front hydraulic brake circuit, position and secure the front brake caliper and bracket assembly upward.

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Fig 1: Lower Brake Caliper Bracket Bolt

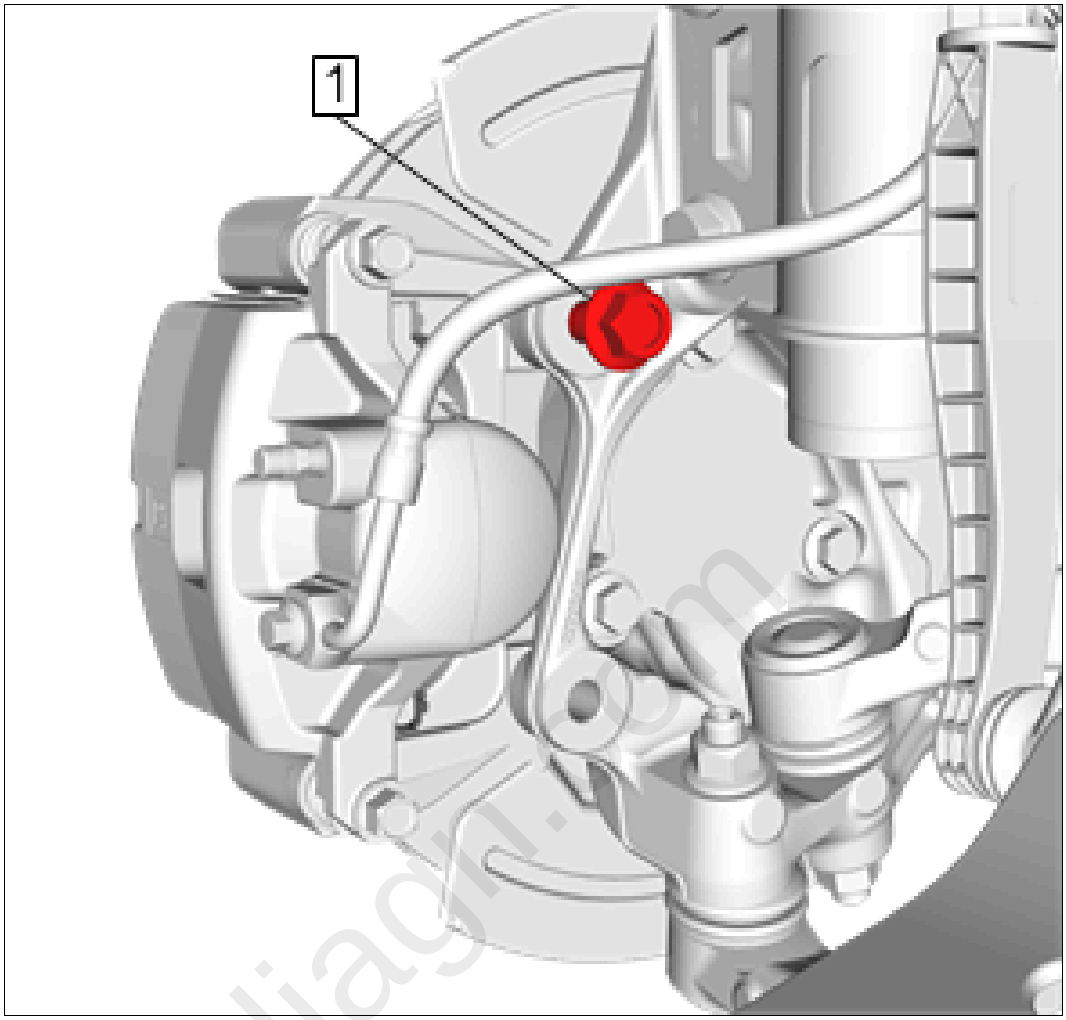


Courtesy of GENERAL MOTORS COMPANY

1. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

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Fig 2: Upper Brake Caliper Bracket Bolt

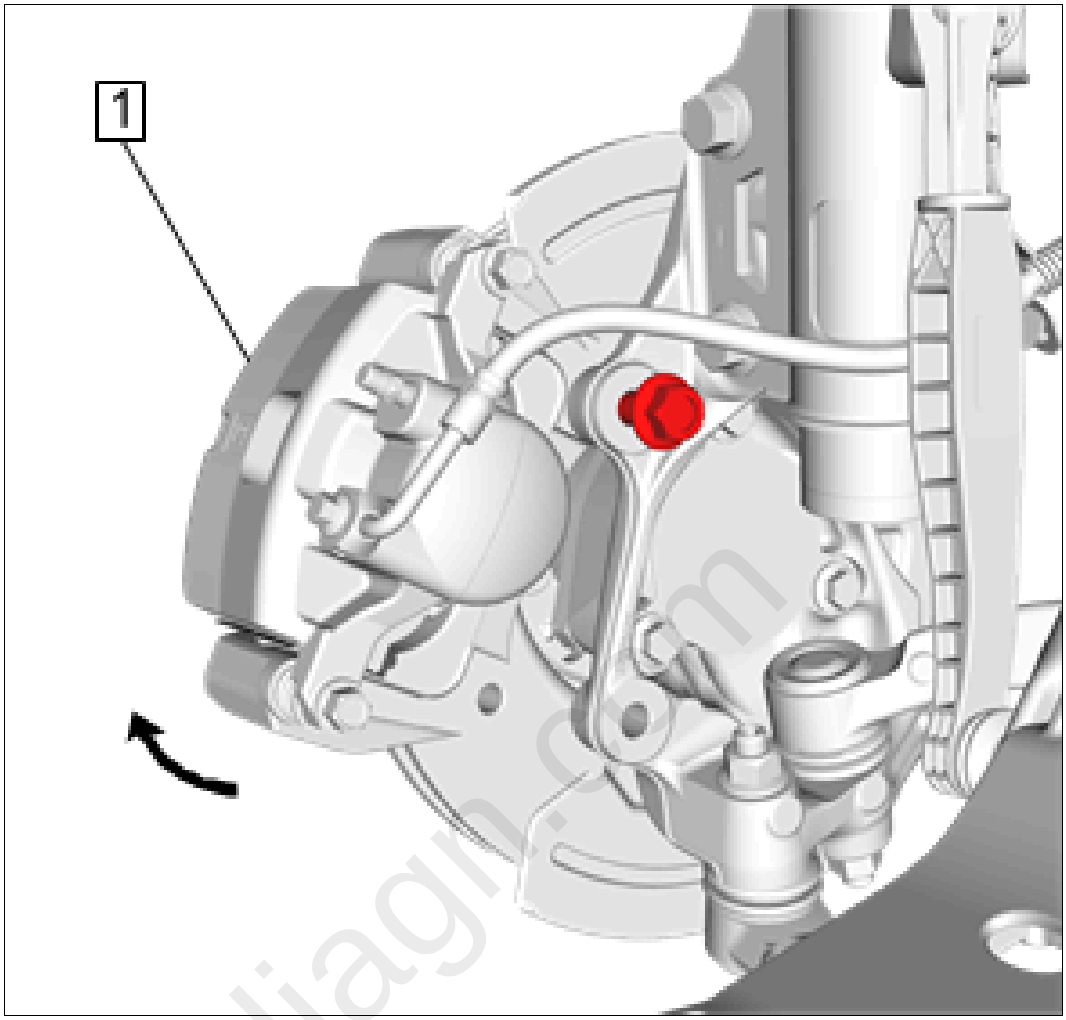


Courtesy of GENERAL MOTORS COMPANY

2. Loosen, but do NOT remove, the upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

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Fig 3: Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

3. Rotate the brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
4. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.

2. With the ignition switch OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. Place a clean shop cloth beneath the brake master cylinder to catch brake fluid spills.
4. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
5. Fill the brake master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container. Add brake fluid as needed to ensure that the brake master cylinder reservoir remains at least half-full throughout the bleed procedure. The reservoir cap must be installed at all times except when filling the reservoir. Fluid and Lubricant Recommendations
6. Install a proper box-end wrench onto the wheel hydraulic circuit bleeder valve which has been

serviced.

7. Install a transparent hose over the end of the bleeder valve.
8. Submerge the open end of the transparent hose into a transparent container partially filled with brake fluid from a clean, sealed brake fluid container.
9. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the pedal.
10. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
11. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
12. Wait 15 seconds, then repeat steps 9-11 until all air is purged from the wheel hydraulic circuit.
13. After all air has been purged from the hydraulic circuit, tighten the bleeder valve and install the dust cap.
14. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.
15. Slowly apply and release the brake pedal. Observe the brake pedal feel.
16. If the brake pedal feels spongy, perform the Bleeding the Complete Brake Hydraulic System procedure.
17. Turn the ignition switch ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

> *NOTE:*
>
> *Do NOT allow the vehicle to be driven until it is diagnosed and repaired.*

18. If the brake system warning lamp remains illuminated, diagnose and repair the condition. - Diagnostic Starting Point - Vehicle

Bleeding the Complete Brake Hydraulic System

1. With the ignition switch OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
2. Place a clean shop cloth beneath the brake master cylinder to catch brake fluid spills.
3. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
4. Fill the brake master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container. Add brake fluid as needed to ensure that the brake master cylinder reservoir remains at least half-full throughout the bleed procedure. The reservoir cap must be installed at all times except when filling the reservoir. Fluid and Lubricant Recommendations
5. If the master cylinder was replaced, the master cylinder must be bench bled. Master Cylinder Bench Bleeding

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6. If the brake pipes have been removed from the master cylinder, the following steps must be performed.
    1. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe fitting from the front port of the brake master cylinder.
    2. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder. Capture and properly dispose of the brake fluid in an approved container.
    3. Install the front brake pipe fitting to the front port of the brake master cylinder and tighten the fitting. Fastener Specifications
    4. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the pedal.
    5. Loosen the front brake pipe fitting from the front port of the brake master cylinder to purge air from the master cylinder port.
    6. Tighten the front brake pipe fitting, then have the assistant slowly release the brake pedal.
    7. Wait 15 seconds, then repeat steps 6.4-6.6 until all air is purged from the front brake pipe fitting of the front port of the master cylinder.
    8. After all air is purged from the front port of the brake master cylinder, tighten the front master cylinder brake pipe fitting. Fastener Specifications
    9. With the front brake pipe fitting installed securely to the front port of the brake master cylinder, loosen and separate the rear brake pipe fitting from the rear port of the brake master cylinder.
    10. Repeat steps 6.2-6.7 for the rear port of the brake master cylinder.
    11. After all air is purged from the rear port of the brake master cylinder, tighten the rear master cylinder brake pipe fitting. Fastener Specifications
    12. Slowly apply and release the brake pedal. Observe the brake pedal feel.
    13. If the brake pedal feels spongy, proceed to step 7.
    14. If the brake pedal feels firm, proceed to step 33.
7. If the brake pipes have been removed from the brake pressure modulator valve (BPMV) assembly, if equipped, or the brake proportion valve assembly, if equipped, air must be purged from each port of the respective assembly beginning with the feed pipes from the master cylinder.
    1. Loosen and separate one of the master cylinder brake pipe fittings from the inlet port of the assembly to be bled.
    2. Allow a small amount of brake fluid to gravity bleed from the open port of the assembly. Capture and properly dispose of the brake fluid in an approved container.
    3. Install the brake pipe fitting and to the inlet port of the assembly and tighten securely.
    4. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the pedal.

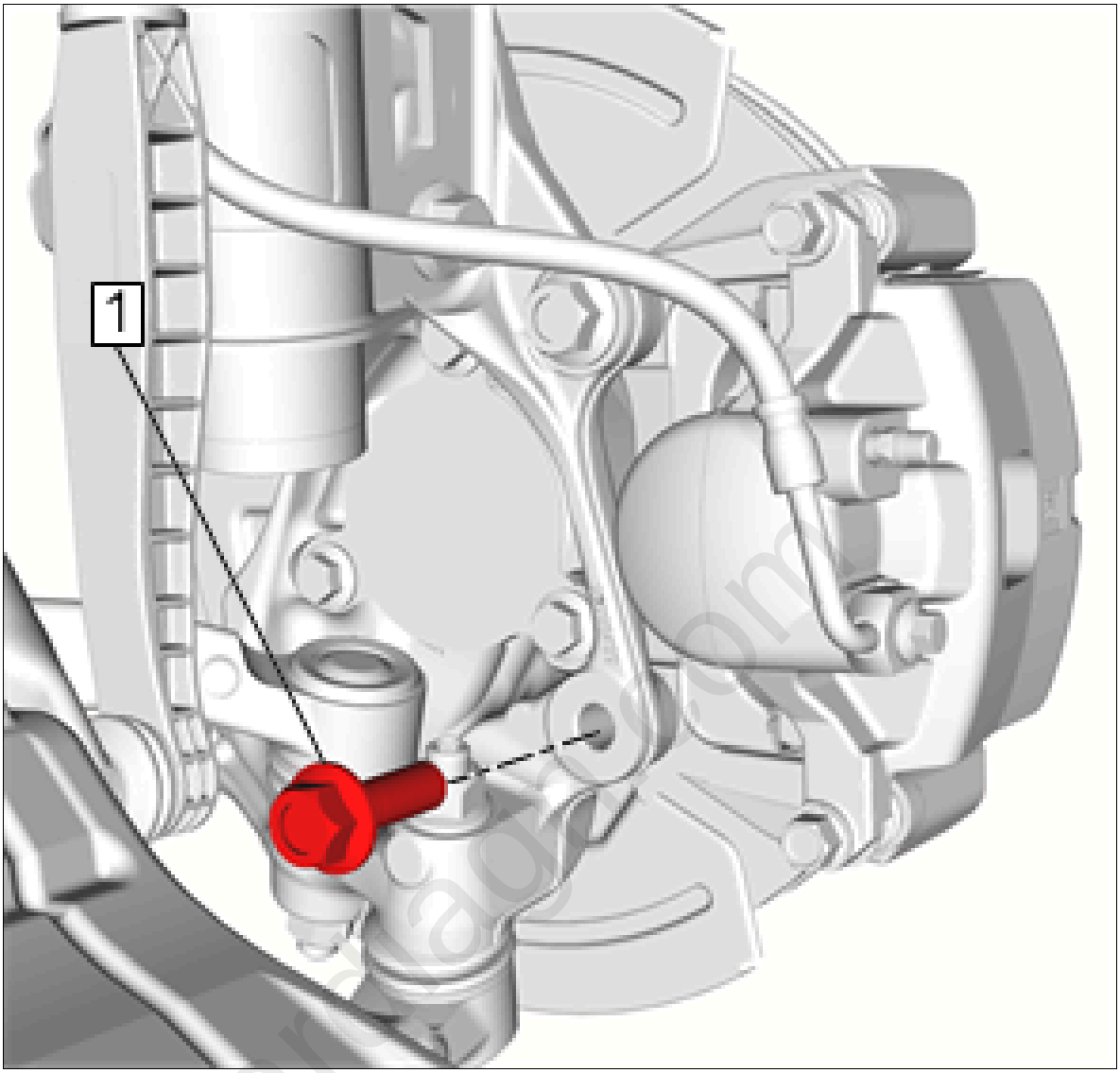
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5. Loosen the same brake pipe fitting to purge air from the open port of the assembly.
6. Tighten the brake pipe fitting, then have the assistant slowly release the brake pedal.
7. Wait 15 seconds, then repeat steps 7.4-7.6 until all air is purged from the brake pipe fitting of the assembly.
8. Repeat steps 7.1-7.7 for all of the remaining ports of the assembly.
9. After bleeding each port of the assembly, tighten all of the brake pipe fittings on the assembly. Fastener Specifications
10. Fill the master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container.
11. Slowly apply and release the brake pedal. Observe the brake pedal feel.
12. If the brake pedal feels spongy, proceed to step 8.
13. If the brake pedal feels firm, proceed to step 33.

8. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
9. Install a transparent hose over the end of the bleeder valve.
10. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.
11. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the brake pedal.
12. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
13. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
14. Wait 15 seconds, then repeat steps 11-13 until all air is purged from the wheel hydraulic circuit.
15. Tighten the RIGHT REAR hydraulic wheel circuit bleeder valve securely.
16. Install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve, then repeat steps 9-14.

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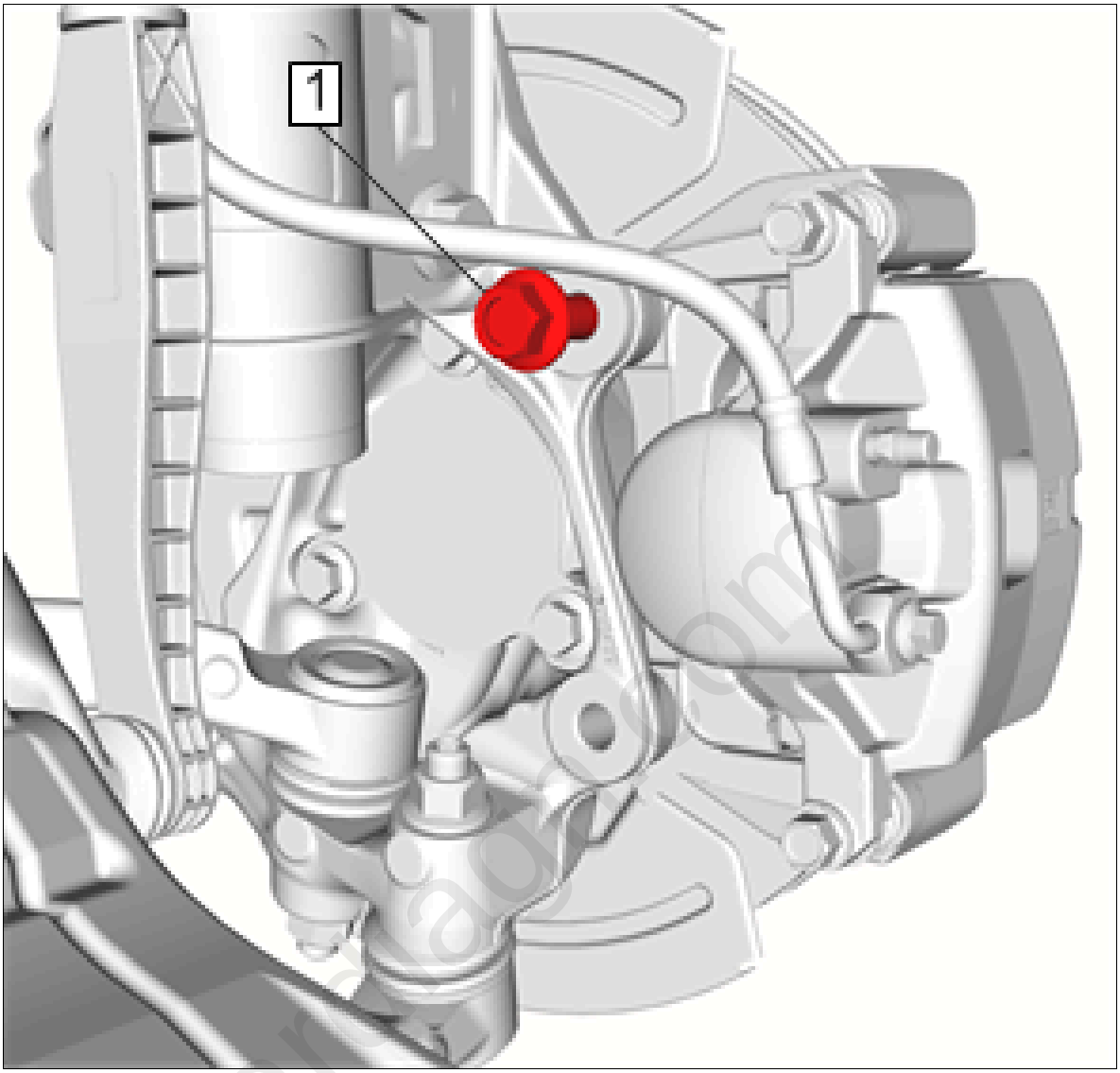
Fig 4: Right Front Lower Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

17. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the RIGHT FRONT lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

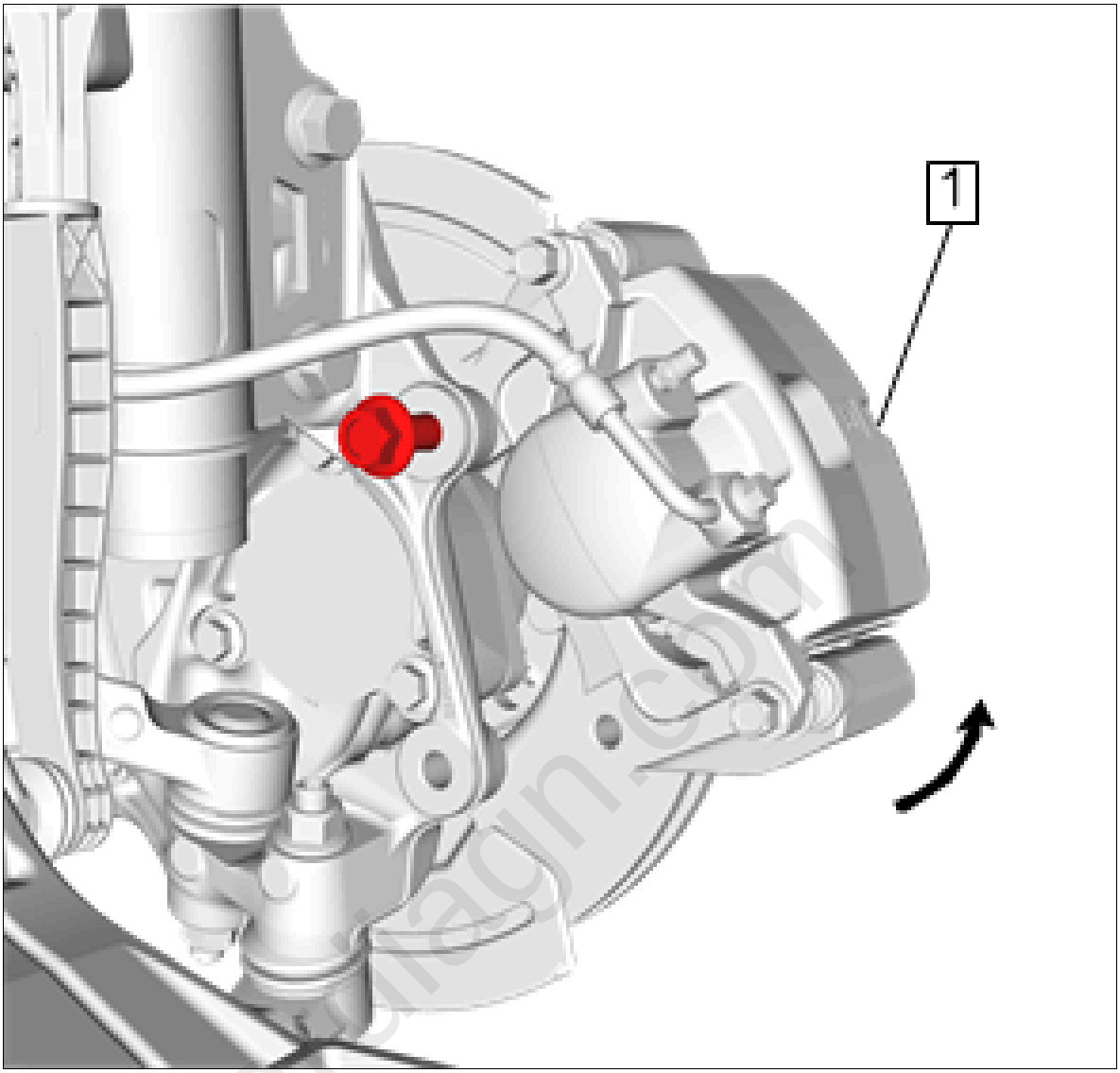
Fig 5: Right Front Upper Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

18. Loosen, but do NOT remove, the RIGHT FRONT upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

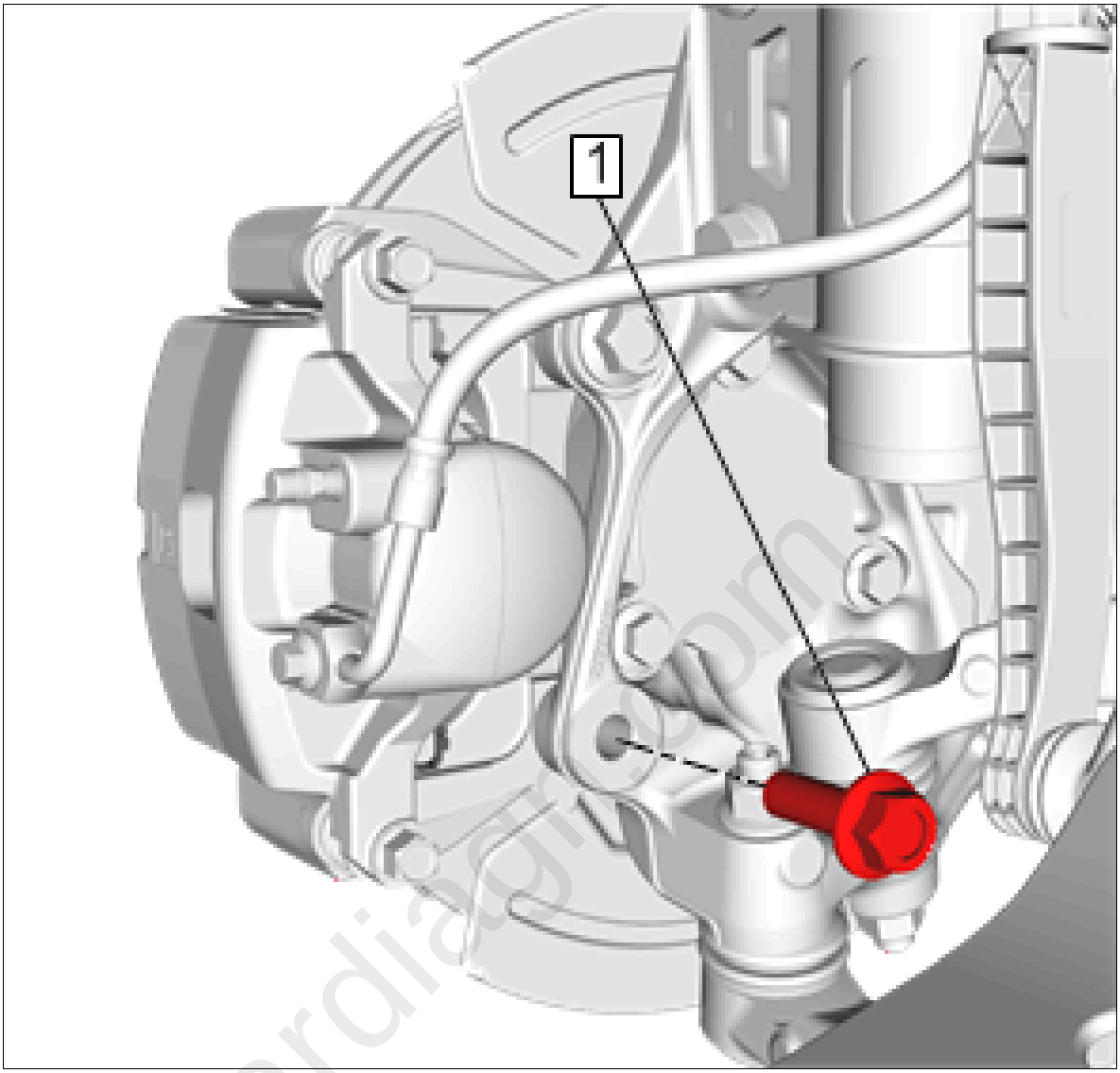
Fig 6: Right Front Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

19. Rotate the RIGHT FRONT brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
20. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.
21. Install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve, then repeat steps 9-14.

Fig 7: Left Front Lower Brake Caliper Bracket Bolt

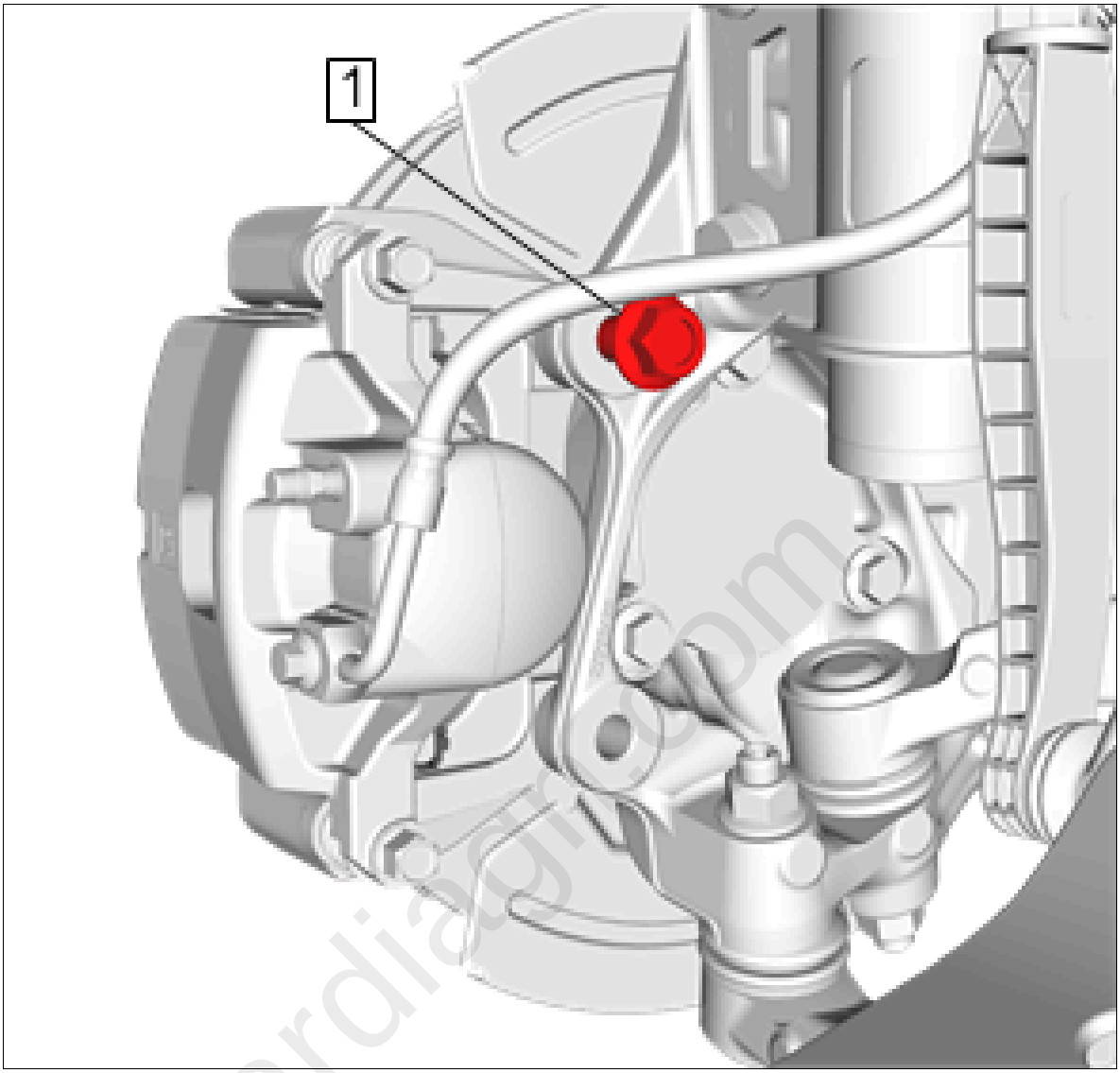


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22. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the LEFT FRONT lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

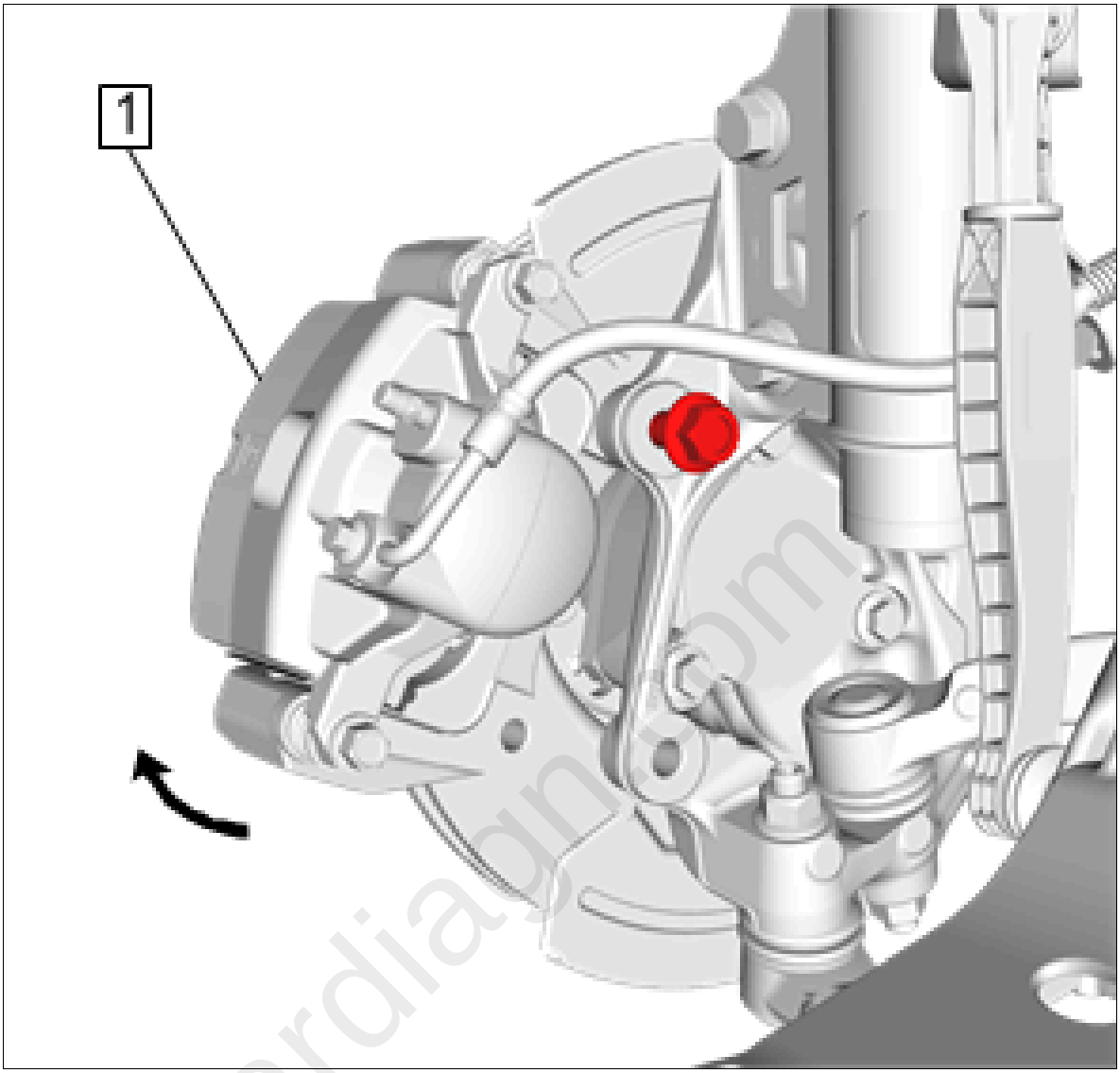
Fig 8: Left Front Upper Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

23. Loosen, but do NOT remove, the LEFT FRONT upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

Fig 9: Left Front Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

24. Rotate the LEFT FRONT brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
25. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.
26. Install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve, then repeat steps 9-14.
27. After completing the final wheel hydraulic circuit bleeding procedure, tighten all of the wheel hydraulic circuit bleeder valves and install the bleeder valve dust caps.
28. Install and tighten the front brake caliper bracket bolts. - Front Brake Caliper Bracket Replacement
29. Fill the master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container.

30. Slowly apply and release the brake pedal. Observe the brake pedal feel.
31. If the brake pedal feels spongy, perform the following procedures:
    1. If equipped with antilock brakes, install a scan tool and perform the Antilock Brake System Automated Bleed to remove air which may be trapped in the BPMV.
    2. Inspect the hydraulic brake system for external leaks. Brake System External Leak Inspection
    3. Repeat the Bleeding the Complete Brake Hydraulic System procedure.
32. If the brake pedal still feels spongy, pressure bleed the hydraulic brake system. Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9)
33. Turn the ignition switch ON with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

> *NOTE:*
>
> *Do NOT allow the vehicle to be driven until it is diagnosed and repaired.*

34. If the brake system warning lamp remains illuminated, diagnose and repair the condition. - Diagnostic Starting Point - Vehicle

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE SYSTEM BLEEDING (PRESSURE JL9)

> *WARNING:*
>
> *Brake Fluid Irritant Warning*

> *CAUTION:*
>
> *Brake Fluid Effects on Paint and Electrical Components Caution*

> *CAUTION:*
>
> *Only use products that comply with GM specifications and check manufacturer information respectively. We recommend the use of GM genuine products. Instructions must be followed at all times. The use of any type of fluid other than the recommended type of brake fluid, may cause contamination which could result in damage to the internal rubber seals and/or rubber linings of hydraulic brake system components.*

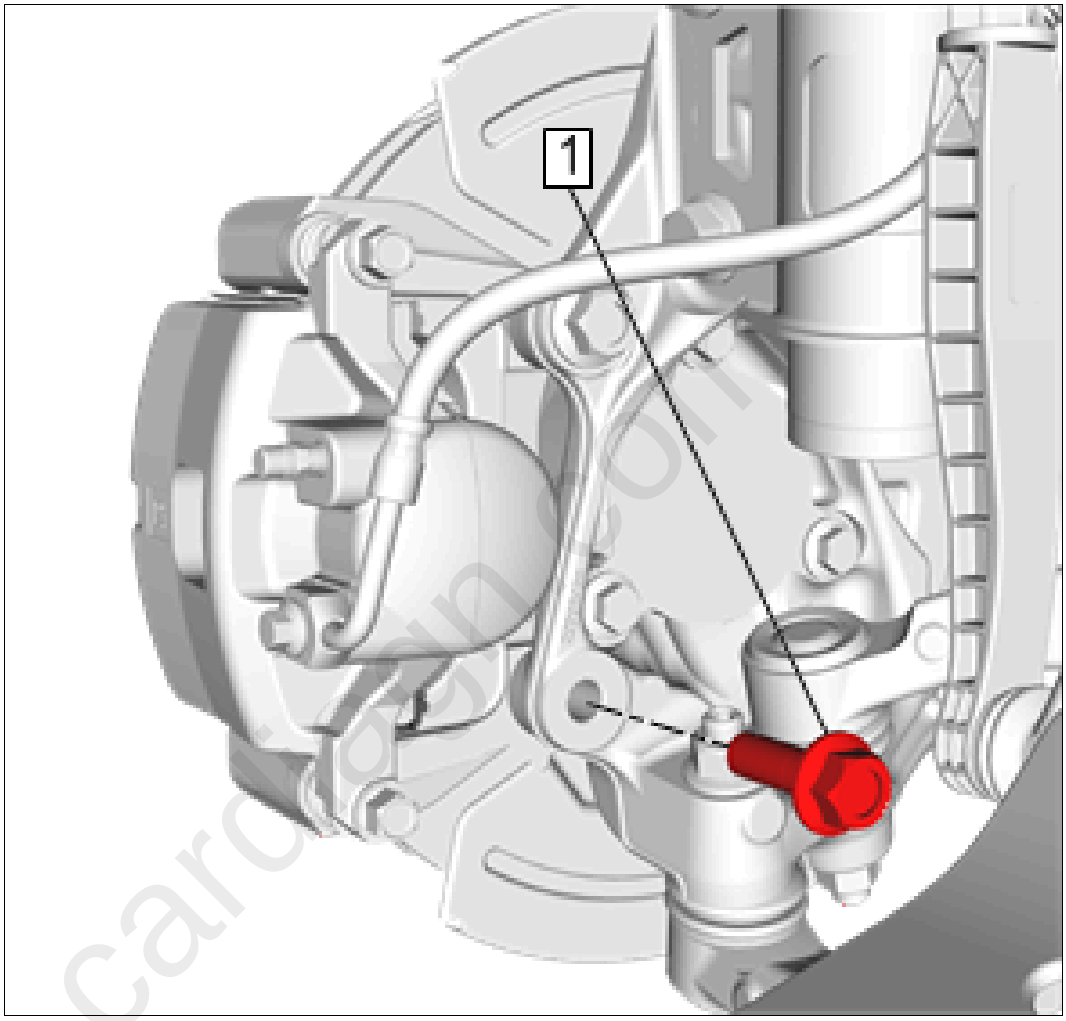
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If hydraulic components were serviced on only one wheel hydraulic circuit, perform the following procedure.

Bleeding a Single Hydraulic Brake Circuit

1. If bleeding the left front or right front hydraulic brake circuit, position and secure the front brake caliper and bracket assembly upward.

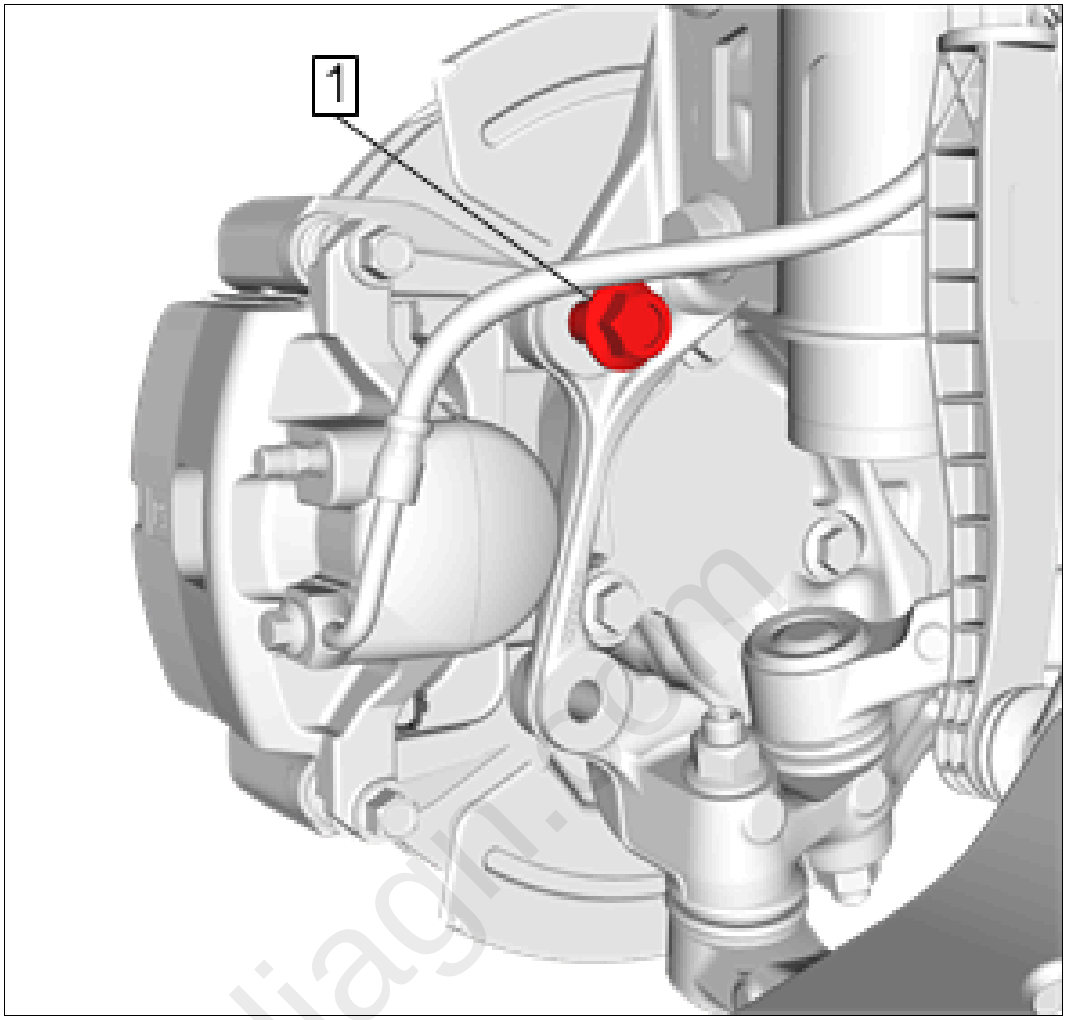
Fig 1: Lower Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

1. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

Fig 2: Upper Brake Caliper Bracket Bolt

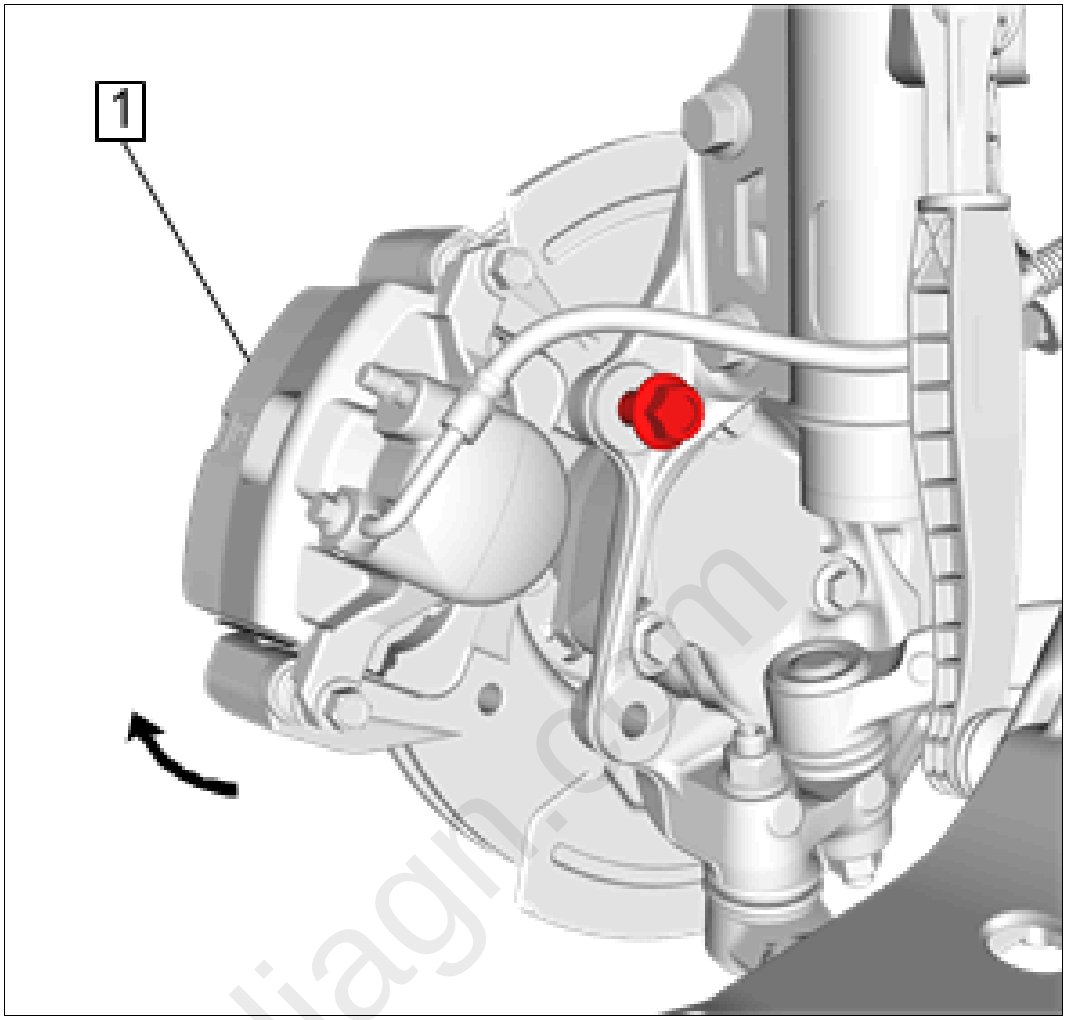


Courtesy of GENERAL MOTORS COMPANY

2. Loosen, but do NOT remove, the upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

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Fig 3: Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

3. Rotate the brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
4. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.

2. With the ignition switch OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. Place a clean shop cloth beneath the brake master cylinder to catch brake fluid spills.
4. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
5. Fill the brake master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container. Fluid and Lubricant Recommendations

> *NOTE:*
>
> *The pressure bleeding equipment must be the diaphragm type. The rubber*

diaphragm between the air supply and the brake fluid prevents air, moisture, oil, and other contaminants from entering the hydraulic system.

6. Following the brake pressure bleeder manufacturer's instructions, fill the brake pressure bleeder with GM approved brake fluid from a clean, sealed brake fluid container.
7. Install the appropriate master cylinder reservoir adapter and connect the brake pressure bleeder.
8. Charge the brake pressure bleeder air tank to 170-200 kPa/1.7-2.0 bar (25-30 psi), or as recommended by the brake pressure bleeder manufacturer's instructions.
9. Open the brake pressure bleeder fluid tank valve to allow pressurized brake fluid to enter the brake hydraulic system.

> *NOTE:*
>
> *Any brake fluid leaks identified require repair prior to completing this procedure.*

10. Wait approximately 30 seconds, then inspect the entire hydraulic brake system for external brake fluid leaks.
11. Install a proper box-end wrench onto the wheel hydraulic circuit bleeder valve which has been serviced.
12. Install a transparent hose over the end of the bleeder valve.
13. Submerge the open end of the transparent hose into a transparent container partially filled with brake fluid from a clean, sealed brake fluid container.
14. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
15. Allow fluid to flow until air bubbles stop flowing from the bleeder.
16. After all air has been purged from the hydraulic circuit, tighten the bleeder valve and install the dust cap.

> *NOTE:*
>
> *The brake reservoir may have residual pressure after the bleeding operation is complete. Wrap a clean shop towel around the bleeder adapter and all hose connections before disconnecting the pressure bleeding equipment to prevent brake fluid from contacting and damaging vehicle components and painted surfaces.*

17. Close the brake pressure bleeder fluid tank valve then disconnect the brake pressure bleeder from the master cylinder reservoir bleeder adapter.
18. Remove the master cylinder reservoir bleeder adapter from the master cylinder reservoir.

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19. Fill the brake master cylinder reservoir to the maximum-fill level with GM approved brake fluid from a clean, sealed brake fluid container.
20. Slowly apply and release the brake pedal. Observe the brake pedal feel.
21. If the brake pedal feels spongy, perform the Bleeding the Complete Brake Hydraulic System procedure.
22. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

> *NOTE:*
>
> *Do NOT allow the vehicle to be driven until it is diagnosed and repaired.*

23. If the brake system warning lamp remains illuminated, diagnose and repair the condition. - Diagnostic Starting Point - Vehicle

Bleeding the Complete Brake Hydraulic System

1. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
2. Place a clean shop cloth beneath the brake master cylinder to catch brake fluid spills.
3. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
4. Fill the brake master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container. Fluid and Lubricant Recommendations
5. If the master cylinder was replaced, the master cylinder must be bench bled. Master Cylinder Bench Bleeding
6. If the brake pipes have been removed from the master cylinder, the following steps must be performed.
    1. With the rear brake pipe installed securely to the master cylinder, loosen and separate the front brake pipe fitting from the front port of the brake master cylinder.
    2. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder. Capture and properly dispose of the brake fluid in an approved container.
    3. Install the front brake pipe fitting to the front port of the brake master cylinder and tighten the fitting. Fastener Specifications
    4. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the pedal.
    5. Loosen the front brake pipe fitting from the front port of the brake master cylinder to purge air from the master cylinder port.
    6. Tighten the front brake pipe fitting, then have the assistant slowly release the brake pedal.

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7. Wait 15 seconds, then repeat steps 6.4-6.6 until all air is purged from the front brake pipe fitting of the front port of the master cylinder.
8. After all air is purged from the front port of the brake master cylinder, tighten the front master cylinder brake pipe fitting. Fastener Specifications
9. With the front brake pipe fitting installed securely to the front port of the brake master cylinder, loosen and separate the rear brake pipe fitting from the rear port of the brake master cylinder.
10. Repeat steps 6.2-6.7 for the rear port of the brake master cylinder.
11. After all air is purged from the rear port of the brake master cylinder, tighten the rear master cylinder brake pipe fitting. Fastener Specifications
12. Slowly apply and release the brake pedal. Observe the brake pedal feel.
13. If the brake pedal feels spongy, proceed to step 7.
14. If the brake pedal feels firm, proceed to step 38.

7. If the brake pipes have been removed from the brake pressure modulator valve (BPMV) assembly, if equipped, or the brake proportion valve assembly, if equipped, air must be purged from each port of the respective assembly beginning with the feed pipes from the master cylinder.
    1. Loosen and separate one of the master cylinder brake pipe fittings from the inlet port of the assembly to be bled.
    2. Allow a small amount of brake fluid to gravity bleed from the open port of the assembly. Capture and properly dispose of the brake fluid in an approved container.
    3. Install the brake pipe fitting and to the inlet port of the assembly and tighten securely.
    4. Have an assistant slowly apply the brake pedal fully and maintain steady pressure on the pedal.
    5. Loosen the same brake pipe fitting to purge air from the open port of the assembly.
    6. Tighten the brake pipe fitting, then have the assistant slowly release the brake pedal.
    7. Wait 15 seconds, then repeat steps 7.4-7.6 until all air is purged from the brake pipe fitting of the assembly.
    8. Repeat steps 7.1-7.7 for all of the remaining ports of the assembly.
    9. After bleeding each port of the assembly, tighten all of the brake pipe fittings on the assembly. Fastener Specifications
    10. Fill the master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container.
    11. Slowly apply and release the brake pedal. Observe the brake pedal feel.
    12. If the brake pedal feels spongy, proceed to step 8.
    13. If the brake pedal feels firm, proceed to step 38.

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> *NOTE:*
>
> *The pressure bleeding equipment must be the diaphragm type. The rubber diaphragm between the air supply and the brake fluid prevents air, moisture, oil, and other contaminants from entering the hydraulic system.*

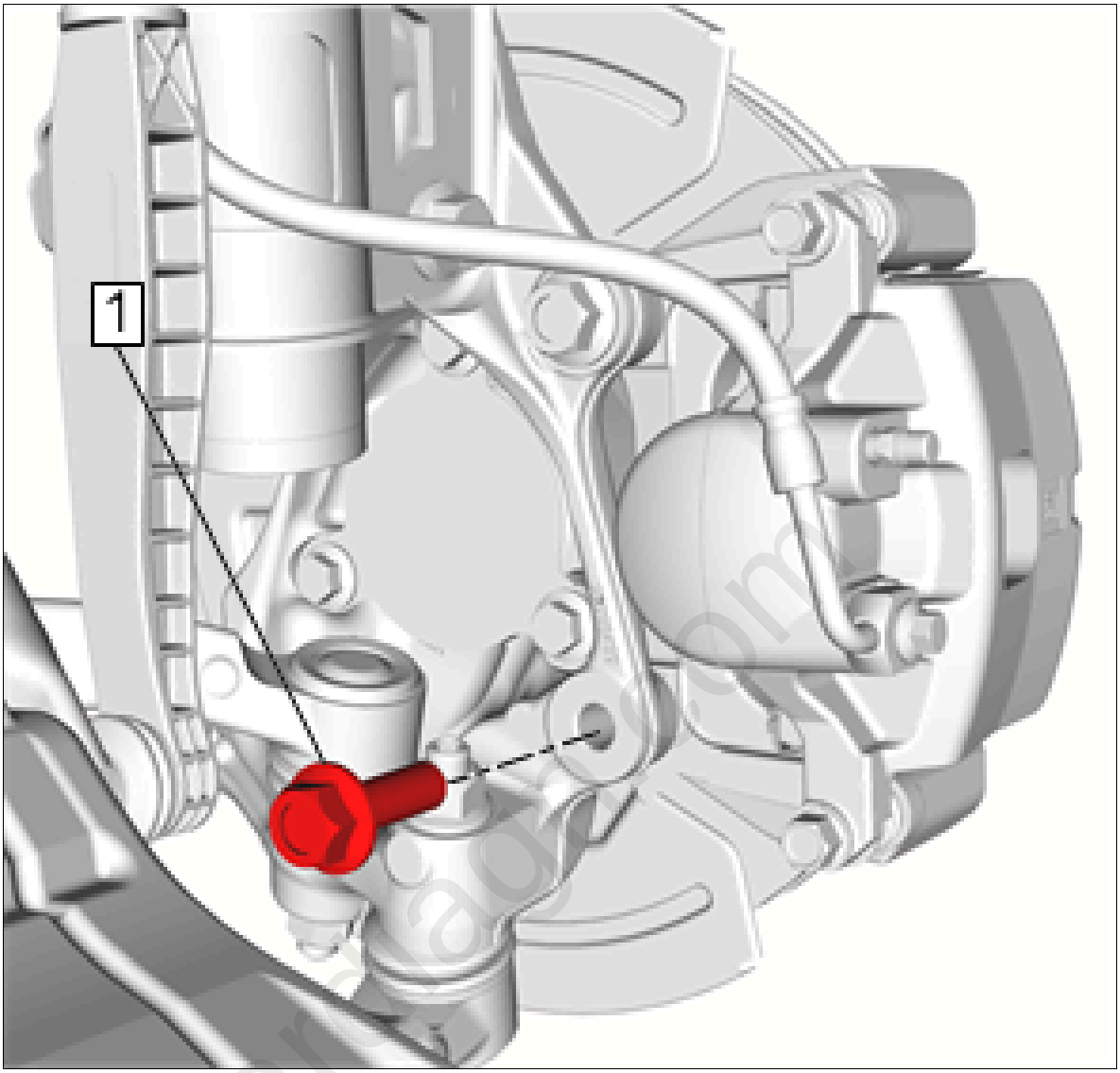
8. Following the brake pressure bleeder manufacturer's instructions, fill the brake pressure bleeder with GM approved brake fluid from a clean, sealed brake fluid container.
9. Install the appropriate master cylinder reservoir adapter and connect the brake pressure bleeder.
10. Charge the brake pressure bleeder air tank to 170-200 kPa/1.7-2.0 bar (25-30 psi), or as recommended by the brake pressure bleeder manufacturer's instructions.
11. Open the brake pressure bleeder fluid tank valve to allow pressurized brake fluid to enter the brake hydraulic system.

> *NOTE:*
>
> *Any brake fluid leaks identified require repair prior to completing this procedure.*

12. Wait approximately 30 seconds, then inspect the entire hydraulic brake system for external brake fluid leaks.
13. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valve.
14. Install a transparent hose over the end of the bleeder valve.
15. Submerge the open end of the transparent hose into a transparent container partially filled with GM approved brake fluid from a clean, sealed brake fluid container.
16. Have an assistant slowly apply and maintain steady pressure on the brake pedal.
17. Loosen the bleeder valve to purge air from the wheel hydraulic circuit.
18. Allow fluid to flow until air bubbles stop flowing from the bleeder.
19. After all air has been purged from the hydraulic circuit, tighten the bleeder valve and install the dust cap.
20. Install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve, then repeat steps 14-18.

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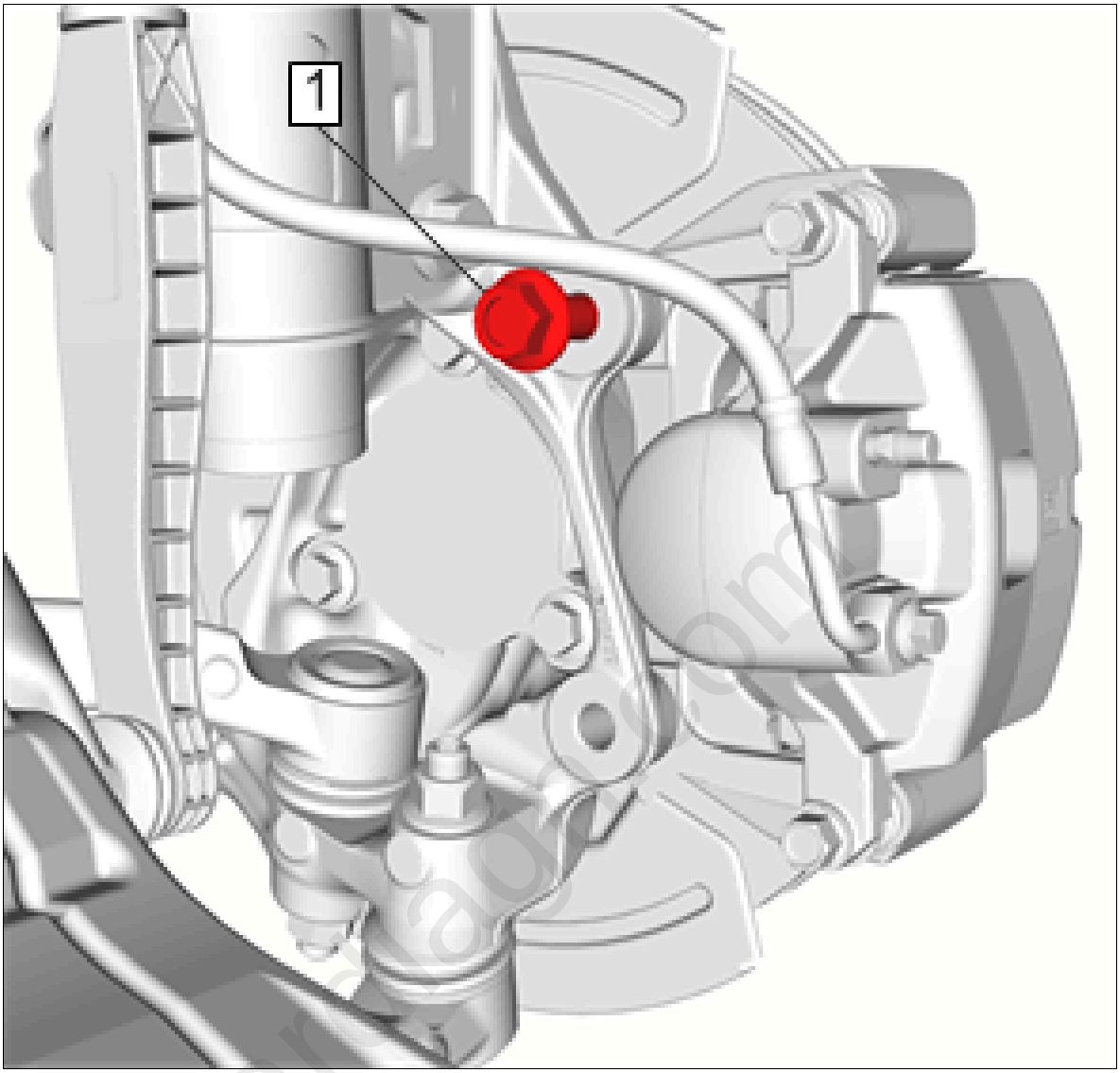
Fig 4: Right Front Lower Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

21. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the RIGHT FRONT lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

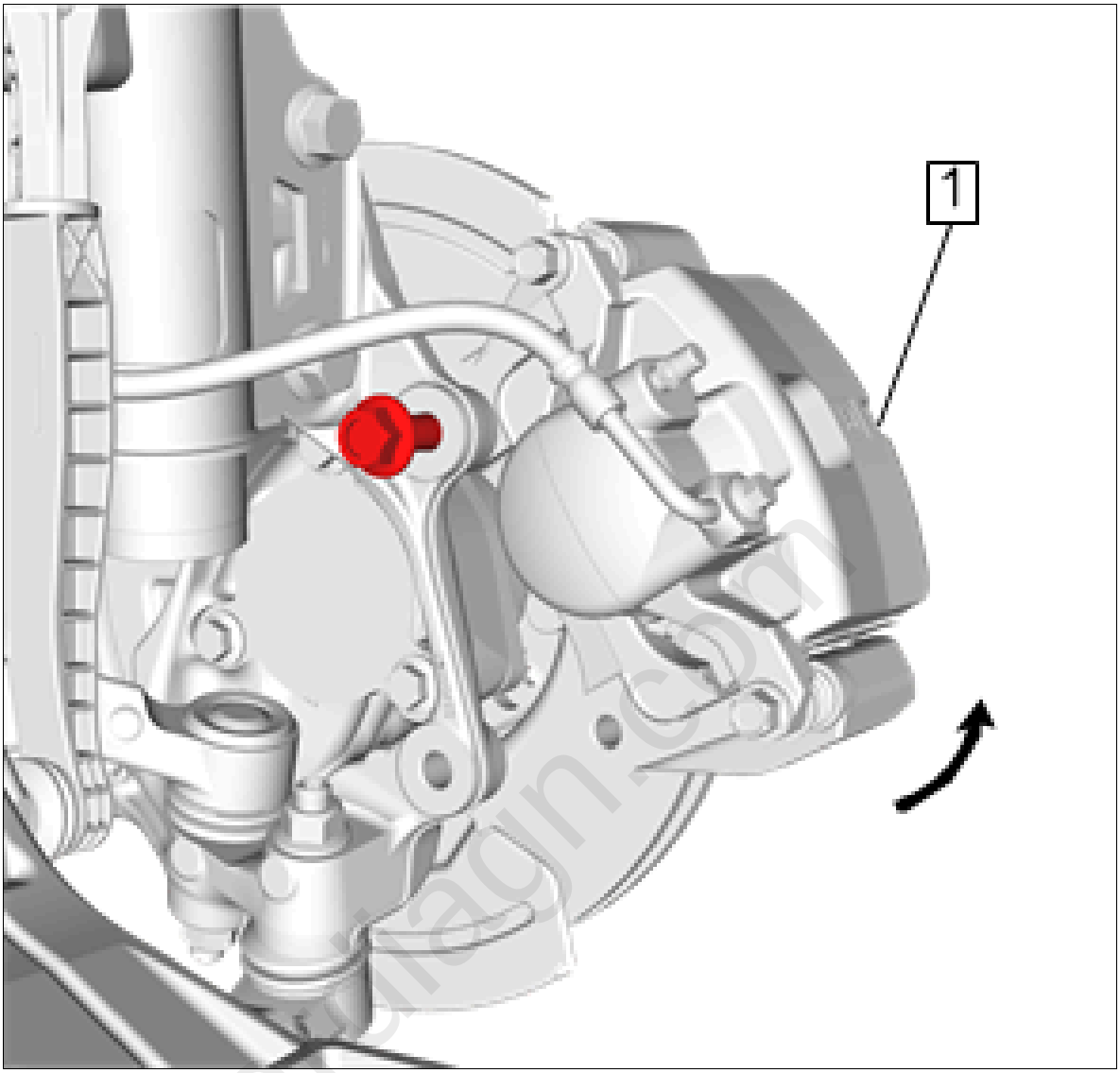
Fig 5: Right Front Upper Brake Caliper Bracket Bolt



Courtesy of GENERAL MOTORS COMPANY

22. Loosen, but do NOT remove, the RIGHT FRONT upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

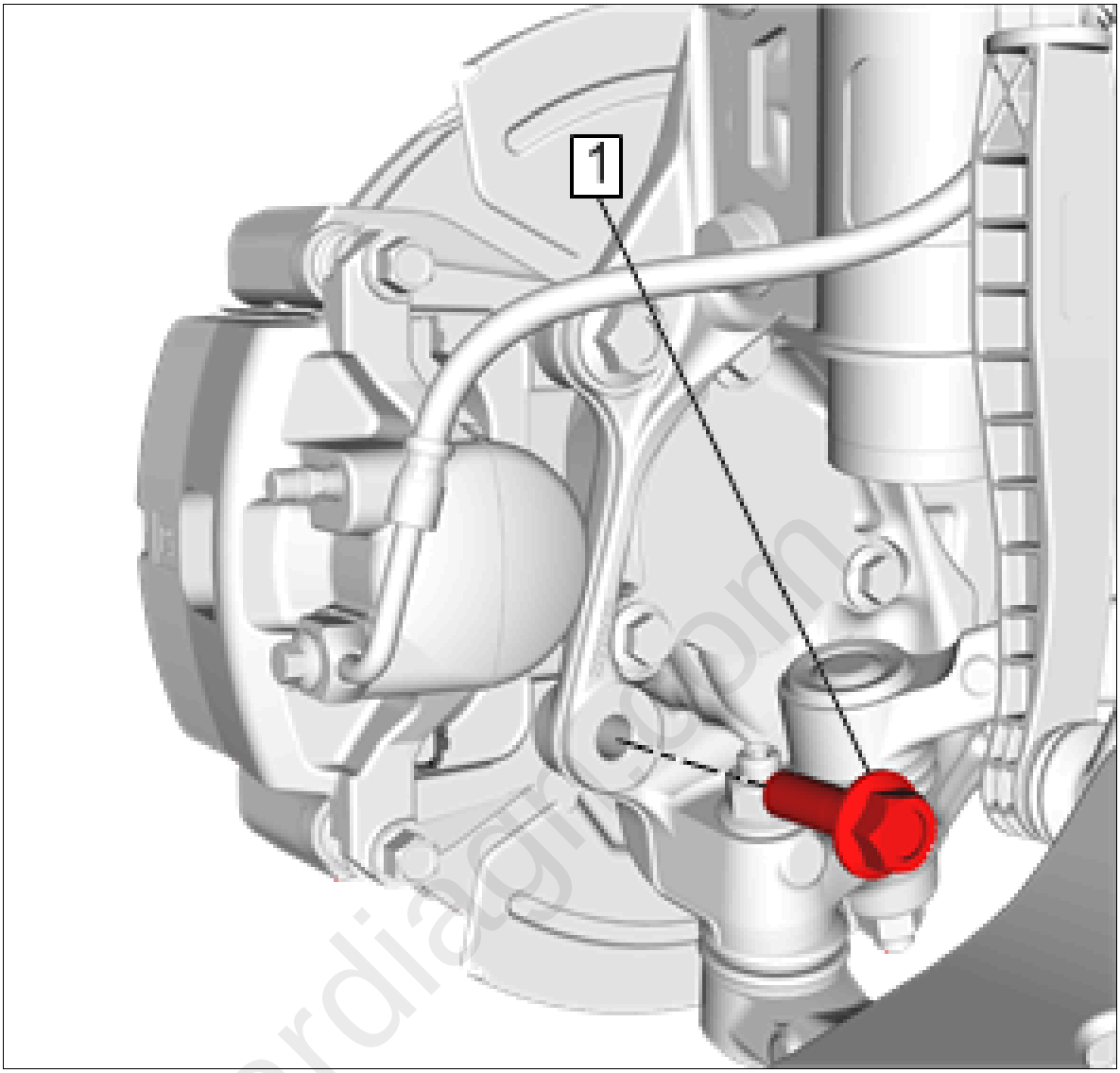
Fig 6: Right Front Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

23. Rotate the RIGHT FRONT brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
24. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.
25. Install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve, then repeat steps 14-18.

Fig 7: Left Front Lower Brake Caliper Bracket Bolt

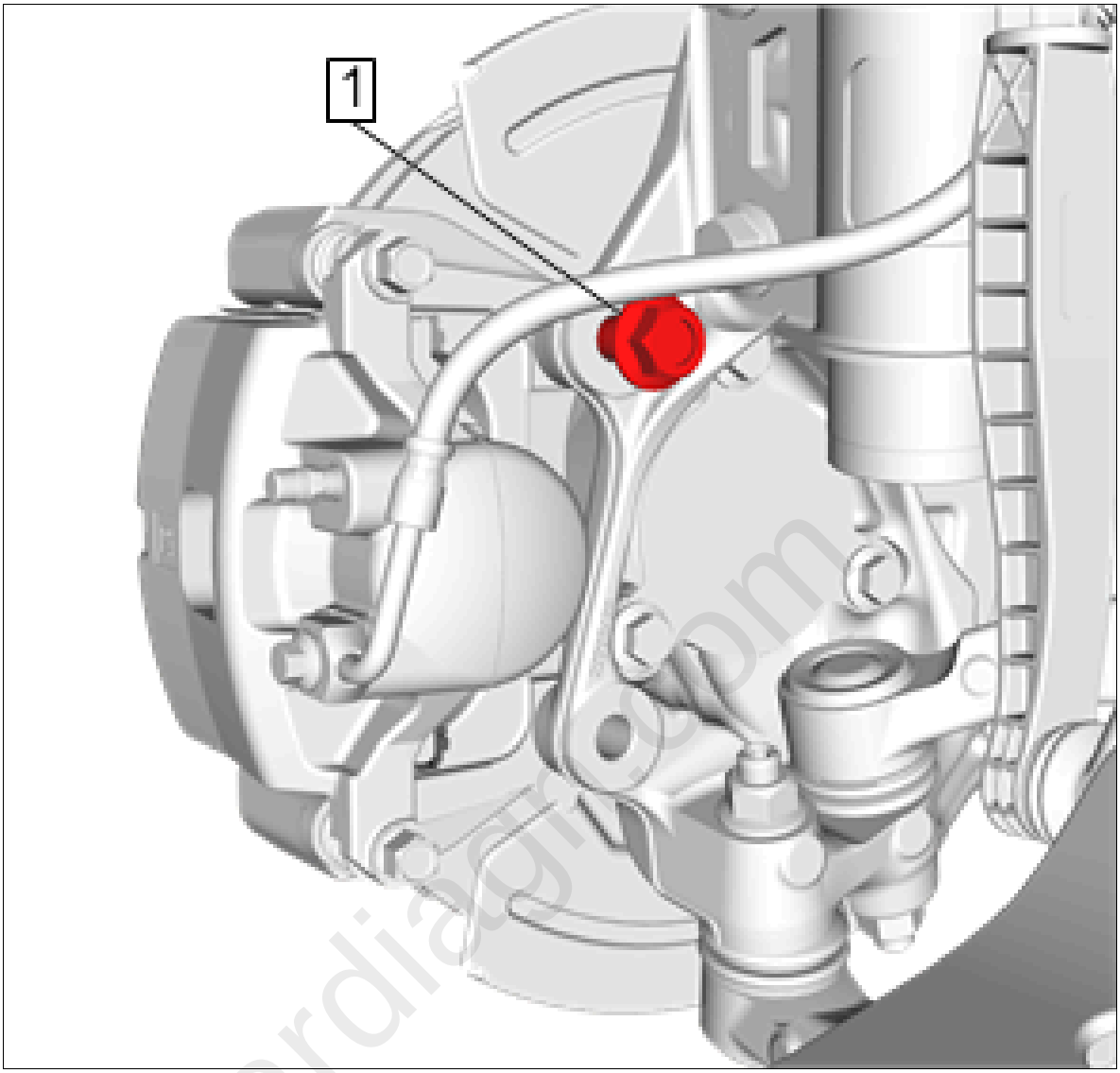


Courtesy of GENERAL MOTORS COMPANY

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26. Without disconnecting the front brake hose and without removing the front disc brake pads, remove the LEFT FRONT lower brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

Fig 8: Left Front Upper Brake Caliper Bracket Bolt

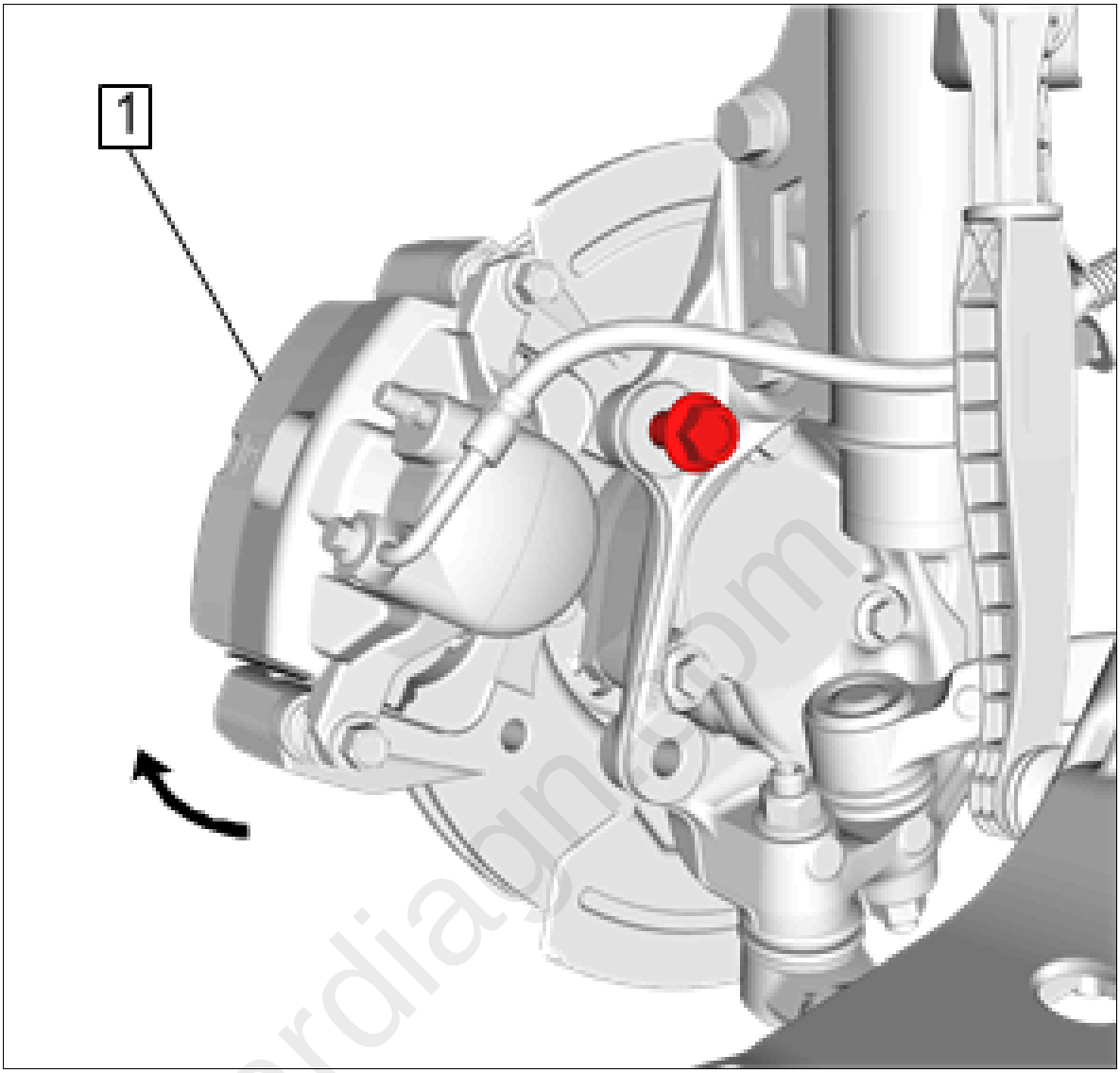


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27. Loosen, but do NOT remove, the LEFT FRONT upper brake caliper bracket bolt (1) - Front Brake Caliper Bracket Replacement

Fig 9: Left Front Brake Caliper And Bracket Assembly



Courtesy of GENERAL MOTORS COMPANY

28. Rotate the LEFT FRONT brake caliper and bracket assembly (1) upward until it contacts the front brake shield.
29. Secure the brake caliper and bracket assembly in this position until the entire bleeding procedure is complete.
30. Install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve, then repeat steps 14-18.
31. After completing the final wheel hydraulic circuit bleeding procedure, tighten all of the wheel hydraulic circuit bleeder valves and install the bleeder valve dust caps.
32. Install and tighten the front brake caliper bracket bolts. - Front Brake Caliper Bracket Replacement
33. Close the brake pressure bleeder fluid tank valve.

NOTE:

The brake reservoir may have residual pressure after the bleeding operation is complete. Wrap a clean shop towel around the bleeder adapter and all hose connections before disconnecting the pressure bleeding equipment to prevent brake fluid from contacting and damaging vehicle components and painted surfaces.

34. Remove the brake pressure bleeding equipment from the vehicle.
35. Fill the brake master cylinder reservoir to the maximum-full level with GM approved brake fluid from a clean, sealed brake fluid container. Fluid and Lubricant Recommendations
36. Slowly apply and release the brake pedal. Observe the brake pedal feel.
37. If the brake pedal still feels spongy, perform the following procedures:
    1. If equipped with antilock brakes, install a scan tool and perform the Antilock Brake System Automated Bleed to remove air which may be trapped in the BPMV.
    2. Inspect the hydraulic brake system for external leaks. Brake System External Leak Inspection
    3. Repeat the Bleeding the Complete Brake Hydraulic System procedure.
38. Turn the ignition switch ON with the engine OFF. Check to see if the brake system warning lamp remains illuminated.

NOTE:

Do NOT allow the vehicle to be driven until it is diagnosed and repaired.

39. If the brake system warning lamp remains illuminated, diagnose and repair the condition. - Diagnostic Starting Point - Vehicle .

REPAIR INSTRUCTIONS > HYDRAULIC BRAKE SYSTEM FLUSHING

WARNING:

Brake Fluid Irritant Warning .

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⚠ *CAUTION:*

Brake Fluid Effects on Paint and Electrical Components Caution .

1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
    1. Fluid separation, indicating 2 types of fluid are present; a substance other than the recommended brake fluid has been introduced into the brake hydraulic system
        1. Swirled appearance - oil-based substance
        2. Layered appearance - silicone-based substance
    2. Fluid discoloration, indicating the presence of moisture or particles that have been introduced into the brake hydraulic system
        1. Cloudy appearance - moisture
        2. Dark appearance/suspended particles in fluid - dirt, rust, corrosion, brake dust
2. Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating brake fluid contamination.
3. If the brake fluid WAS contaminated with an oil-based or a silicone-based substance, indicated by fluid separation and/or a swollen master cylinder reservoir cap diaphragm and/or swollen reservoir-to-master cylinder grommets, perform the following:
    1. Remove ALL of the following components listed from the vehicle. Each component contains internal rubber seals/linings which have been contaminated by the contaminated brake fluid in the brake hydraulic system.
        1. Master Cylinder Reservoir Replacement
        2. Master Cylinder Replacement
        3. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9)
        4. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G)
        5. Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G)
        6. Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55)
        7. Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement
    2. Clean out all the hydraulic brake pipes using denatured alcohol, or equivalent.
    3. Dry the brake pipes using non-lubricated, filtered air.
    4. Repair or replace ALL of the following components listed and install them to the

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vehicle. Each component contains internal rubber seals/linings which have been contaminated by the contaminated brake fluid in the brake hydraulic system.

1. Master Cylinder Replacement ; also perform the following:

   Clean the brake master cylinder reservoir using denatured alcohol, or equivalent, then dry the reservoir using non-lubricated, filtered air. Inspect the reservoir for cracks and/or damage and replace if necessary. Master Cylinder Reservoir Replacement .

   Replace the brake master cylinder reservoir cap diaphragm.

2. Front Brake Hose Replacement (J55, J6G) Front Brake Hose Replacement (JL9)

3. Rear Brake Hose Replacement (JL9, J55) Rear Brake Hose Replacement (J6G)

4. Front Brake Caliper Replacement (JL9)Front Brake Caliper Replacement (J55, J6G)

5. Rear Brake Caliper Replacement (J6G)Rear Brake Caliper Replacement (JL9, J55)

6. Electronic Brake Control Module with Brake Pressure Modulator Valve Replacement

4. If the brake fluid was NOT contaminated with an oil-based or a silicone-based substance, but WAS contaminated with water or dirt, rust, corrosion, and/or brake dust, replace the brake master cylinder reservoir cap diaphragm. The diaphragm may have allowed the moisture or particles to enter the hydraulic system.

5. Fill the brake master cylinder reservoir to the maximum-fill level with approved brake fluid from a clean, sealed brake fluid container as specified in the owners manual.

6. Pressure bleed the hydraulic brake system. Begin the procedure with the pressure bleeder reservoir filled to the maximum-fill level with the correct brake fluid as indicated. Hydraulic Brake System Bleeding (Manual J55, J6G) Hydraulic Brake System Bleeding (Pressure J55, J6G) Hydraulic Brake System Bleeding (Manual JL9) Hydraulic Brake System Bleeding (Pressure JL9) .

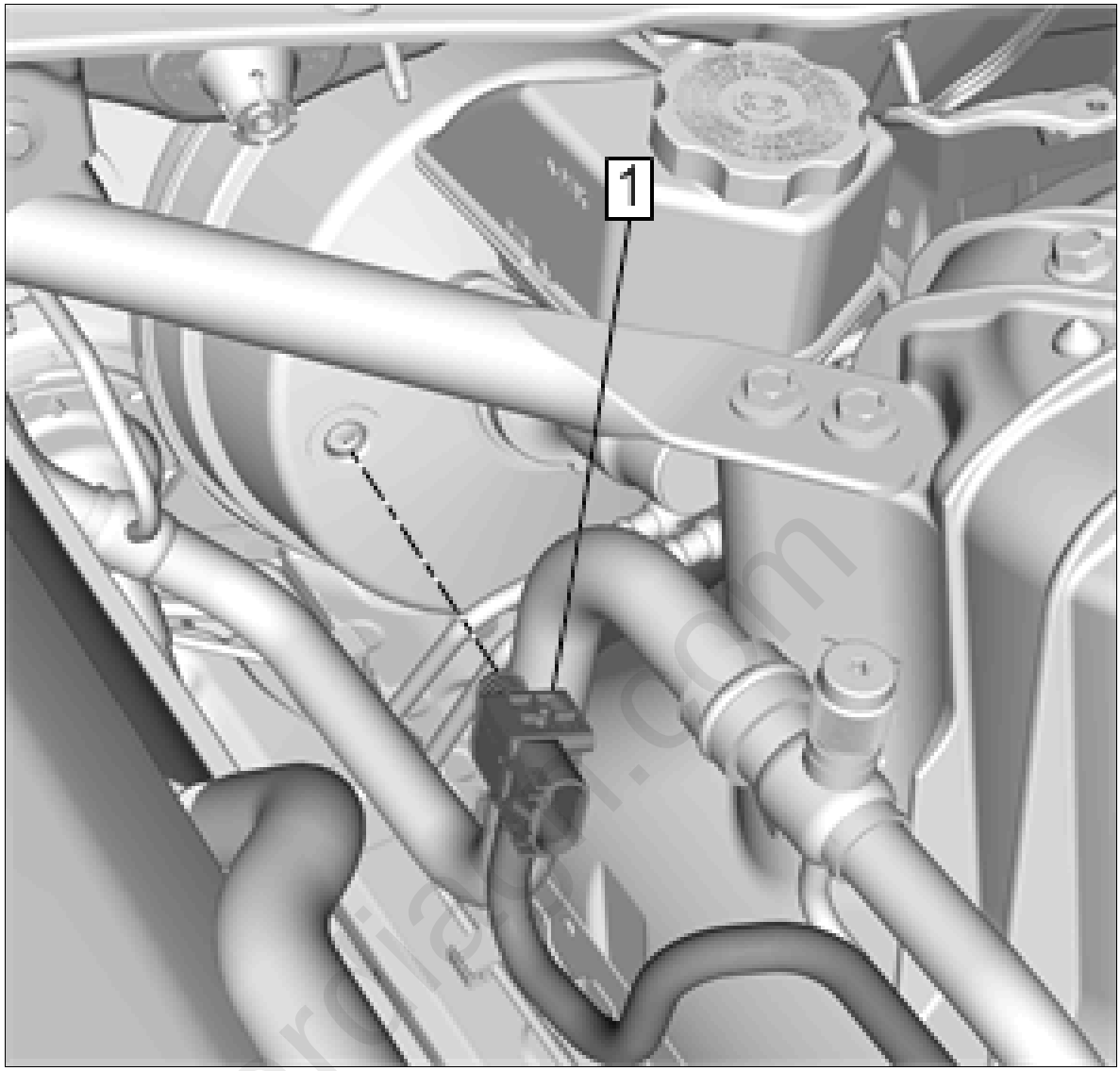
REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PRESSURE SENSOR REPLACEMENT > REMOVAL PROCEDURE

1. Apply the brake pedal several times until the pedal becomes firm to deplete the power brake booster vacuum reserve.

2. Disconnect the power brake booster pressure sensor electrical connector.

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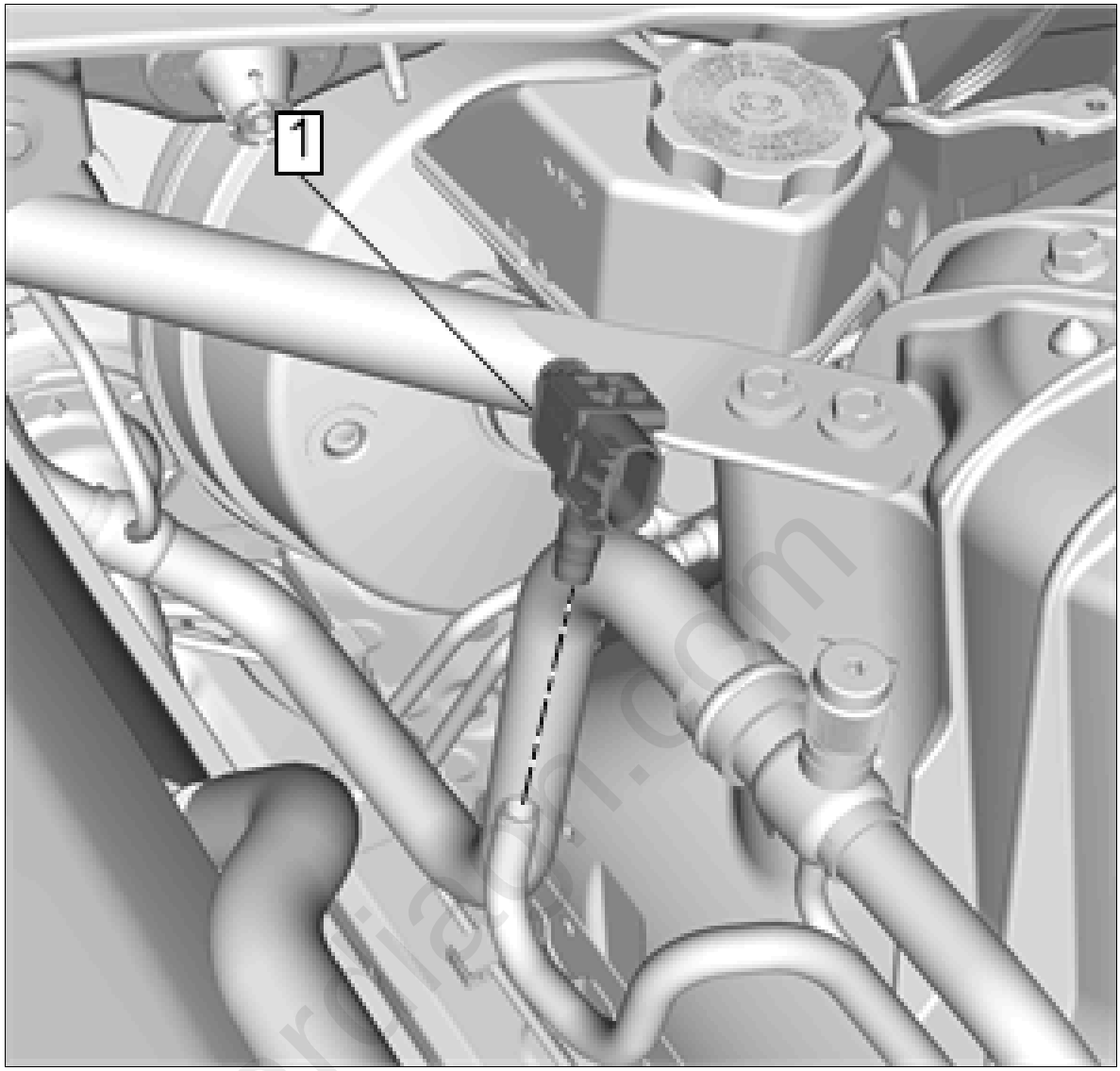
Fig 1: Power Brake Booster Pressure Sensor At Power Brake Booster



Courtesy of GENERAL MOTORS COMPANY

3. Remove Power Brake Booster Pressure Sensor (1) at Power Brake Booster.

Fig 2: Power Brake Booster Pressure Sensor

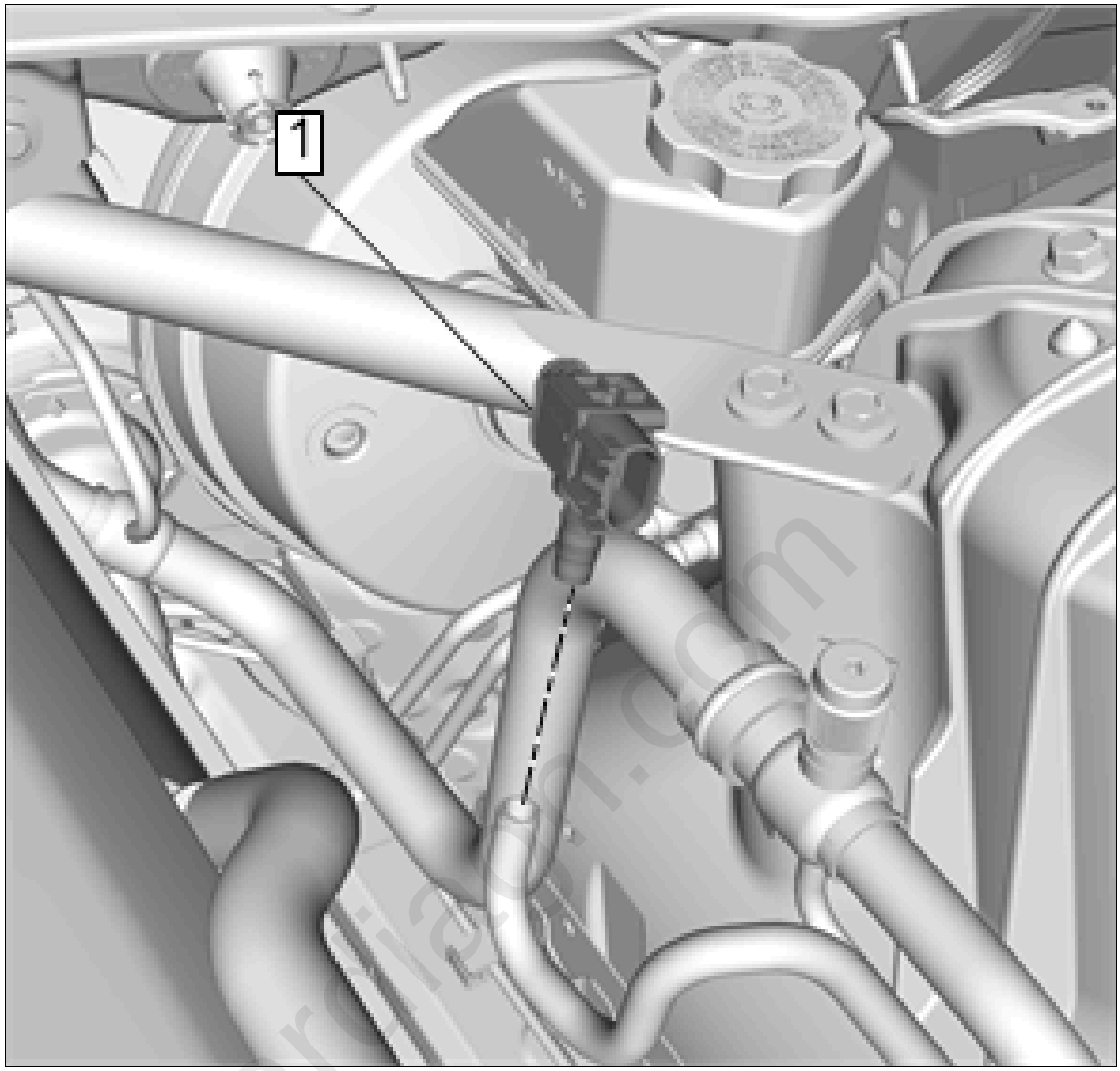


Courtesy of GENERAL MOTORS COMPANY

4. Remove Power Brake Booster Pressure Sensor (1).

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PRESSURE SENSOR REPLACEMENT > INSTALLATION PROCEDURE

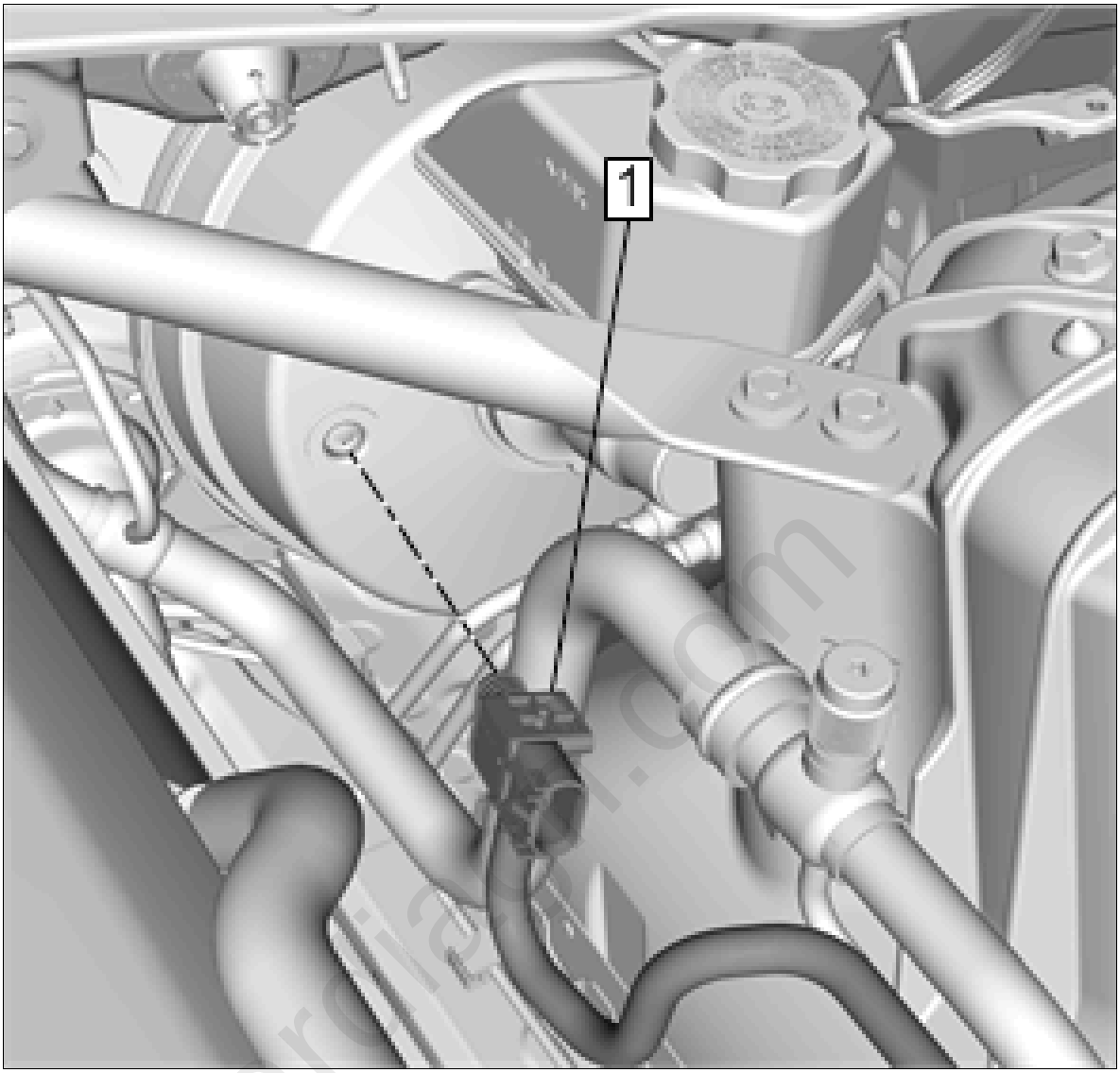
Fig 1: Power Brake Booster Pressure Sensor



Courtesy of GENERAL MOTORS COMPANY

1. Install Power Brake Booster Pressure Sensor (1).

Fig 2: Power Brake Booster Pressure Sensor At Power Brake Booster



Courtesy of GENERAL MOTORS COMPANY

> *NOTE:*
>
> *A small amount of denatured alcohol may be used to ease assembly.*

2. Install Power Brake Booster Pressure Sensor (1) at Power Brake Booster.
3. Connect the power brake booster pressure sensor electrical connector.

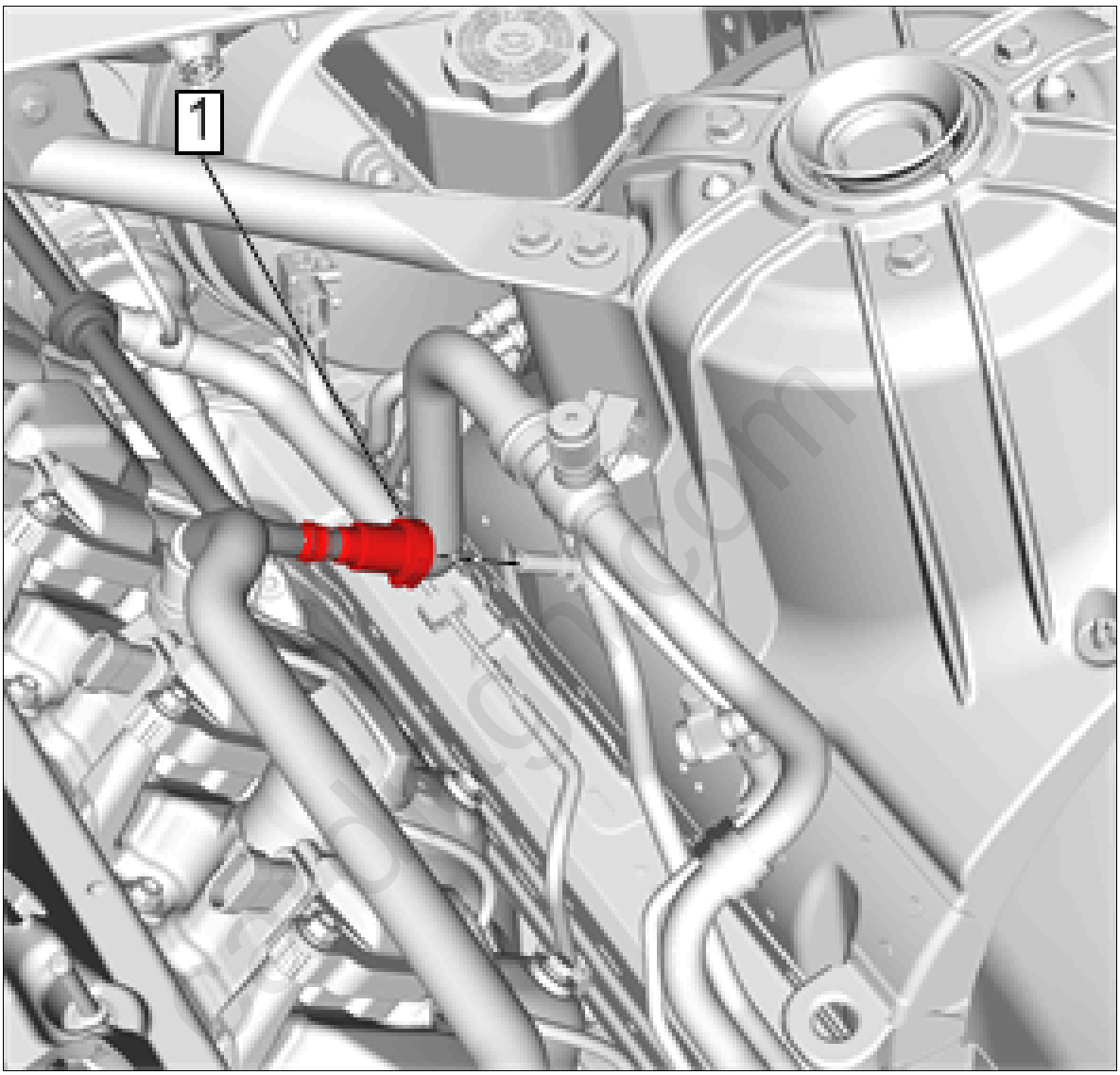
REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PUMP INLET PIPE REPLACEMENT > REMOVAL PROCEDURE

1. Apply the brake pedal several times until the pedal becomes firm to deplete the power vacuum

brake booster vacuum reserve.

2. Remove Front End Sheet Metal Diagonal Brace Replacement - Left Side .
3. Remove Valve Rocker Arm Cover Insulator Replacement - Left Side .

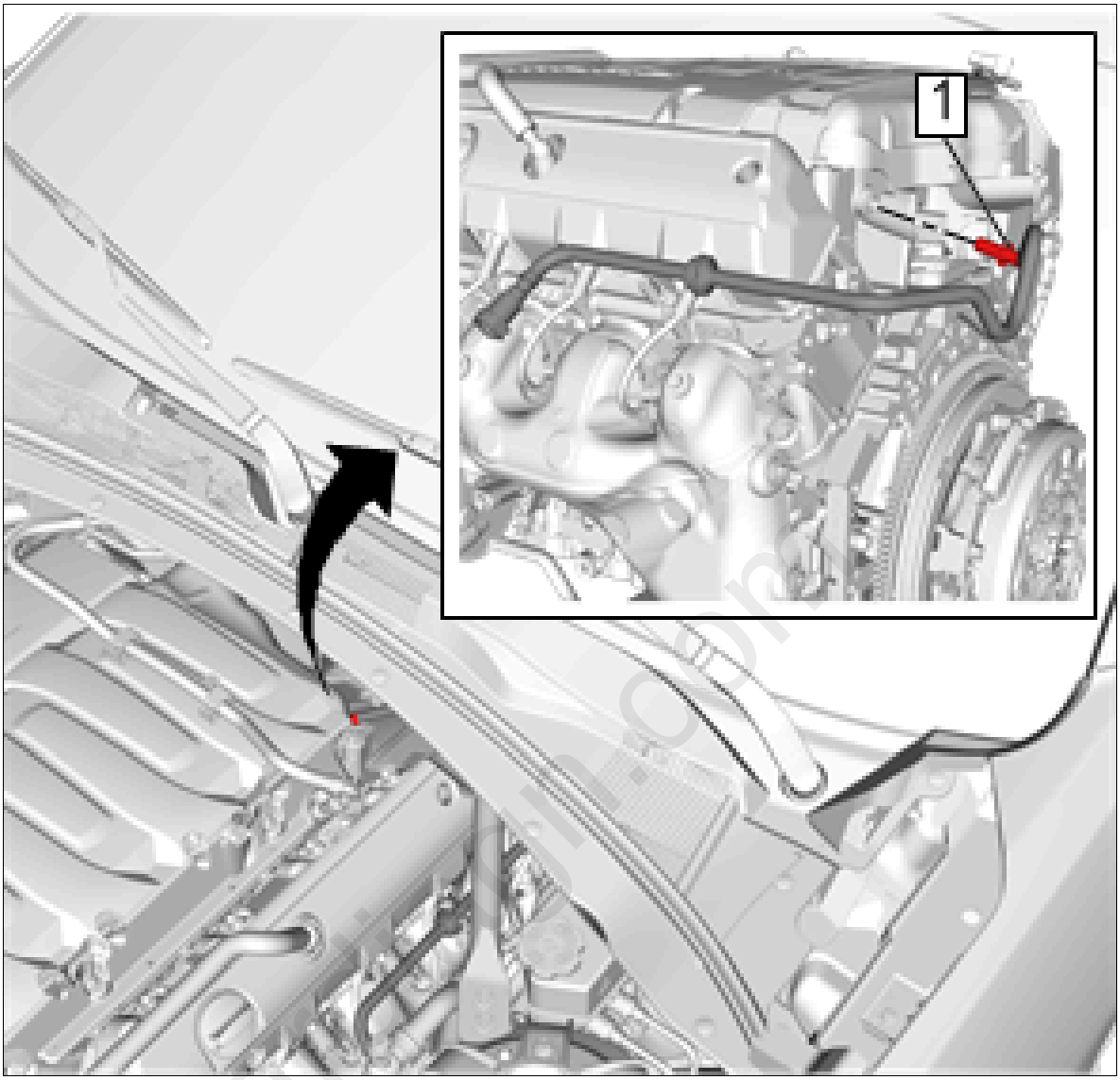
Fig 1: Power Brake Booster Inlet Pipe Quick Connect At Vacuum Pipe



Courtesy of GENERAL MOTORS COMPANY

4. Disconnect Power Brake Booster Inlet Pipe Quick Connect (1) at Vacuum Pipe.

Fig 2: Power Brake Booster Inlet Pipe Fitting At Intake Manifold



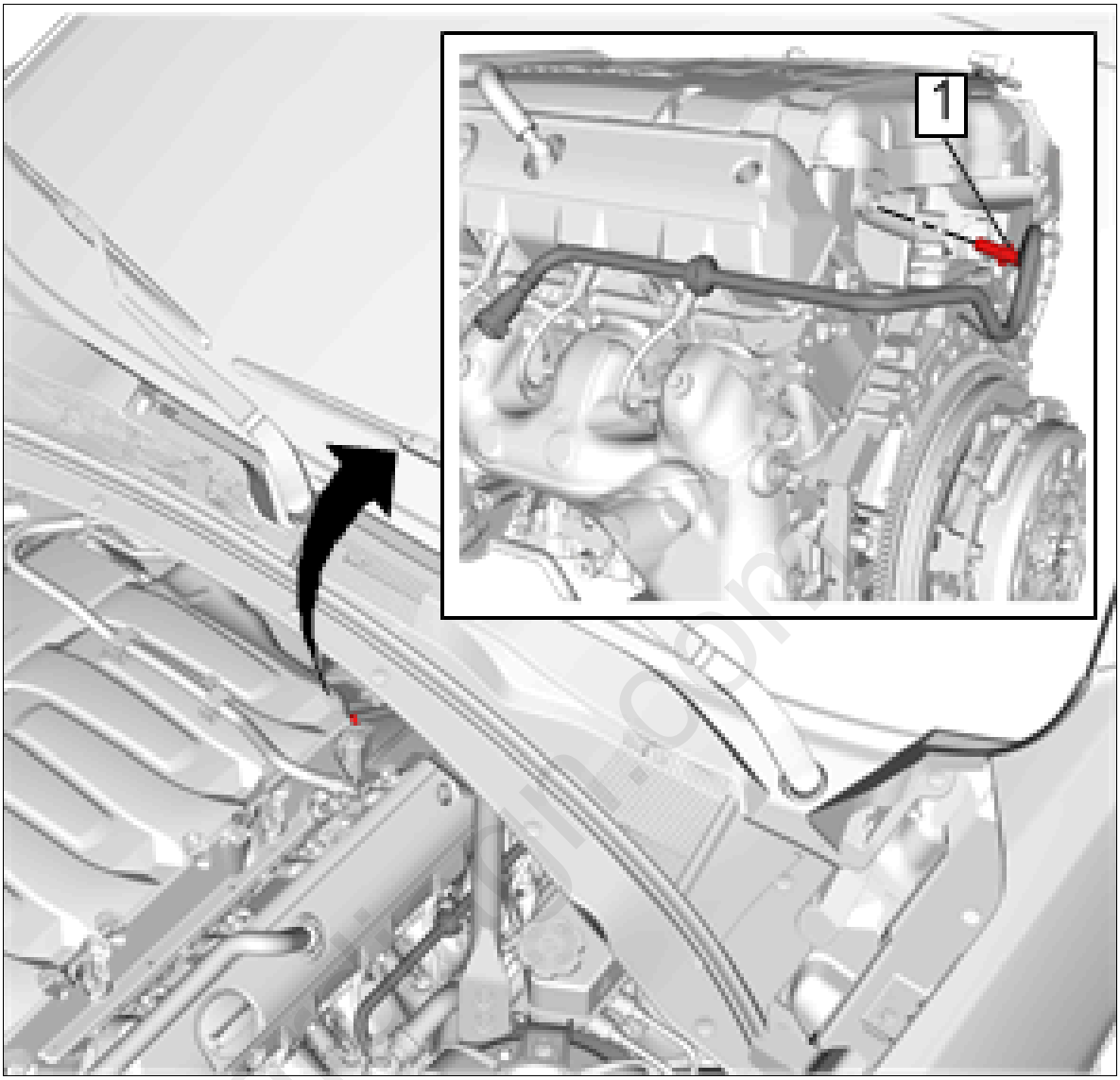
Courtesy of GENERAL MOTORS COMPANY

5. Release Power Brake Booster Inlet Pipe Fitting (1) at Intake Manifold.
6. Remove Power Brake Booster Inlet Pipe.

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PUMP INLET PIPE REPLACEMENT > INSTALLATION PROCEDURE

1. Install Power Brake Booster Inlet Pipe.

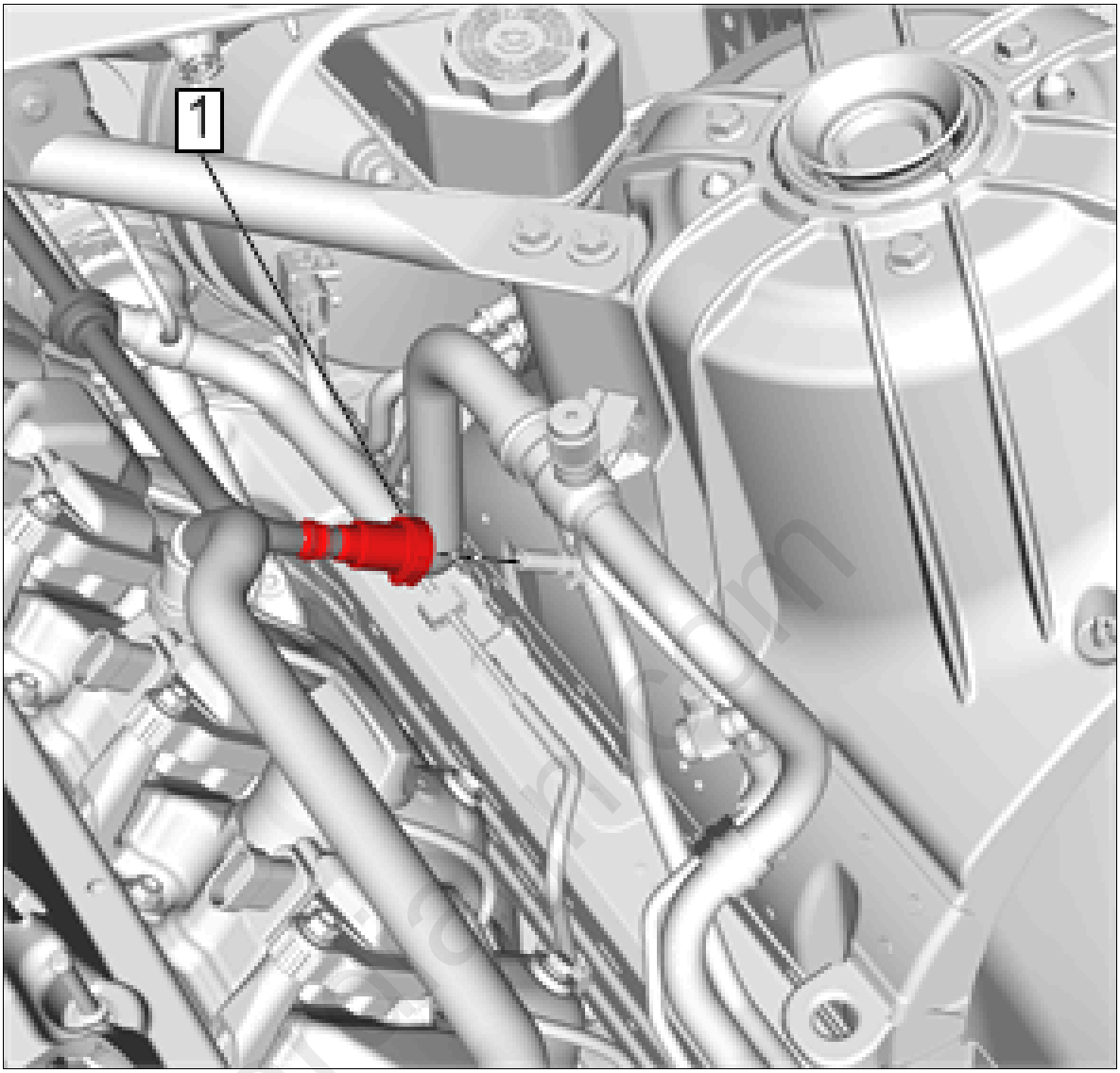
Fig 1: Power Brake Booster Inlet Pipe Fitting At Intake Manifold



Courtesy of GENERAL MOTORS COMPANY

2. Install Power Brake Booster Inlet Pipe Fitting (1) at Intake Manifold.

Fig 2: Power Brake Booster Inlet Pipe Quick Connect At Vacuum Pipe



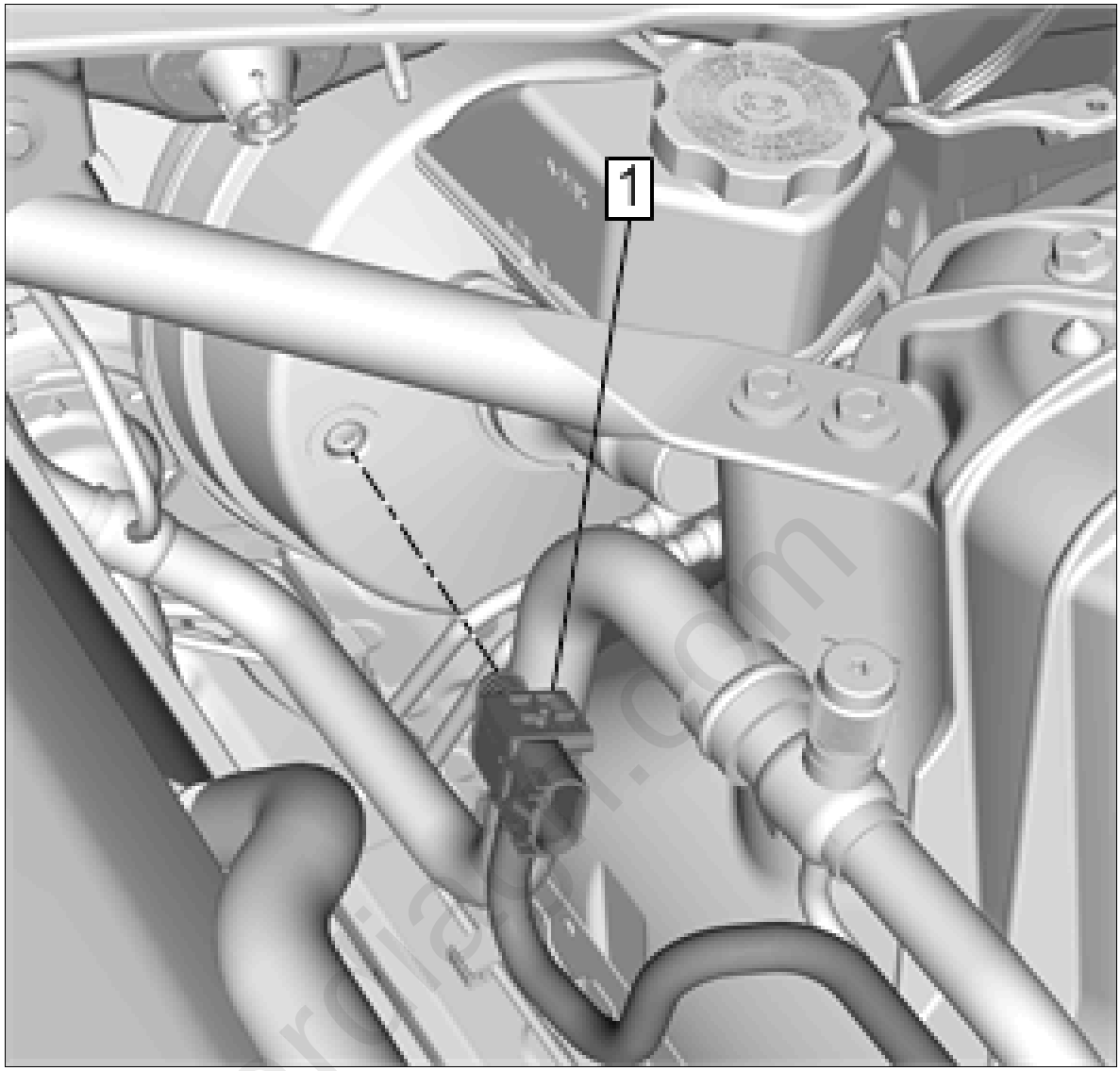
Courtesy of GENERAL MOTORS COMPANY

3. Connect Power Brake Booster Inlet Pipe Quick Connect (1) at Vacuum Pipe.
4. Install Valve Rocker Arm Cover Insulator Replacement - Left Side .
5. Install Front End Sheet Metal Diagonal Brace Replacement - Left Side .

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM PIPE REPLACEMENT > REMOVAL PROCEDURE

1. Apply the brake pedal several times until the pedal becomes firm to deplete the power brake booster vacuum reserve.
2. Disconnect the power brake booster vacuum sensor electrical connector.
3. Remove Air Cleaner Assembly Replacement .

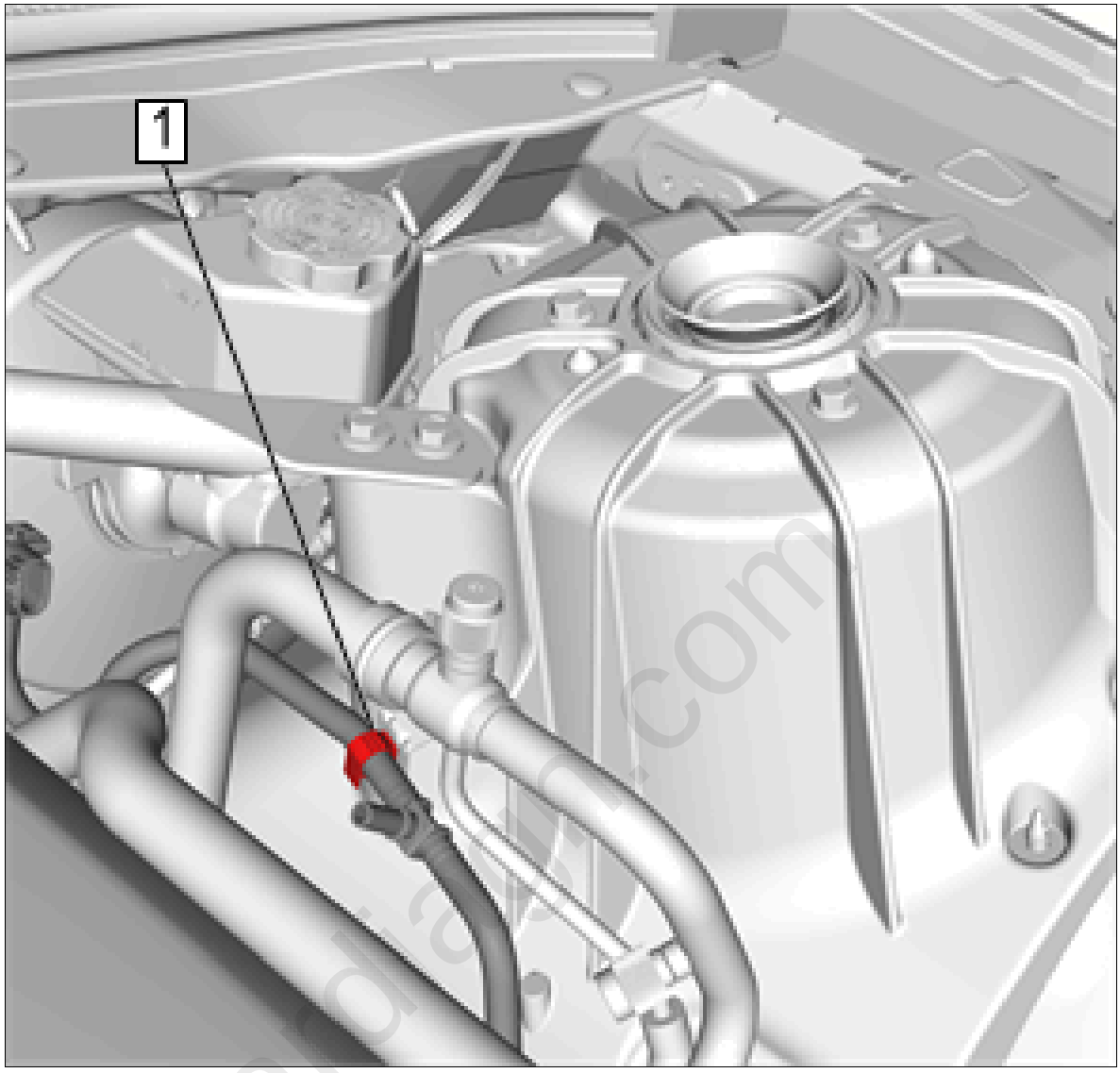
Fig 1: Power Brake Booster Vacuum Sensor At Power Brake Booster



Courtesy of GENERAL MOTORS COMPANY

4. Remove Power Brake Booster Vacuum Sensor (1) at Power Brake Booster.

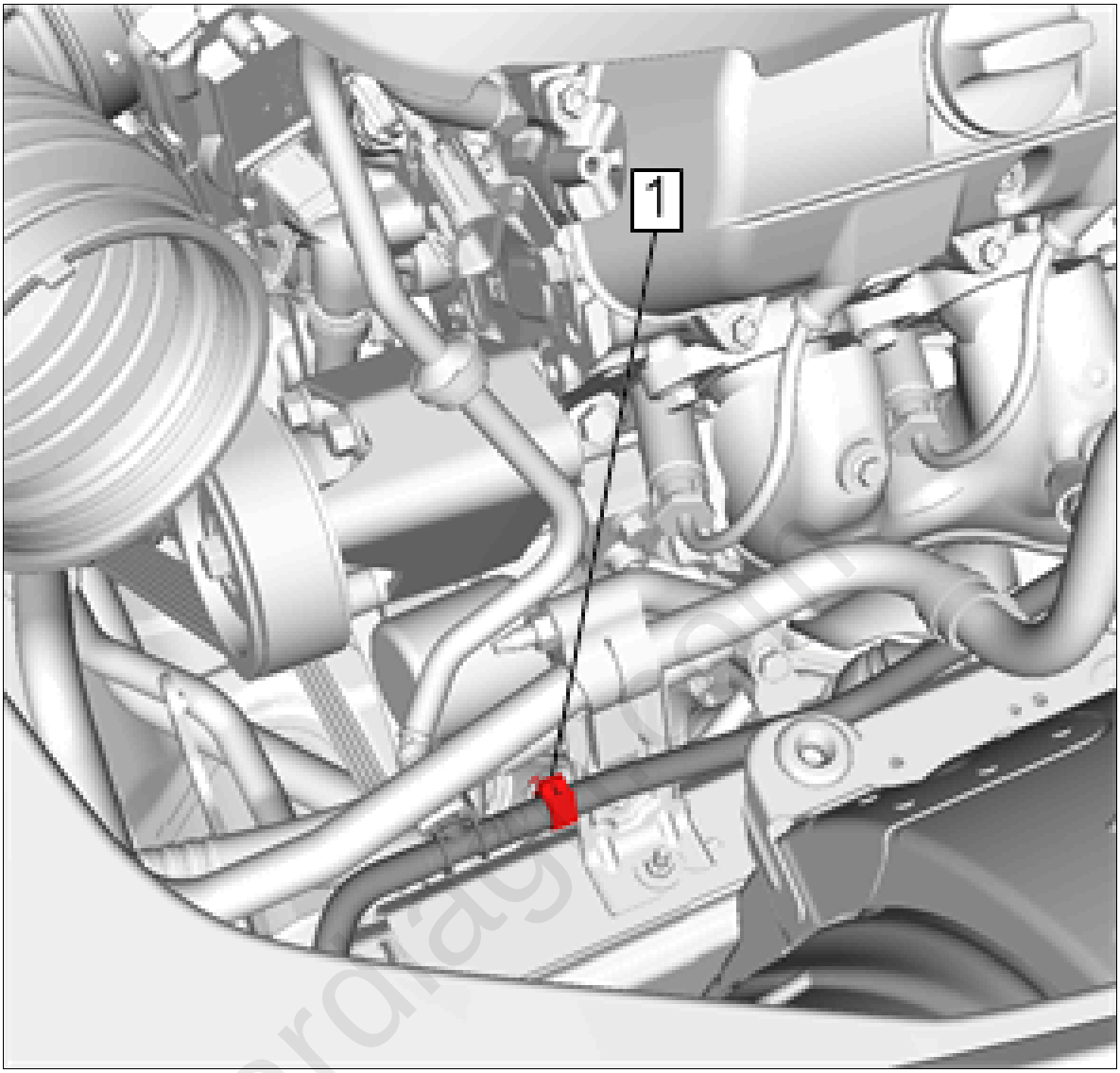
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Release Retainer (1).

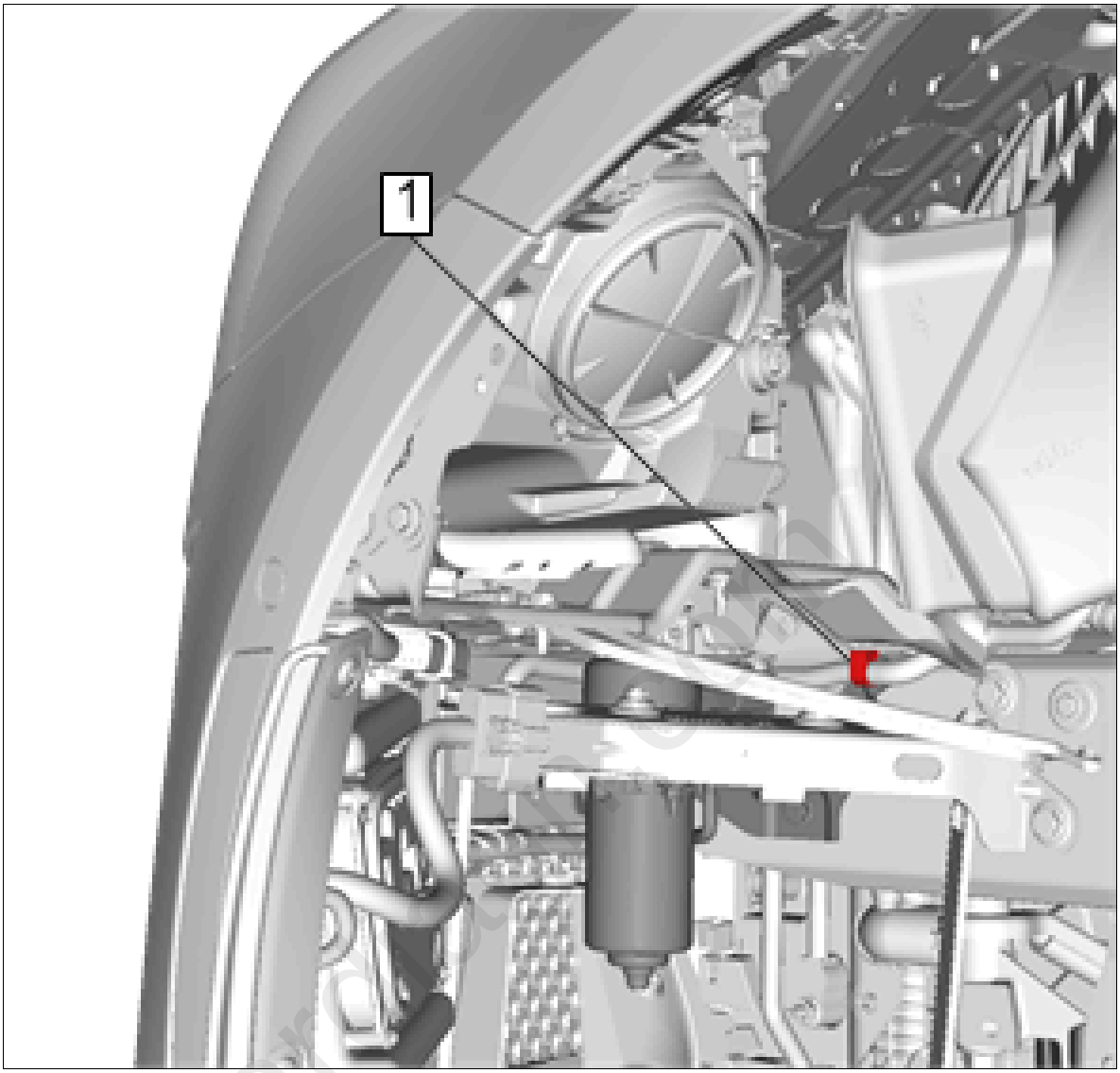
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Release Retainer (1).
7. Remove Radiator Air Side Baffle Replacement - Left Side (LGX LTG)Radiator Air Side Baffle Replacement - Left Side (LT1) .

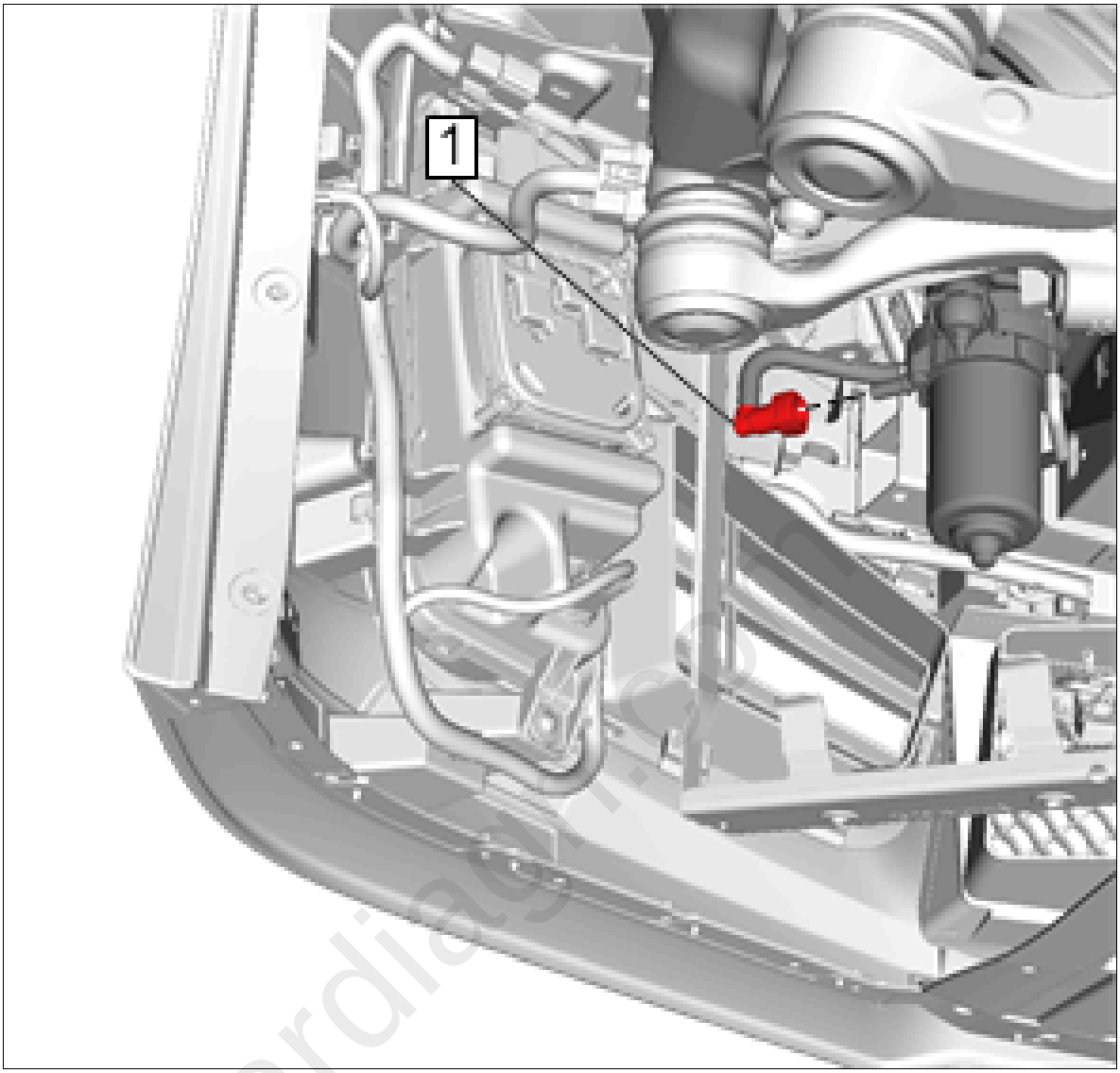
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

8. Release Retainer (1).

Fig 5: Quick Connect Fitting At Vacuum Pump Assembly



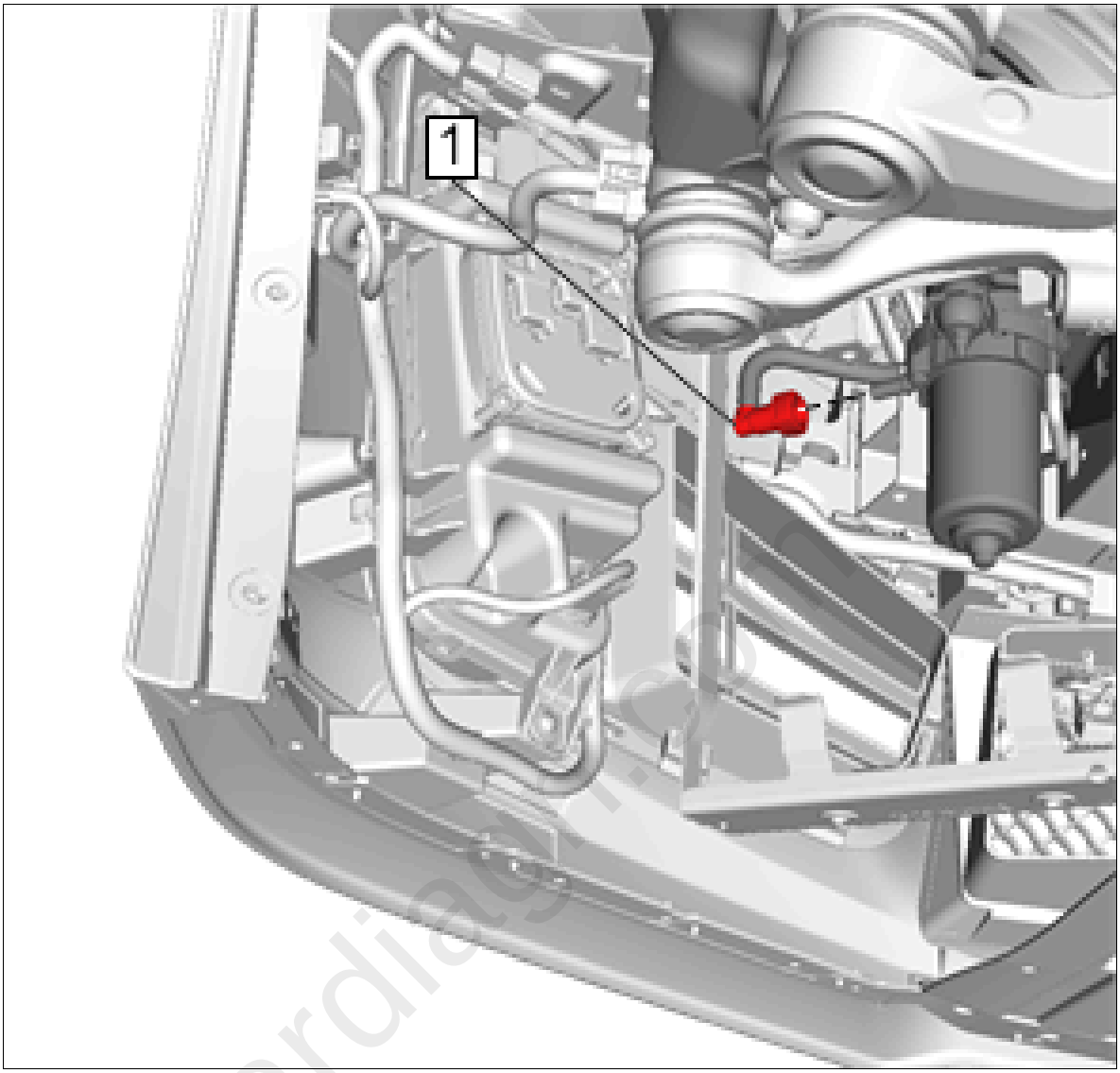
Courtesy of GENERAL MOTORS COMPANY

9. Release Quick Connect Fitting (1) at Vacuum Pump Assembly.
10. Remove Power Brake Booster Vacuum Pipe.

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM PIPE REPLACEMENT > INSTALLATION PROCEDURE

1. Install Power Brake Booster Vacuum Pipe.

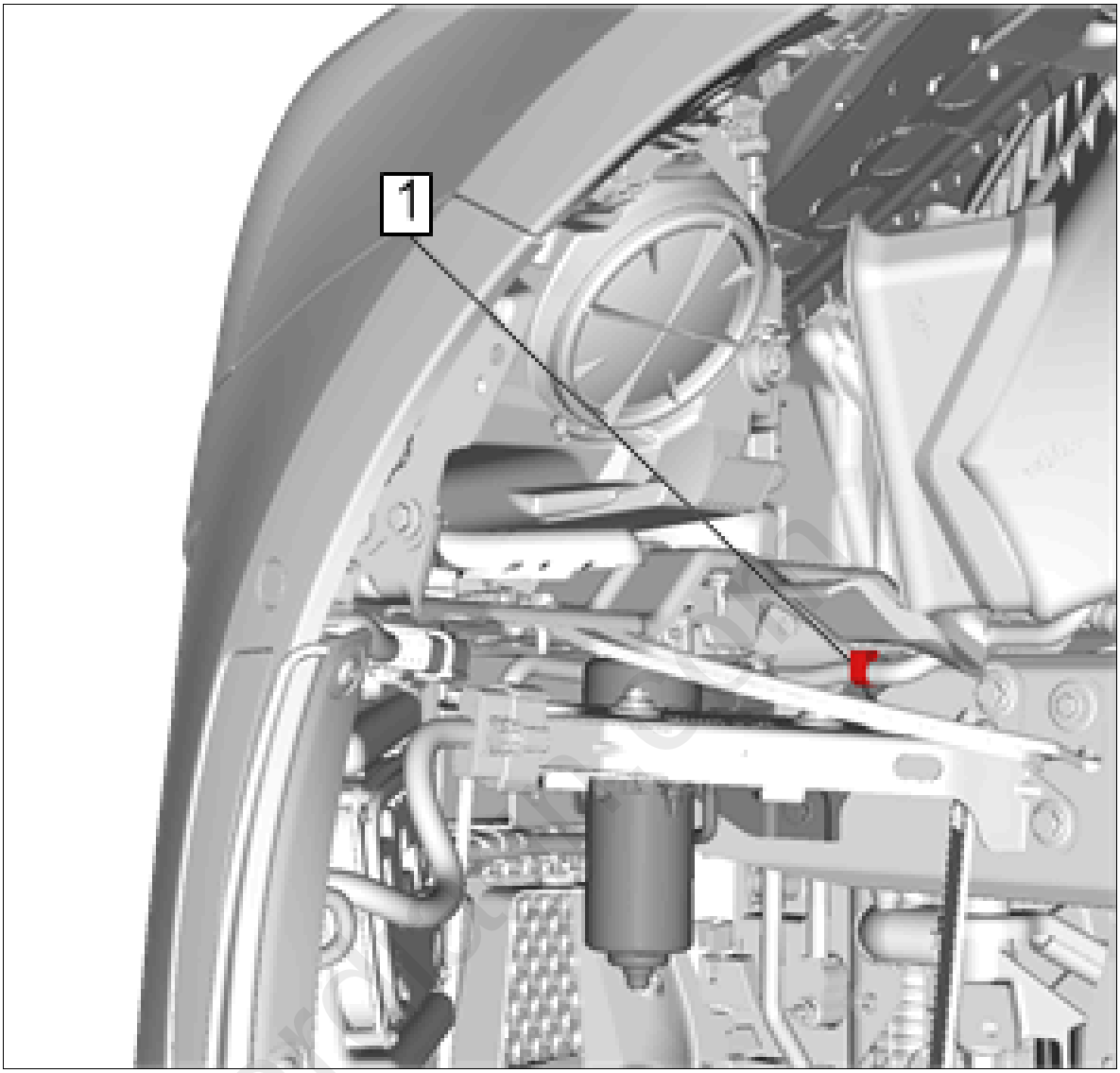
Fig 1: Quick Connect Fitting At Vacuum Pump Assembly



Courtesy of GENERAL MOTORS COMPANY

2. Connect Quick Connect Fitting (1) at Vacuum Pump Assembly.

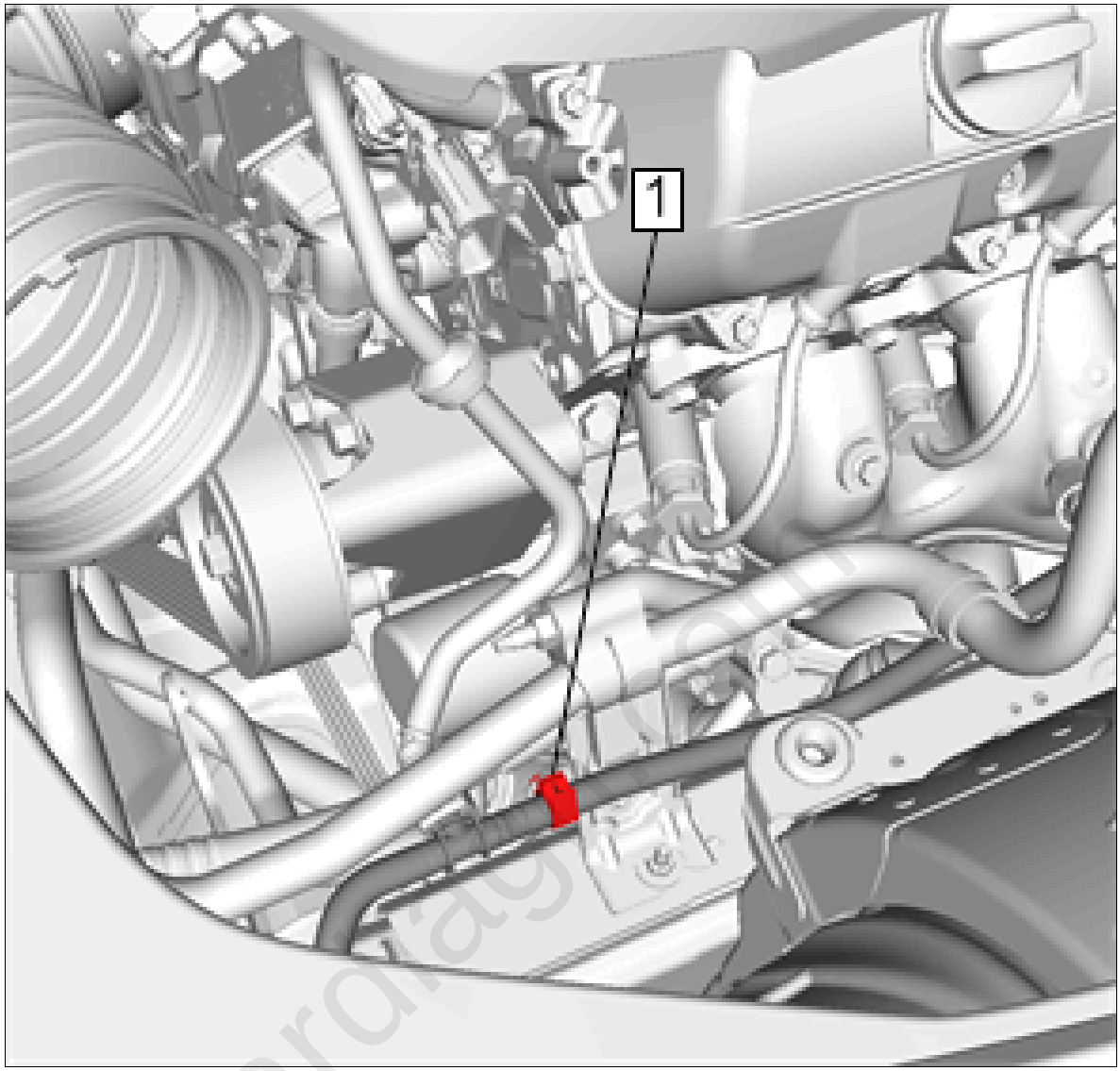
Fig 2: Retainer



Courtesy of GENERAL MOTORS COMPANY

3. Install Retainer (1).
4. Install Radiator Air Side Baffle Replacement - Left Side (LGX LTG)Radiator Air Side Baffle Replacement - Left Side (LT1) .

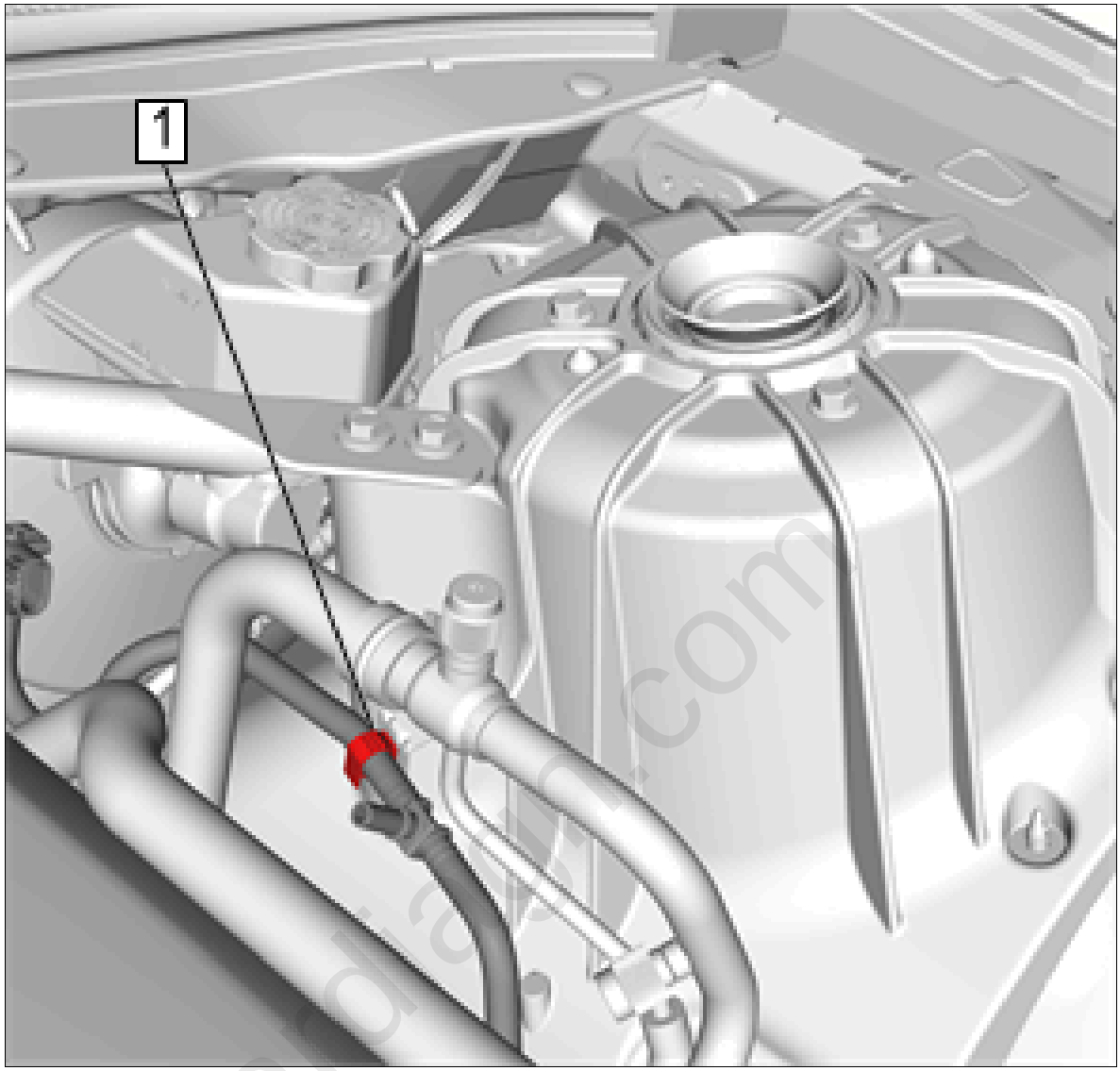
Fig 3: Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Install Retainer (1).

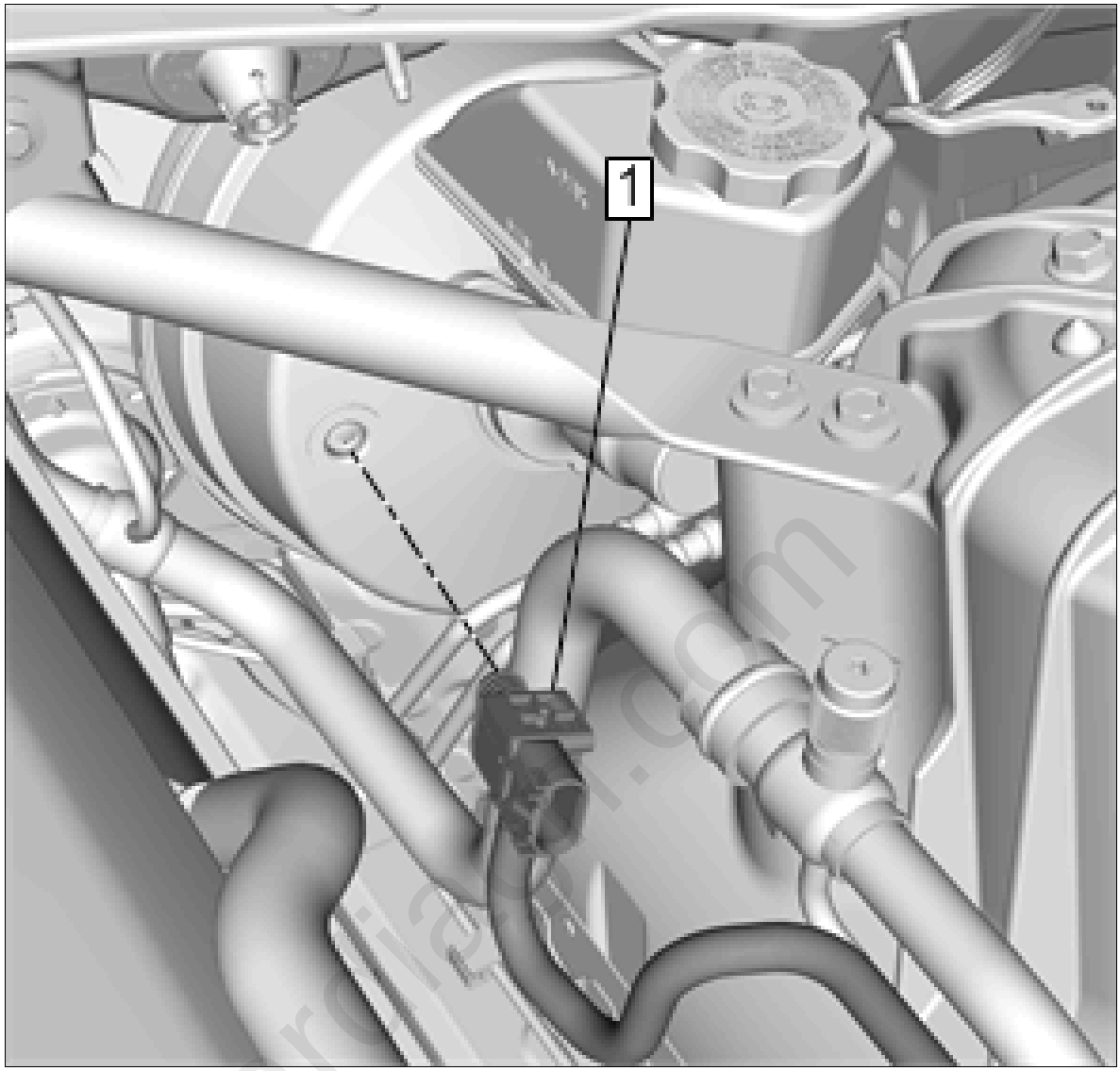
Fig 4: Retainer



Courtesy of GENERAL MOTORS COMPANY

6. Install Retainer (1).

Fig 5: Power Brake Booster Vacuum Sensor At Power Brake Booster



Courtesy of GENERAL MOTORS COMPANY

NOTE:

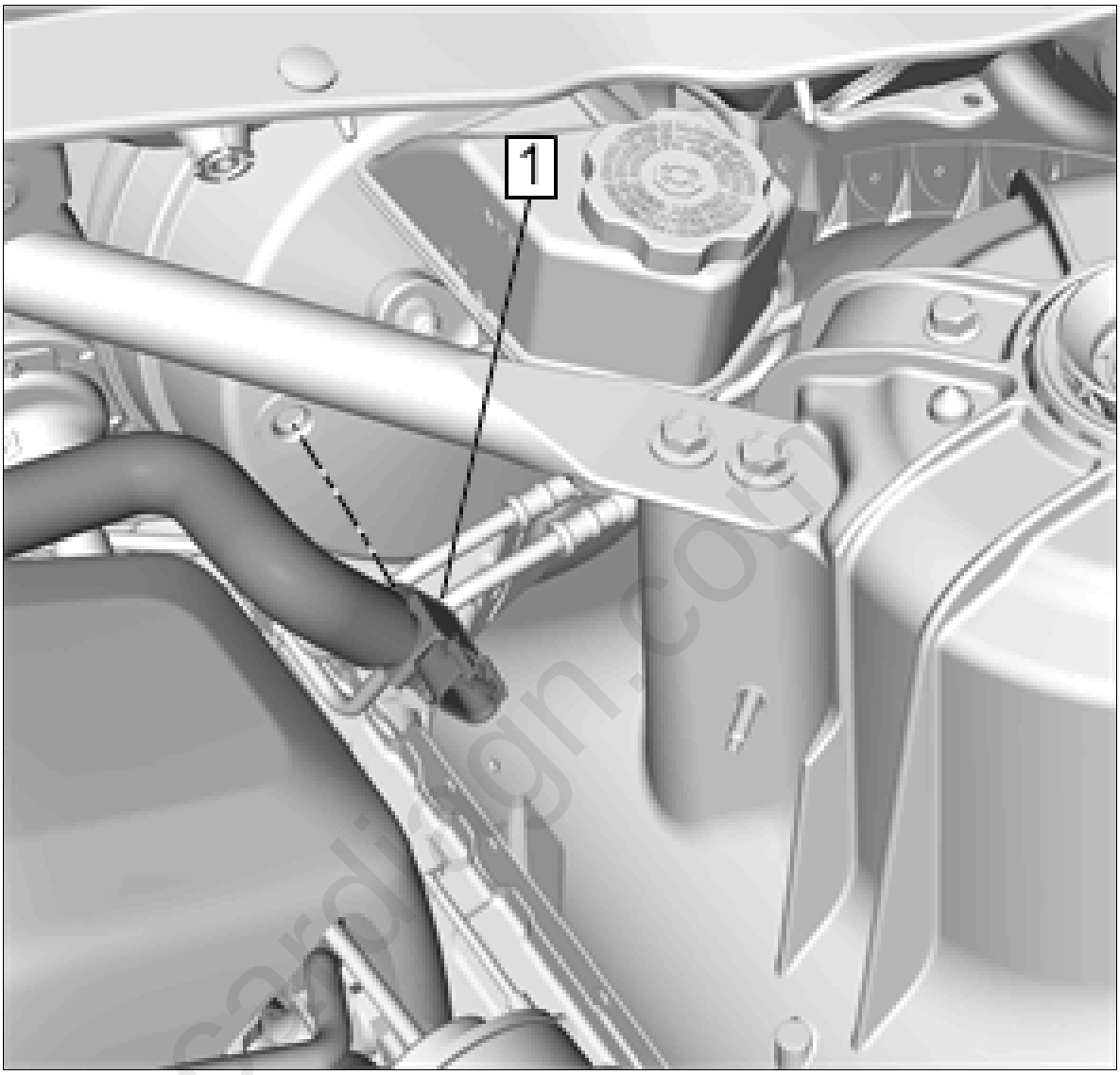
A small amount of denatured alcohol may be used to ease assembly.

7. Install Power Brake Booster Vacuum Sensor (1) at Power Brake Booster.
8. Connect the power brake booster vacuum sensor electrical connector.
9. Install Air Cleaner Assembly Replacement .

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM HOSE REPLACEMENT (LTG) > REMOVAL PROCEDURE

1. Remove Outer Fuel Pump Insulator - Fuel Pump Insulator Replacement (Outer) .
2. Remove Upper Intake Manifold Bracket Replacement .

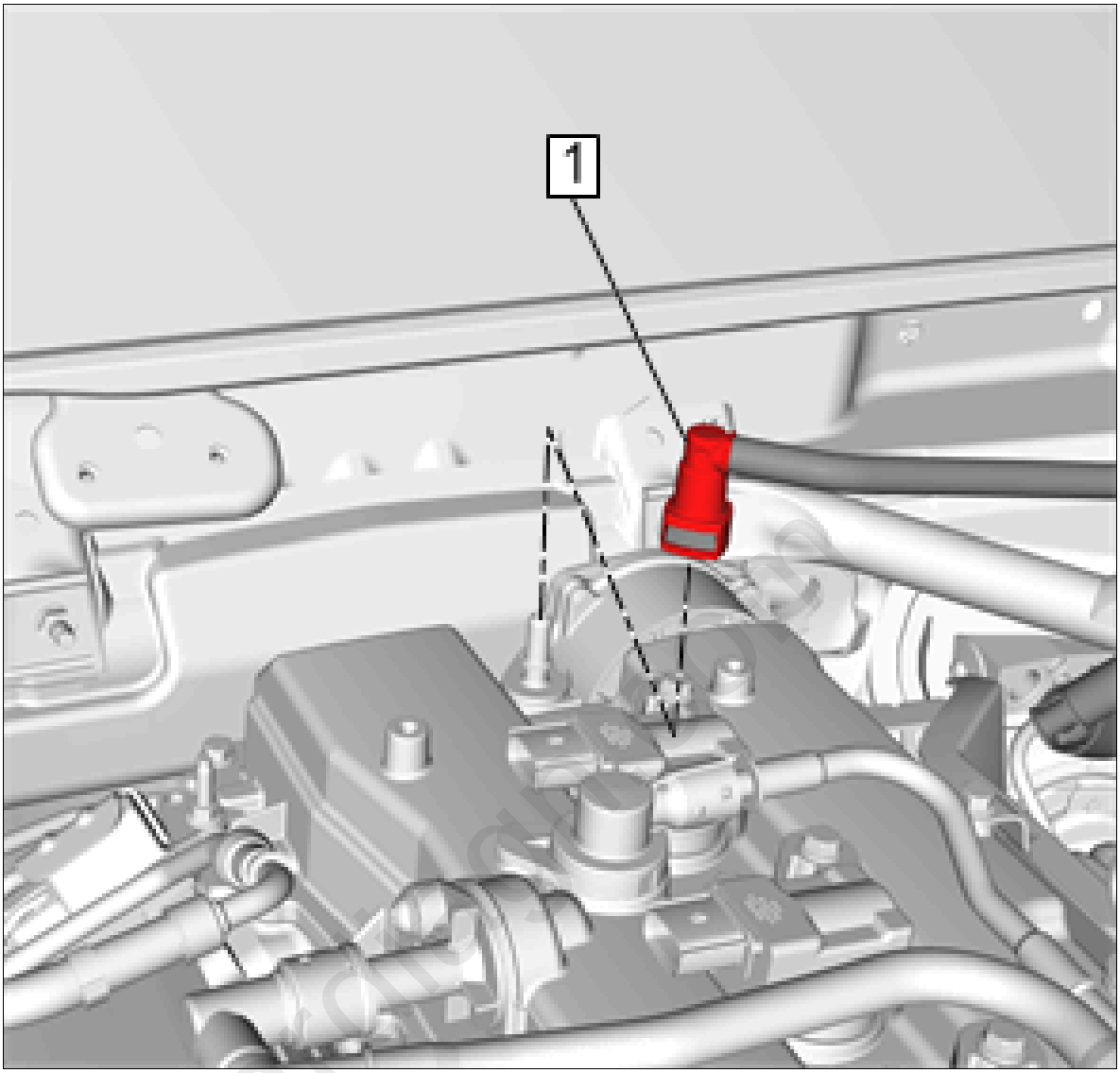
Fig 1: Electrical Connector



Courtesy of GENERAL MOTORS COMPANY

3. Disconnect the electrical connector.
4. Remove Power Brake Booster Vacuum Sensor (1).

Fig 2: Power Brake Booster Vacuum Hose Quick Connect Fitting At Vacuum Pump



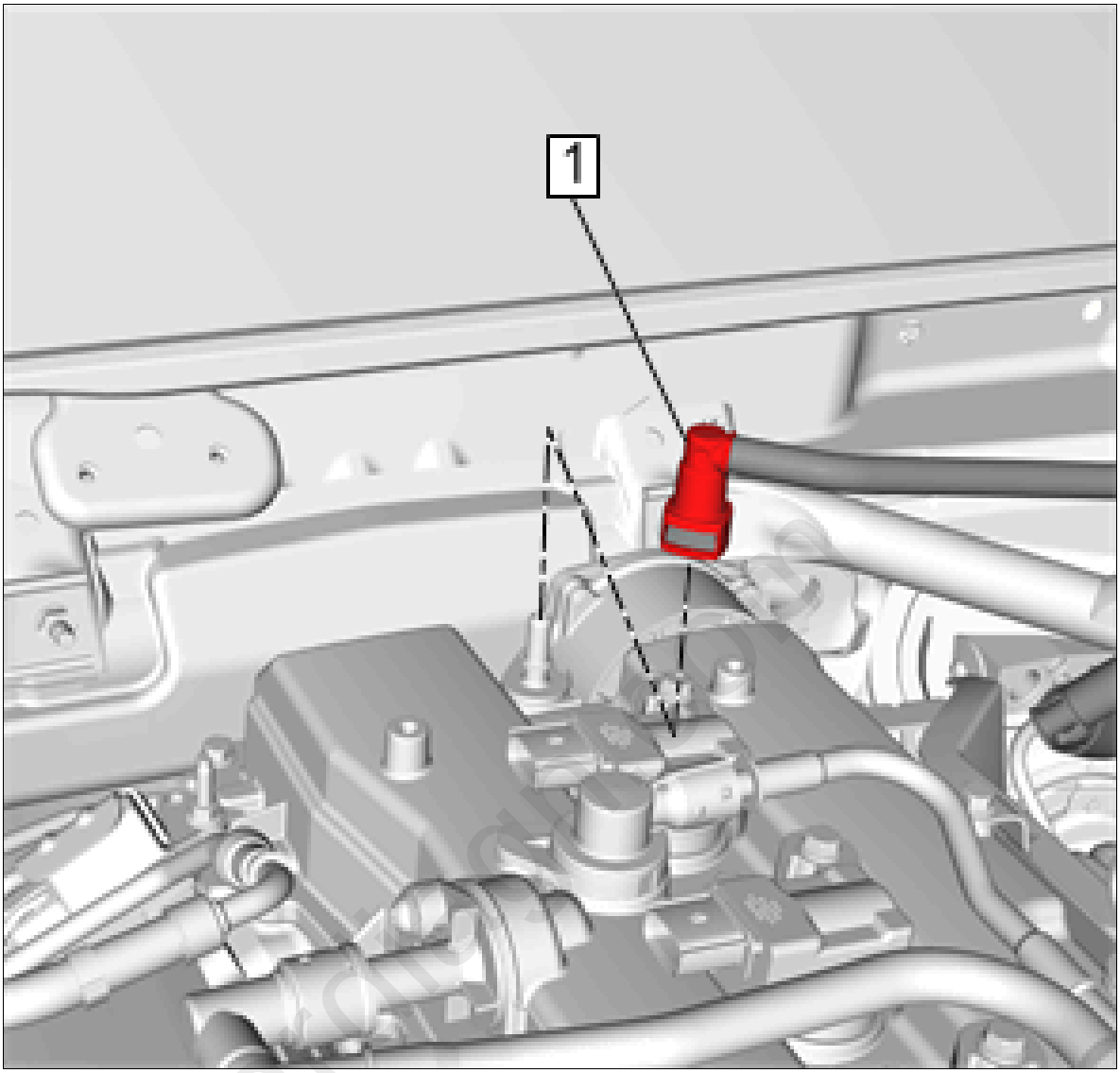
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect Power Brake Booster Vacuum Hose Quick Connect Fitting (1) at Vacuum Pump.
6. Remove Power Brake Booster Vacuum Hose.

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM HOSE REPLACEMENT (LTG) > INSTALLATION PROCEDURE

1. Install Power Brake Booster Vacuum Hose.

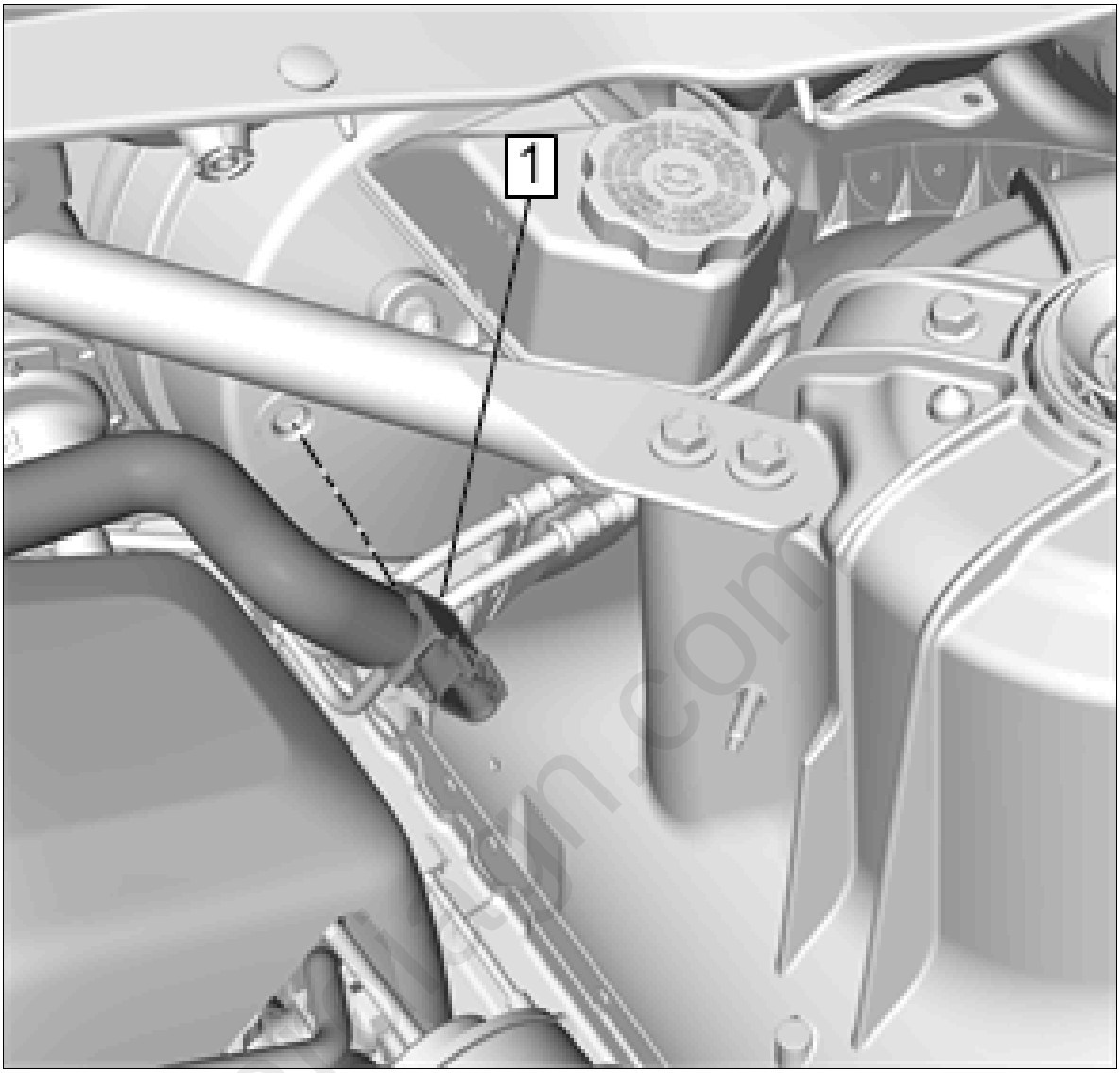
Fig 1: Power Brake Booster Vacuum Hose Quick Connect Fitting At Vacuum Pump



Courtesy of GENERAL MOTORS COMPANY

2. Connect Power Brake Booster Vacuum Hose Quick Connect Fitting (1) at Vacuum Pump.

Fig 2: Power Brake Booster Vacuum Sensor



Courtesy of GENERAL MOTORS COMPANY

> *NOTE:*
>
> *A small amount of denatured alcohol may be used to ease assembly.*

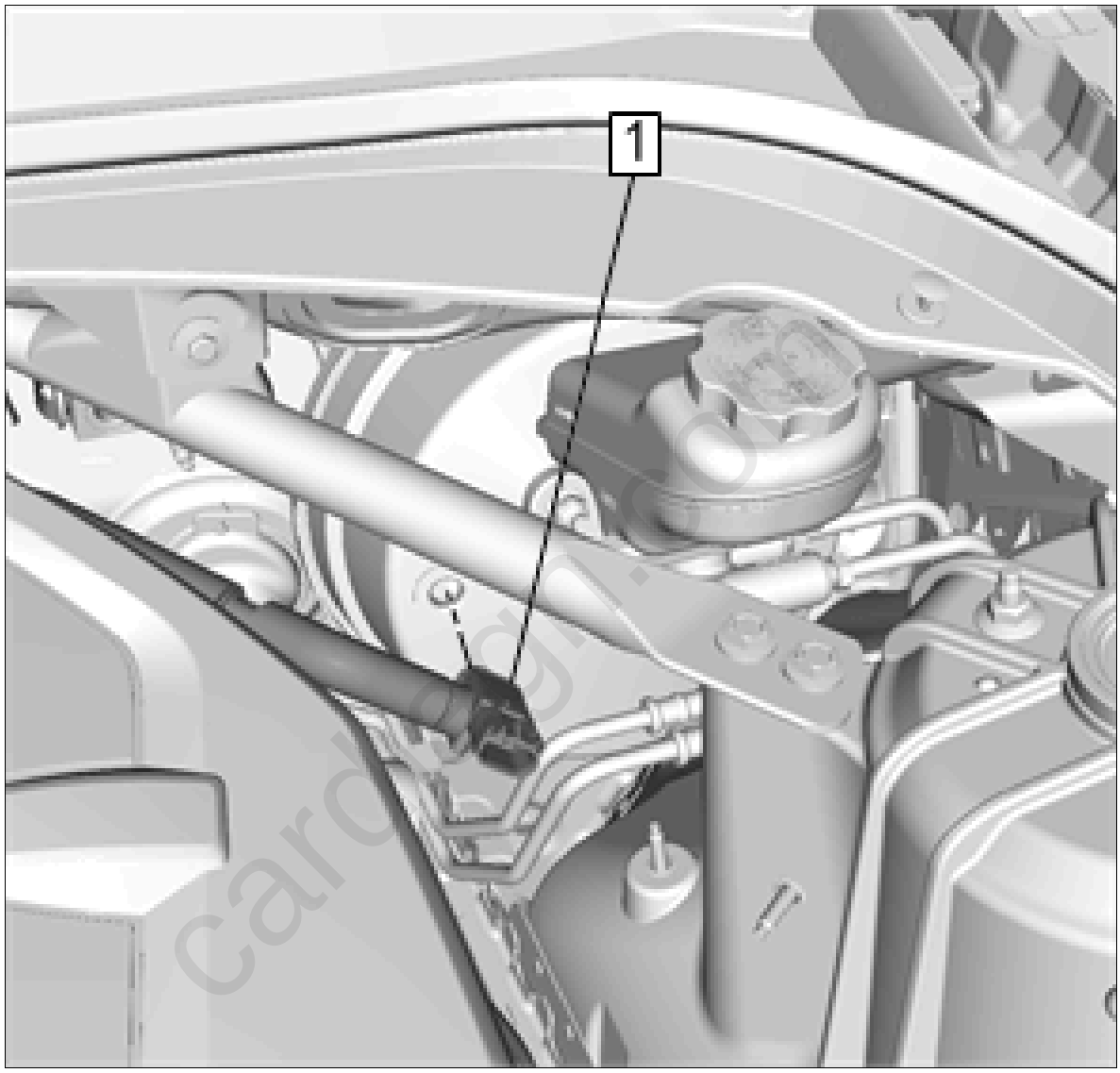
3. Install Power Brake Booster Vacuum Sensor (1).
4. Connect the electrical connector.
5. Install Upper Intake Manifold Bracket Replacement .
6. Install Outer Fuel Pump Insulator - Fuel Pump Insulator Replacement (Outer)

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM HOSE

REPLACEMENT (LGX) > REMOVAL PROCEDURE

1. Apply the brake pedal several times until the pedal becomes firm to deplete the power vacuum brake booster vacuum reserve.
2. Disconnect the power brake booster vacuum sensor electrical connector.

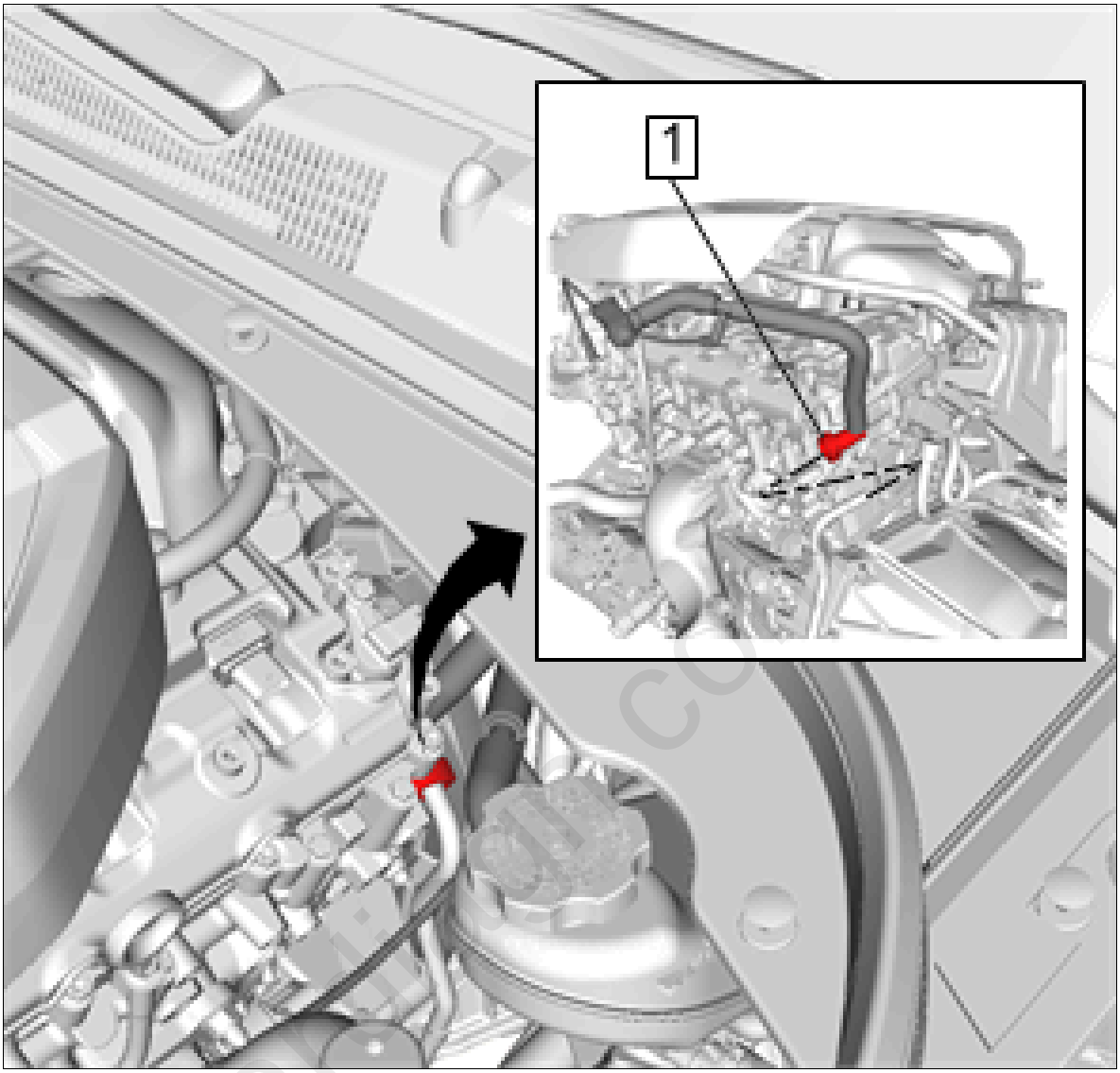
   Fig 1: Power Brake Booster Vacuum Sensor



Courtesy of GENERAL MOTORS COMPANY

3. Remove Power Brake Booster Vacuum Sensor (1).
4. Remove Front End Sheet Metal Diagonal Brace Replacement - Left Side .

Fig 2: Power Brake Booster Vacuum Hose Quick Connect



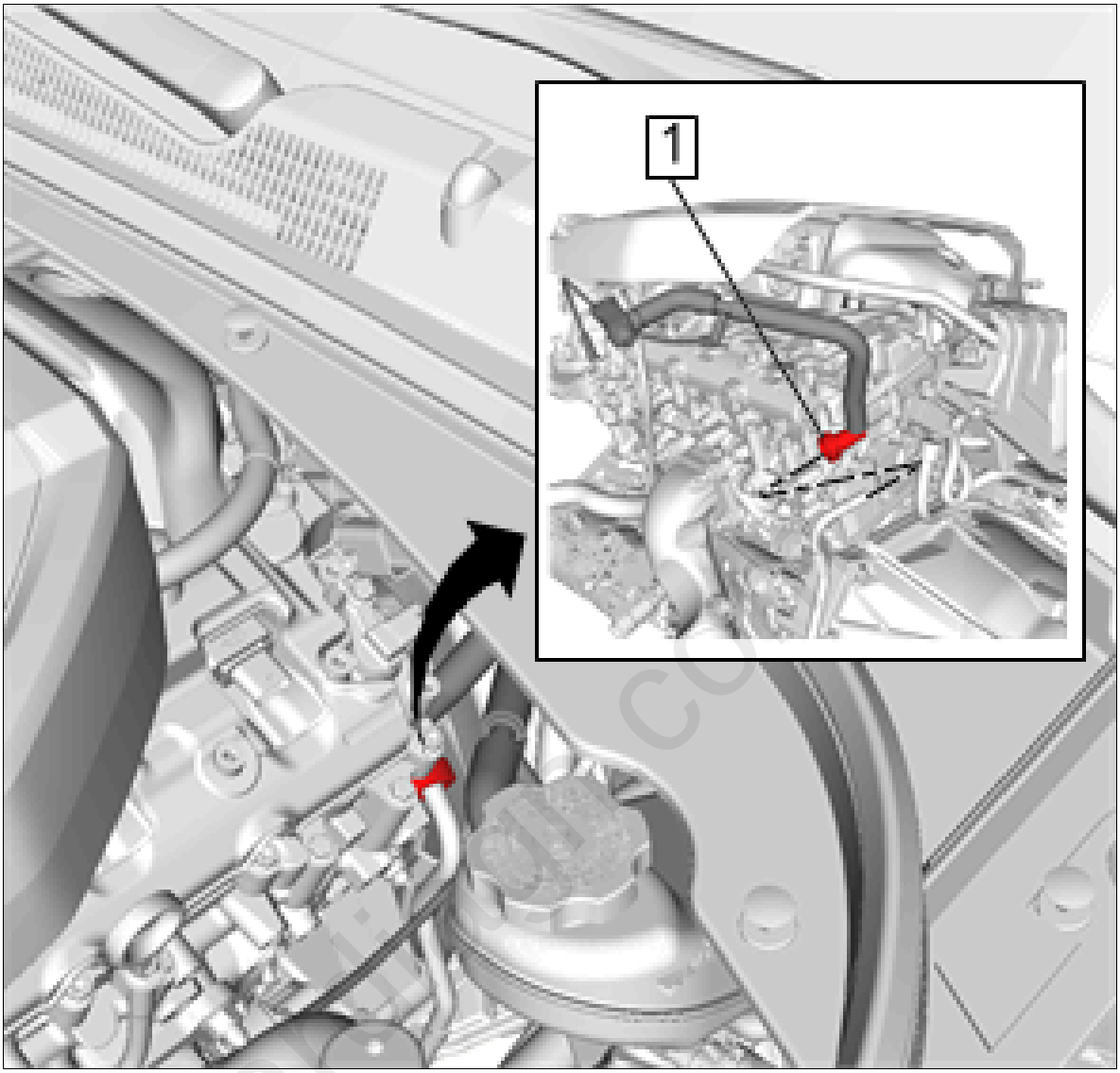
Courtesy of GENERAL MOTORS COMPANY

5. Disconnect Power Brake Booster Vacuum Hose Quick Connect (1) at Vacuum Pipe.
6. Remove Power Brake Booster Vacuum Hose Assembly.

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER VACUUM HOSE REPLACEMENT (LGX) > INSTALLATION PROCEDURE

1. Install Power Brake Booster Vacuum Hose Assembly.

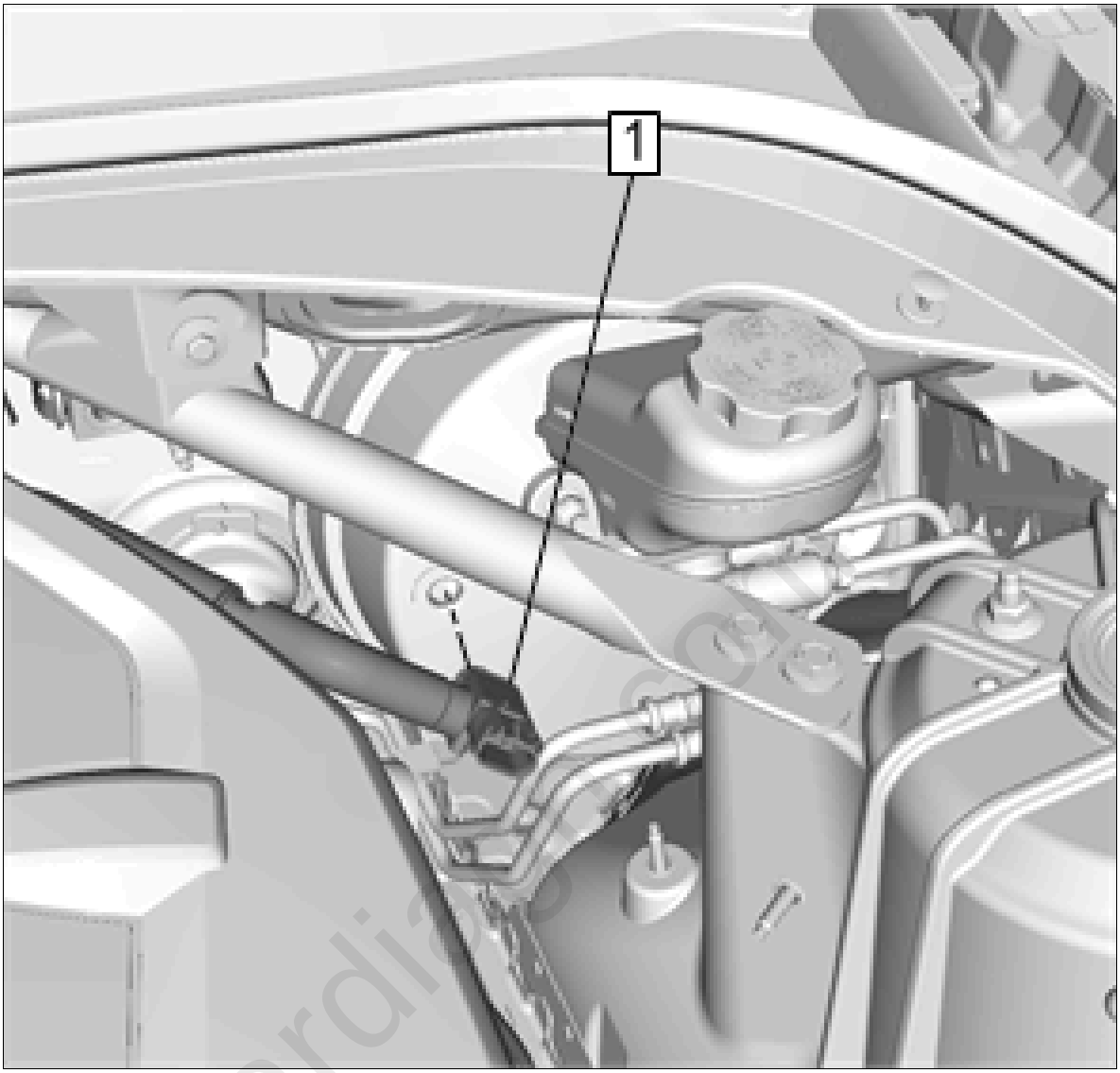
Fig 1: Power Brake Booster Vacuum Hose Quick Connect



Courtesy of GENERAL MOTORS COMPANY

2. Connect Power Brake Booster Vacuum Hose Quick Connect (1) at Vacuum Pipe.
3. Install Front End Sheet Metal Diagonal Brace Replacement - Left Side .

Fig 2: Power Brake Booster Vacuum Sensor



Courtesy of GENERAL MOTORS COMPANY

> *NOTE:*
>
> *A small amount of denatured alcohol may be used to ease assembly.*

4. Install Power Brake Booster Vacuum Sensor (1).
5. Connect the power brake booster vacuum sensor electrical connector.

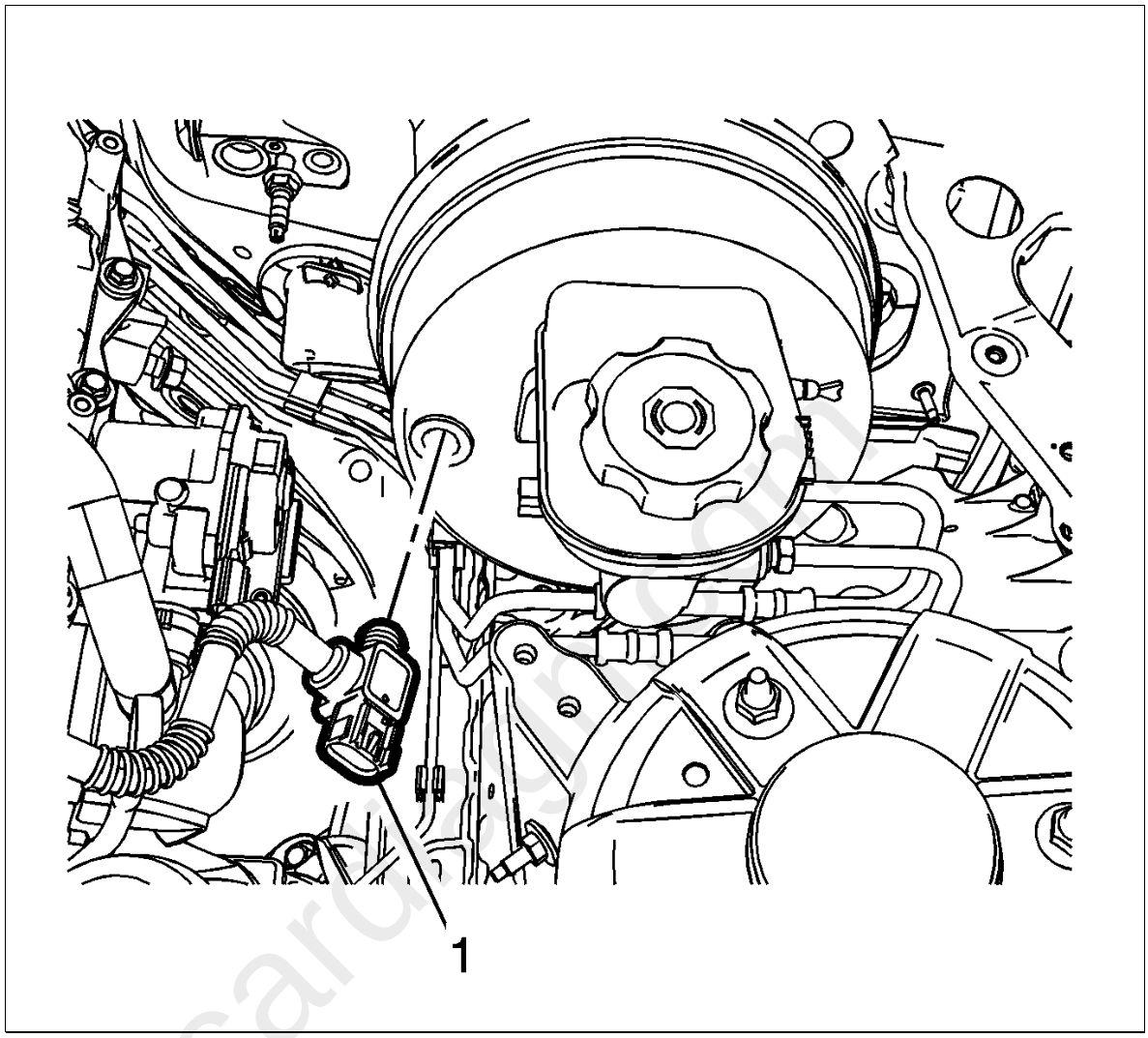
REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER REPLACEMENT > REMOVAL PROCEDURE

1. With the engine OFF, apply and release the brake pedal several times until the pedal becomes

firm to deplete the power vacuum brake booster vacuum reserve.

2. Remove the left front end sheet metal diagonal brace. Refer to Front End Sheet Metal Diagonal Brace Replacement - Left Side .

Fig 1: Brake Vacuum Booster Check Valve



Courtesy of GENERAL MOTORS COMPANY

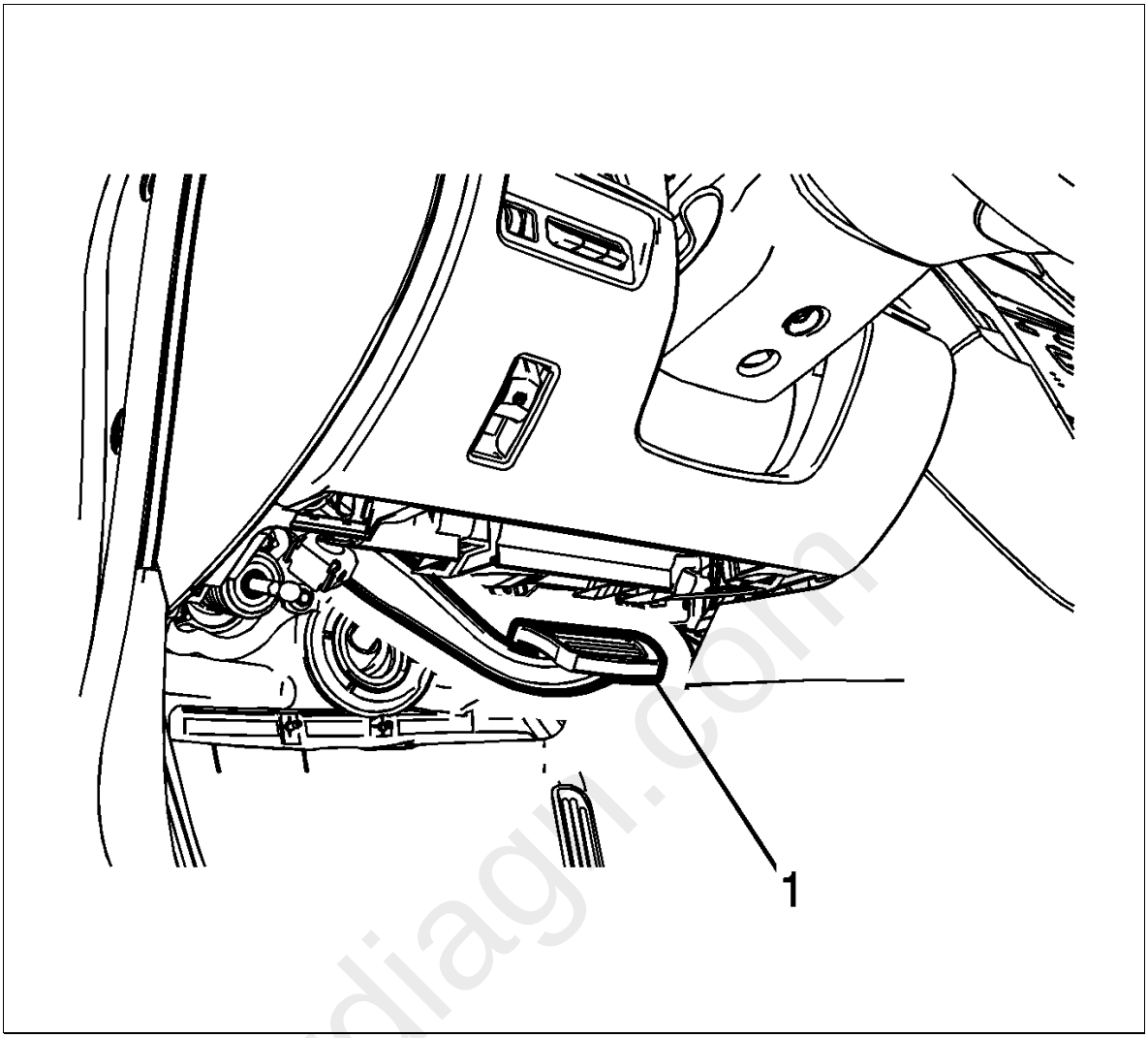
3. Disconnect the power brake booster vacuum sensor electrical connector.

4. Remove the power brake booster vacuum sensor (1) and hose assembly from the power vacuum brake booster and position aside.

5. Remove the master cylinder. Refer to Master Cylinder Replacement .

6. Remove the brake pedal position sensor. Refer to Brake Pedal Position Sensor Replacement .

Fig 2: Brake Pedal



Courtesy of GENERAL MOTORS COMPANY

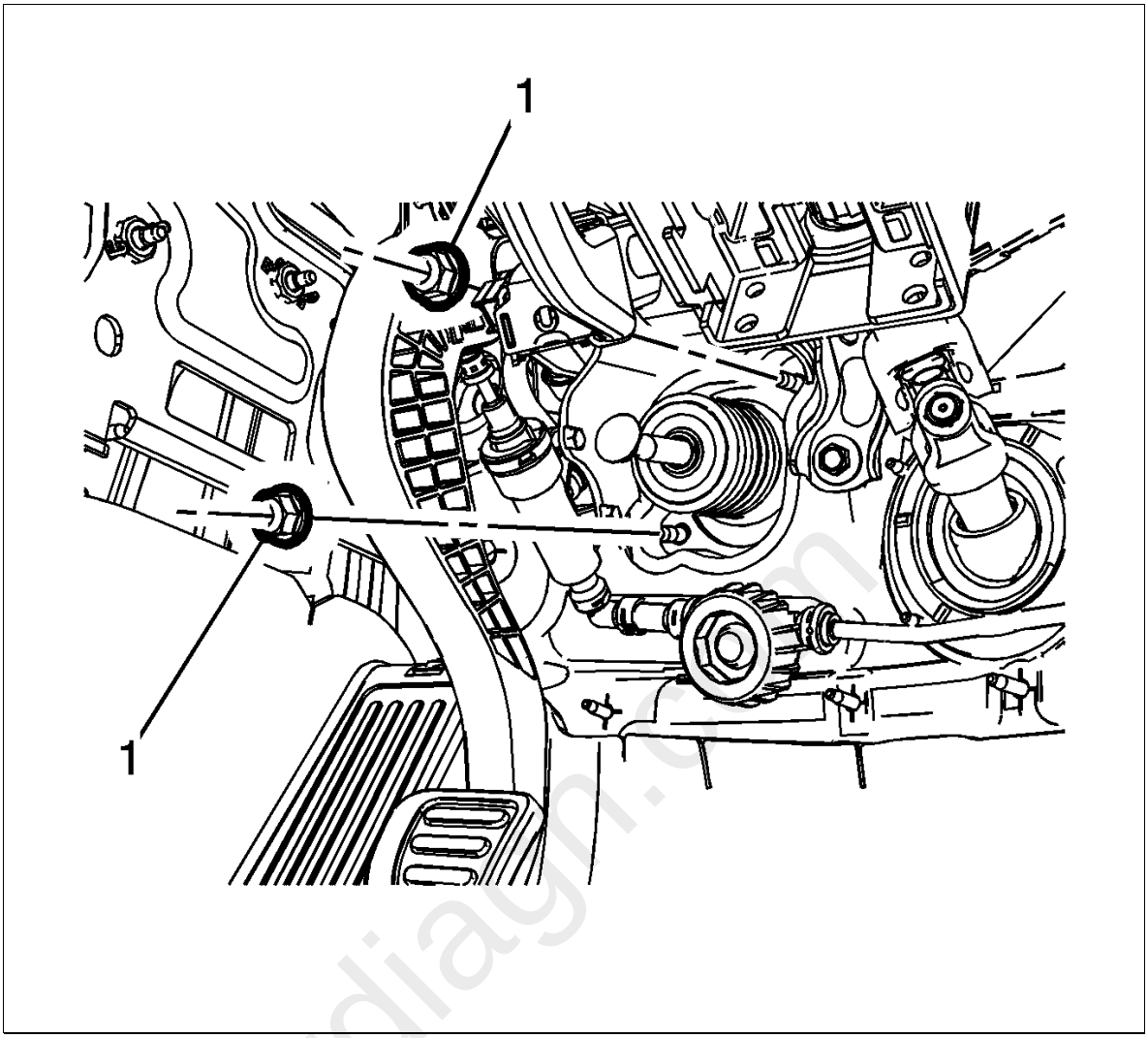
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7. Release the brake pedal (1) from the power vacuum brake booster pushrod by lifting the pedal upward.

> *NOTE:*
>
> *Do not reuse the brake pedal retainer.*

8. Remove and discard the power brake booster pushrod retainer.

Fig 3: Power Vacuum Brake Booster Nuts

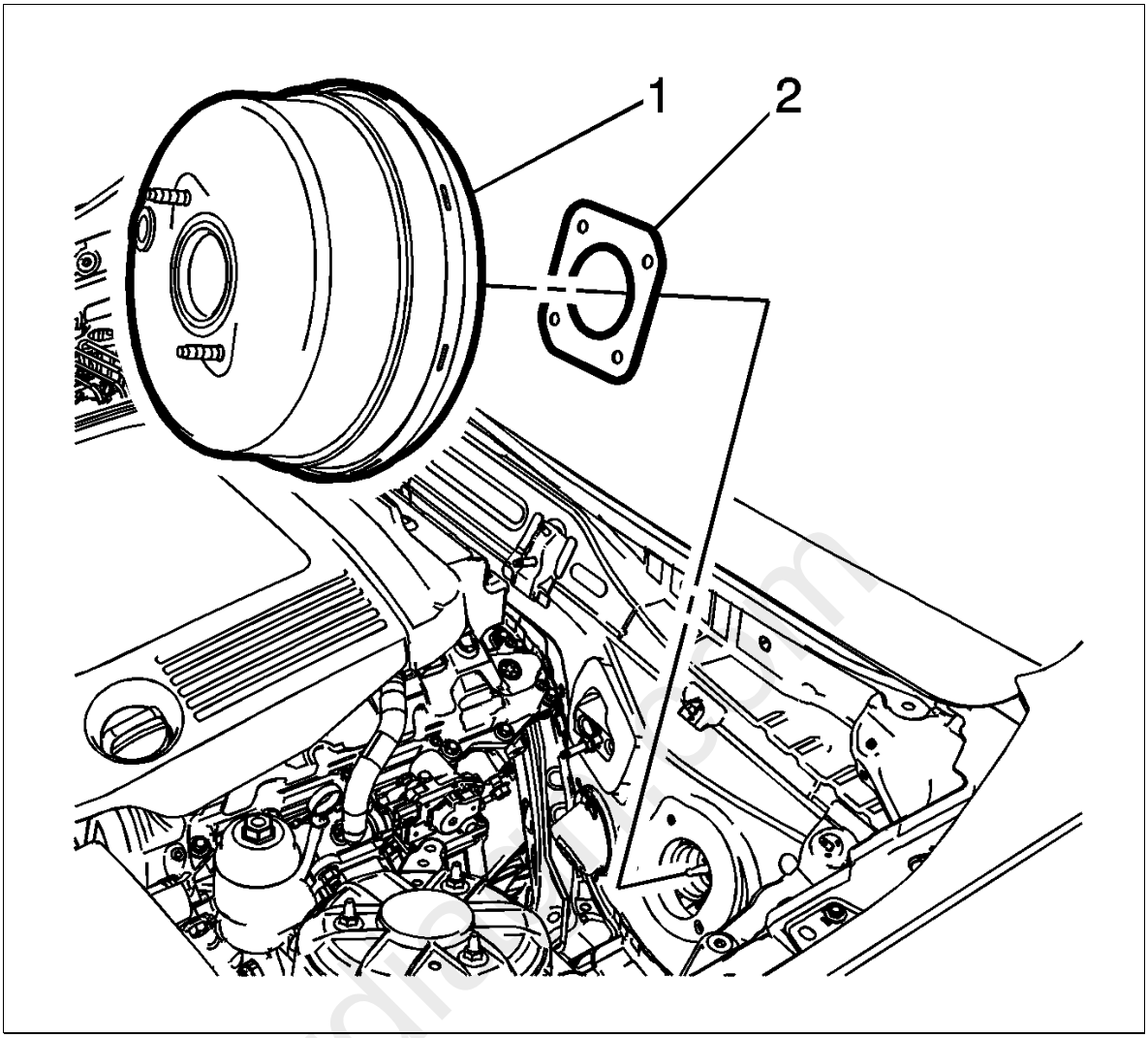


Courtesy of GENERAL MOTORS COMPANY

9. Remove the power vacuum brake booster nuts (1).

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Fig 4: Power Vacuum Brake Booster

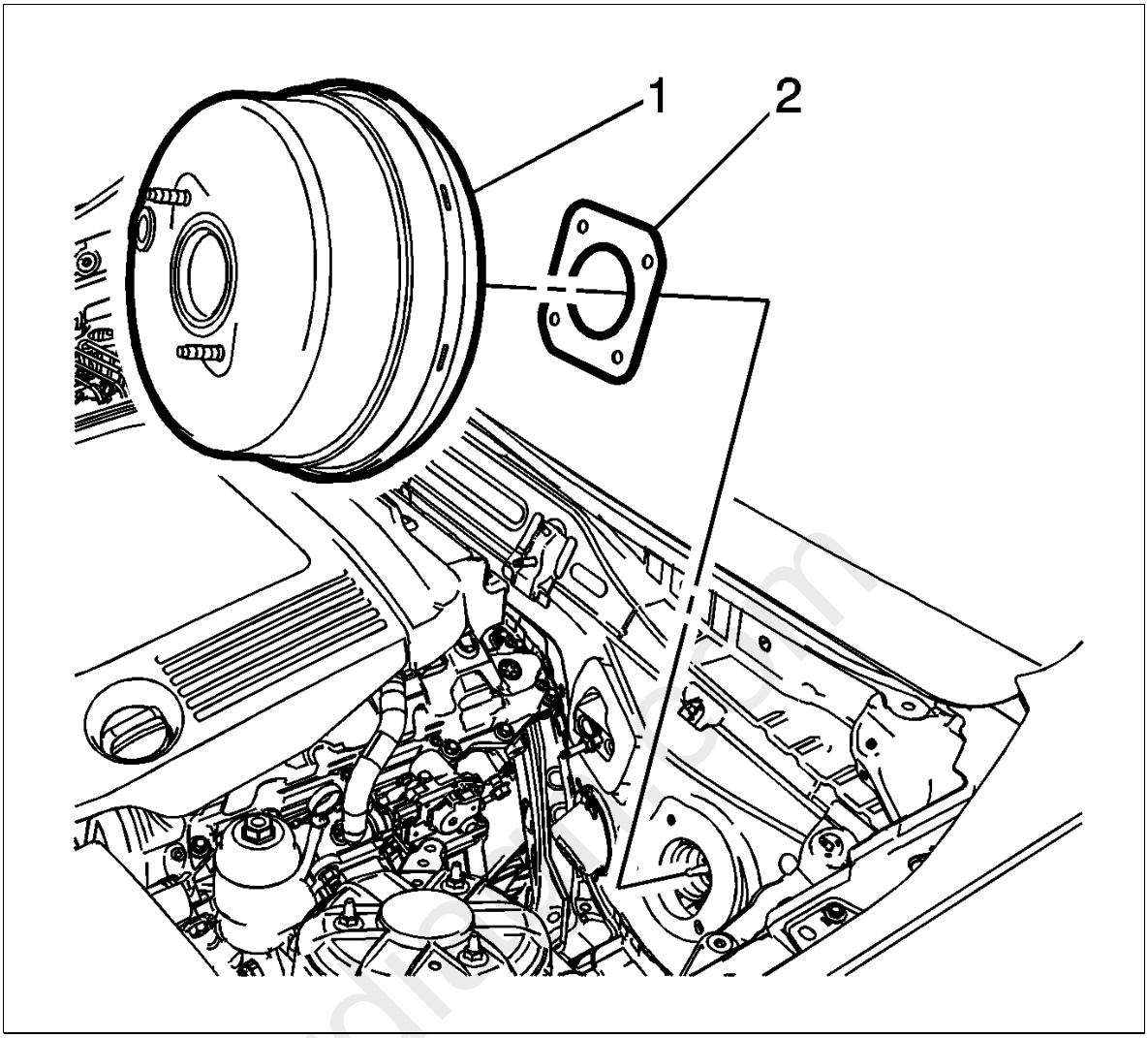


Courtesy of GENERAL MOTORS COMPANY

10. Remove the power vacuum brake booster (1).
11. Inspect the power vacuum brake booster gasket (2) for damage and replace, if necessary.

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER REPLACEMENT > INSTALLATION PROCEDURE

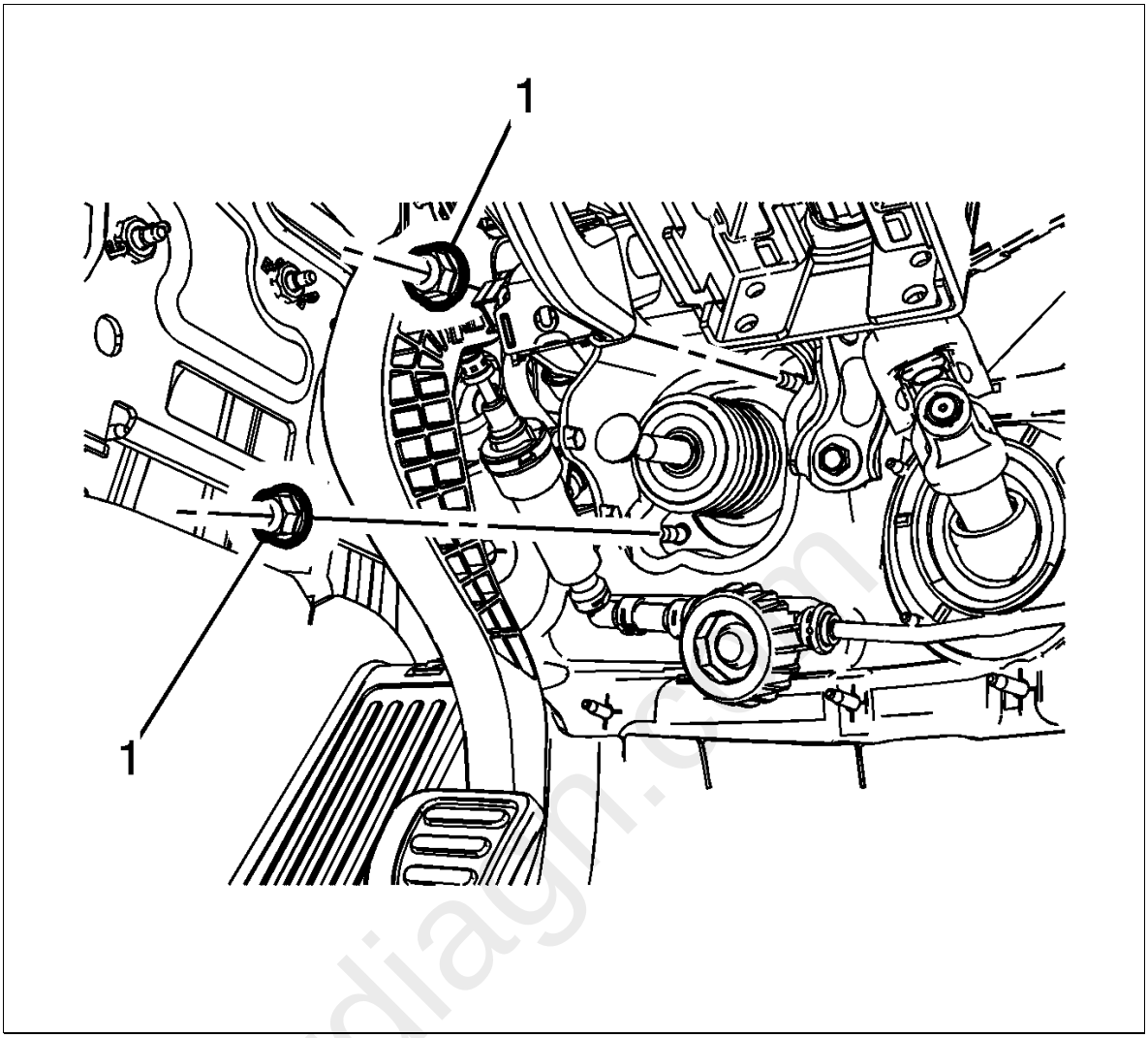
Fig 1: Power Vacuum Brake Booster



Courtesy of GENERAL MOTORS COMPANY

1. Install the power vacuum brake booster (1) and gasket (2).

Fig 2: Power Vacuum Brake Booster Nuts



Courtesy of GENERAL MOTORS COMPANY

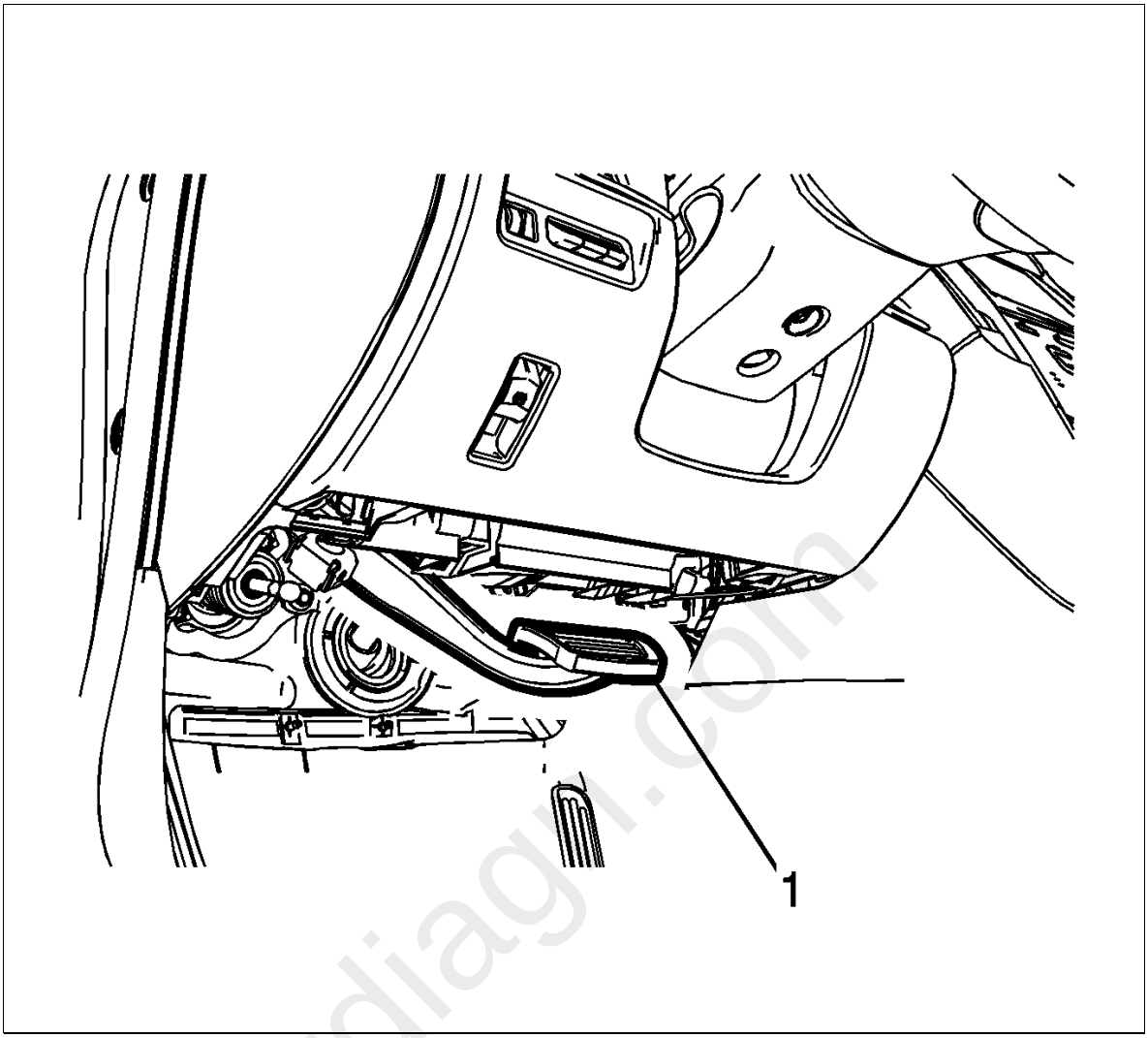
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⚠ *CAUTION:*

Refer to Fastener Caution .

2. Install the power vacuum brake booster nuts (1) and tighten to 25 N.m (18 lb ft).

Fig 3: Brake Pedal



Courtesy of GENERAL MOTORS COMPANY

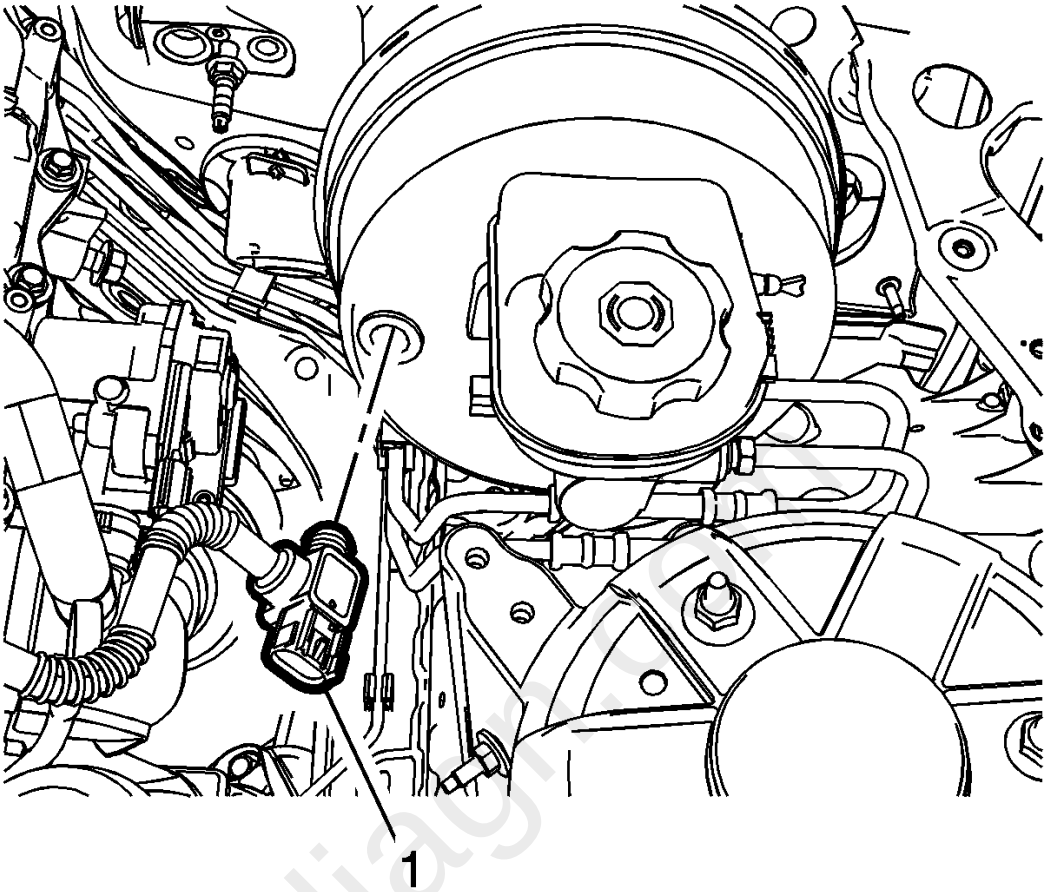
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NOTE:

Install a new power brake booster pushrod retainer.

3. Install a new power brake booster pushrod retainer to the brake pedal arm.
4. Install the brake pedal (1) to the power brake booster pushrod.
5. Install the brake pedal position sensor. Refer to Brake Pedal Position Sensor Replacement .
6. Install the master cylinder. Refer to Master Cylinder Replacement .

Fig 4: Brake Vacuum Booster Check Valve



Courtesy of GENERAL MOTORS COMPANY

NOTE:

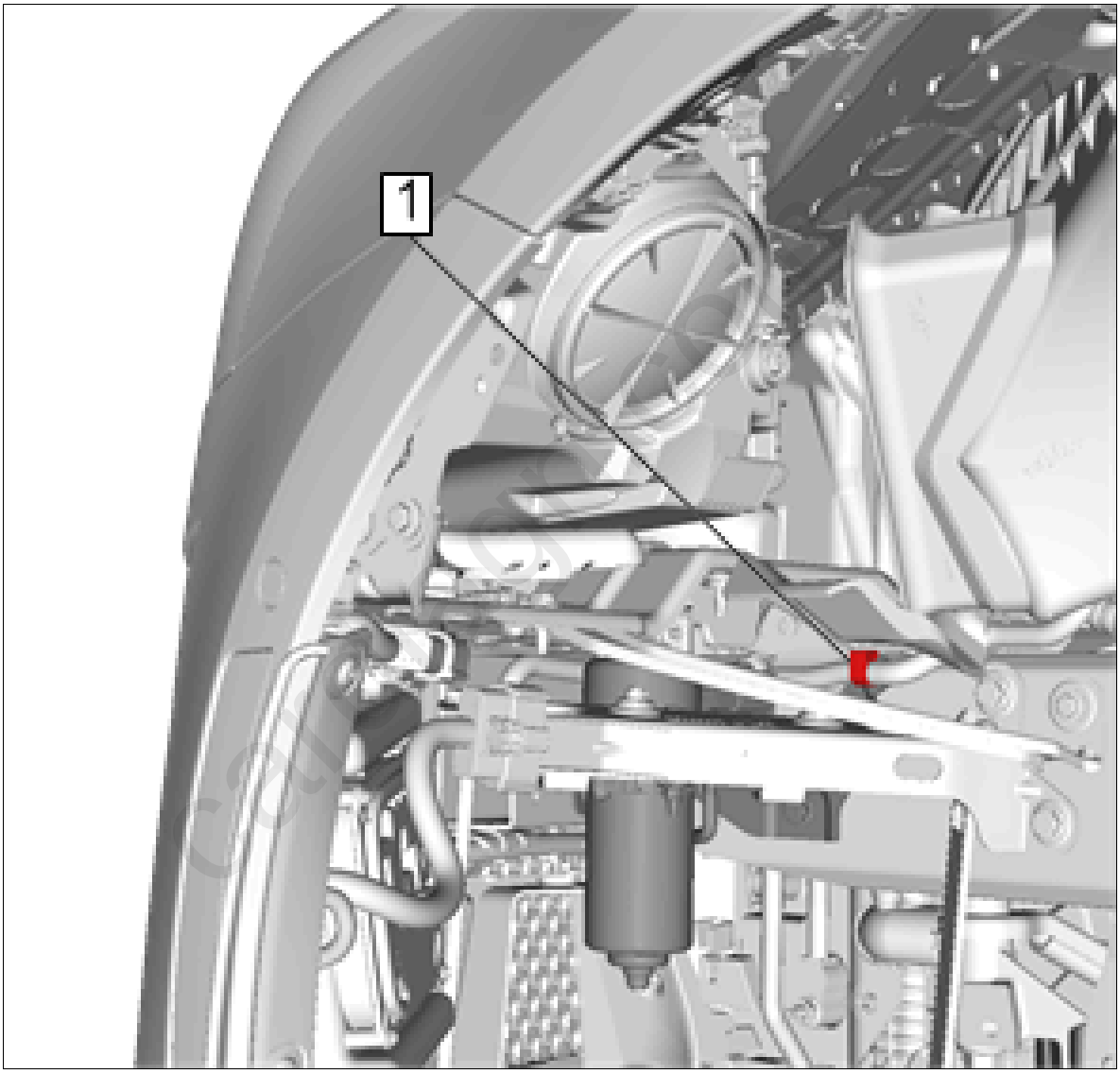
A small amount of denatured alcohol may be used as a lubricant for assembly. Do not use soap.

7. Install the power brake booster vacuum sensor (1) to the power vacuum brake booster.
8. Connect the power brake booster vacuum sensor electrical connector.
9. Install the left front end sheet metal diagonal brace. Refer to Front End Sheet Metal Diagonal Brace Replacement - Left Side .

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PUMP REPLACEMENT > REMOVAL PROCEDURE

1. Apply the brake pedal several times until the pedal becomes firm to deplete the power vacuum brake booster vacuum reserve.
2. Remove Charge Air Cooler Left Side - Charge Air Cooler Replacement - Left Side (LGX with V18)Charge Air Cooler Replacement - Left Side (LT1 V18)Charge Air Cooler Replacement - Left Side (LTG with V18)
3. Disconnect the power brake booster pump electrical connector.
4. Disconnect the power brake booster pump vent hose.

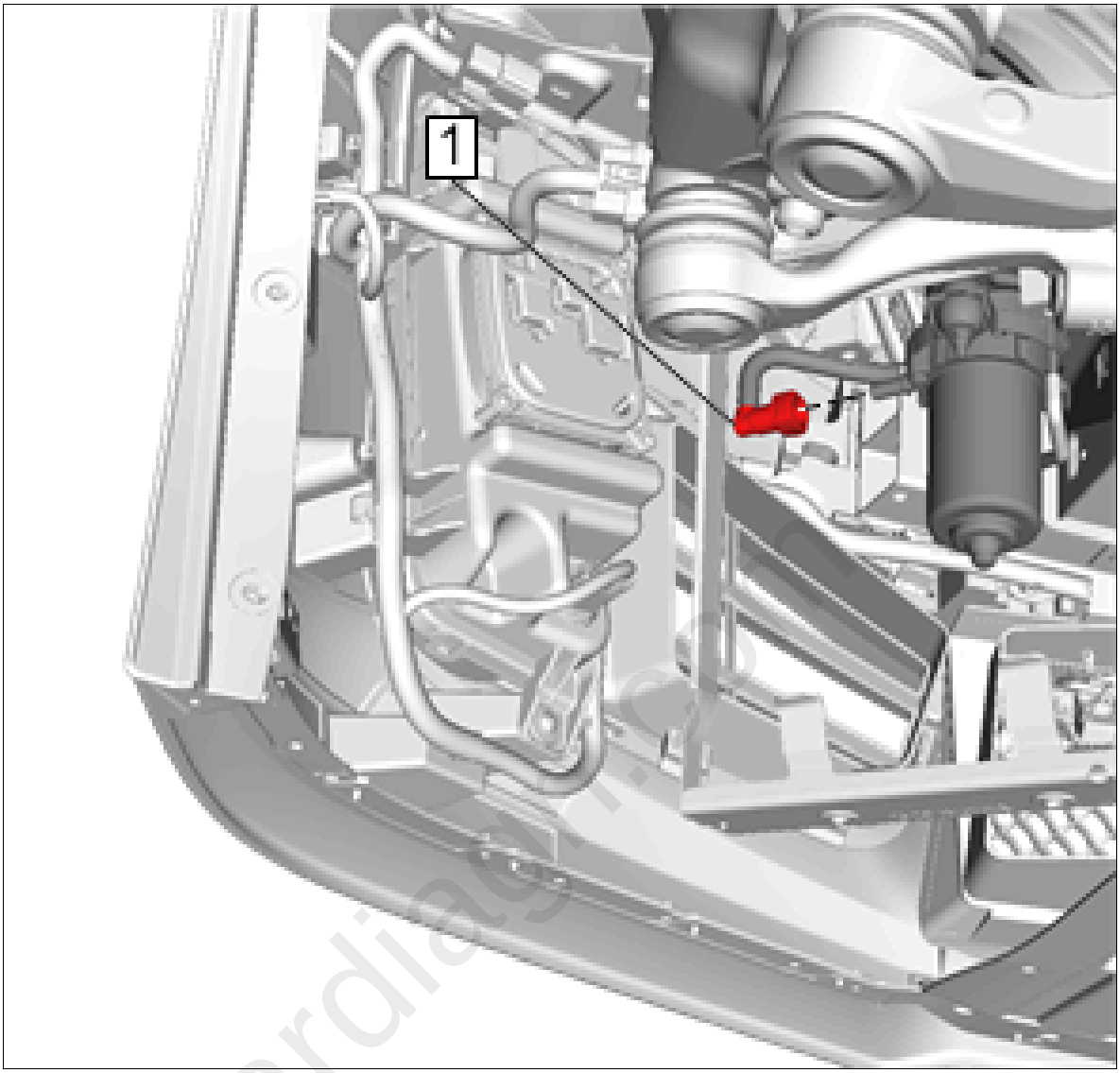
Fig 1: Retainer



Courtesy of GENERAL MOTORS COMPANY

5. Release Retainer (1)

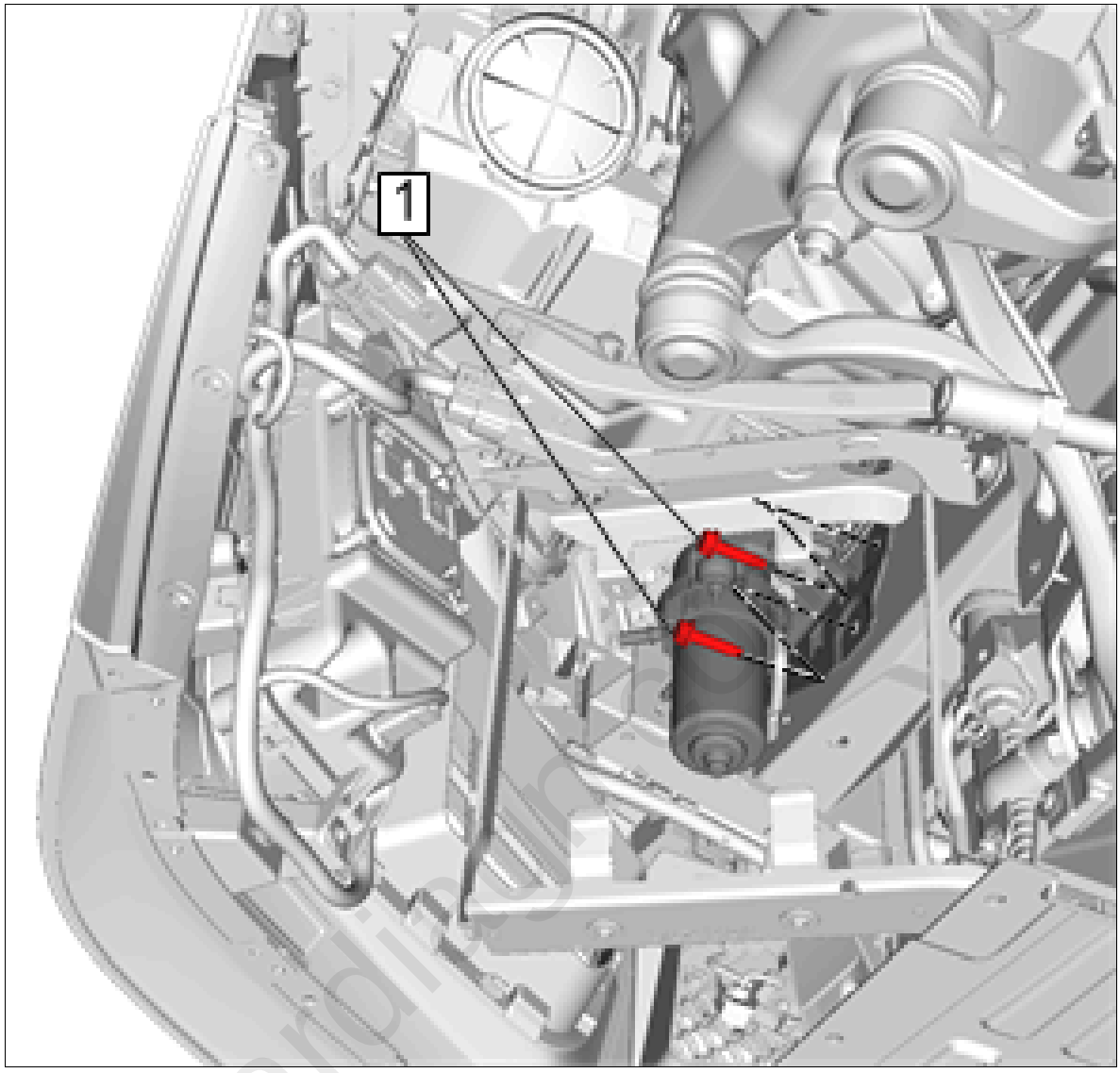
Fig 2: Quick Connect Fitting



Courtesy of GENERAL MOTORS COMPANY

6. Release Quick Connect Fitting (1)

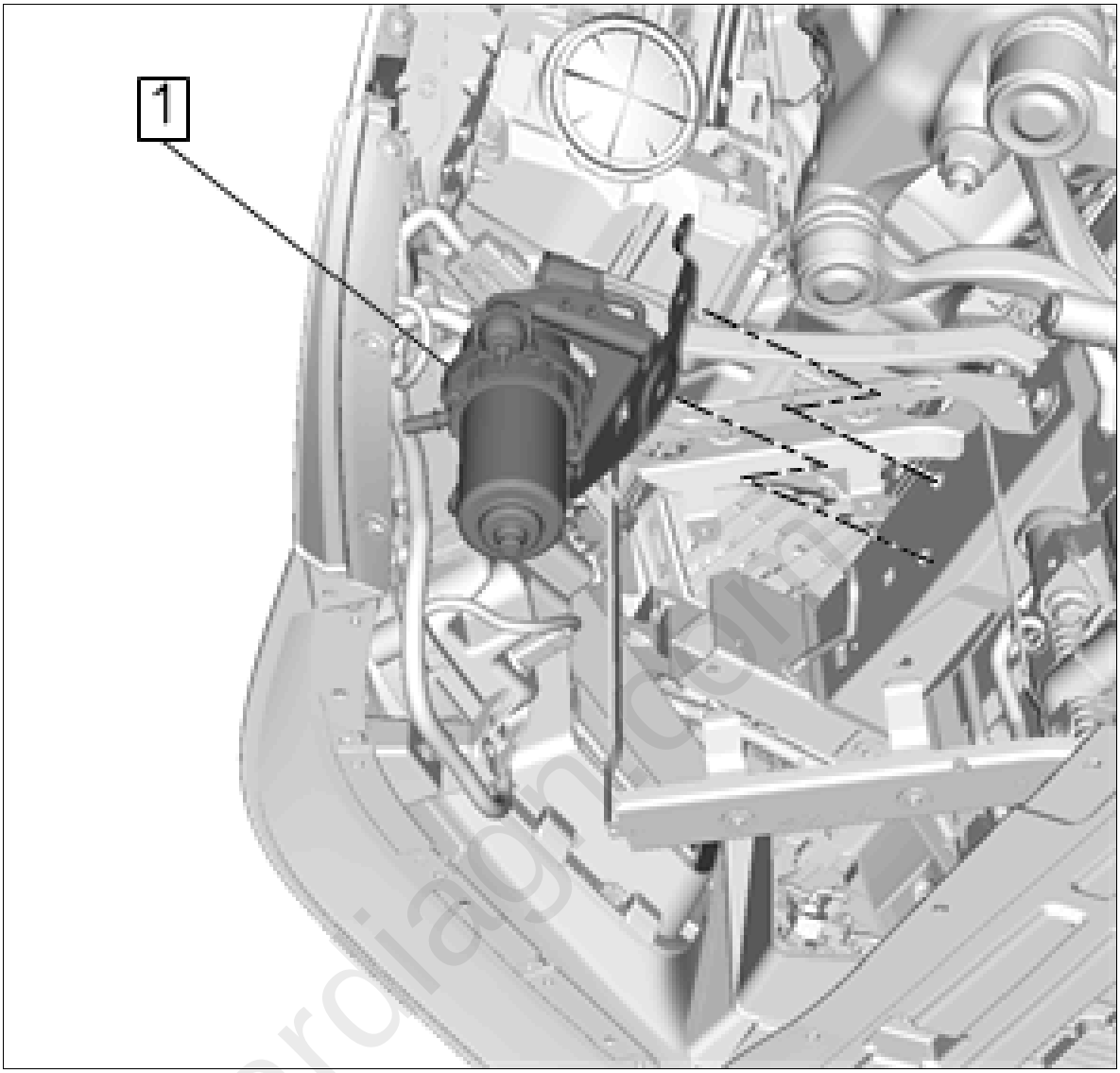
Fig 3: Bolt



Courtesy of GENERAL MOTORS COMPANY

7. Remove Bolt (1) (Qty: 2)

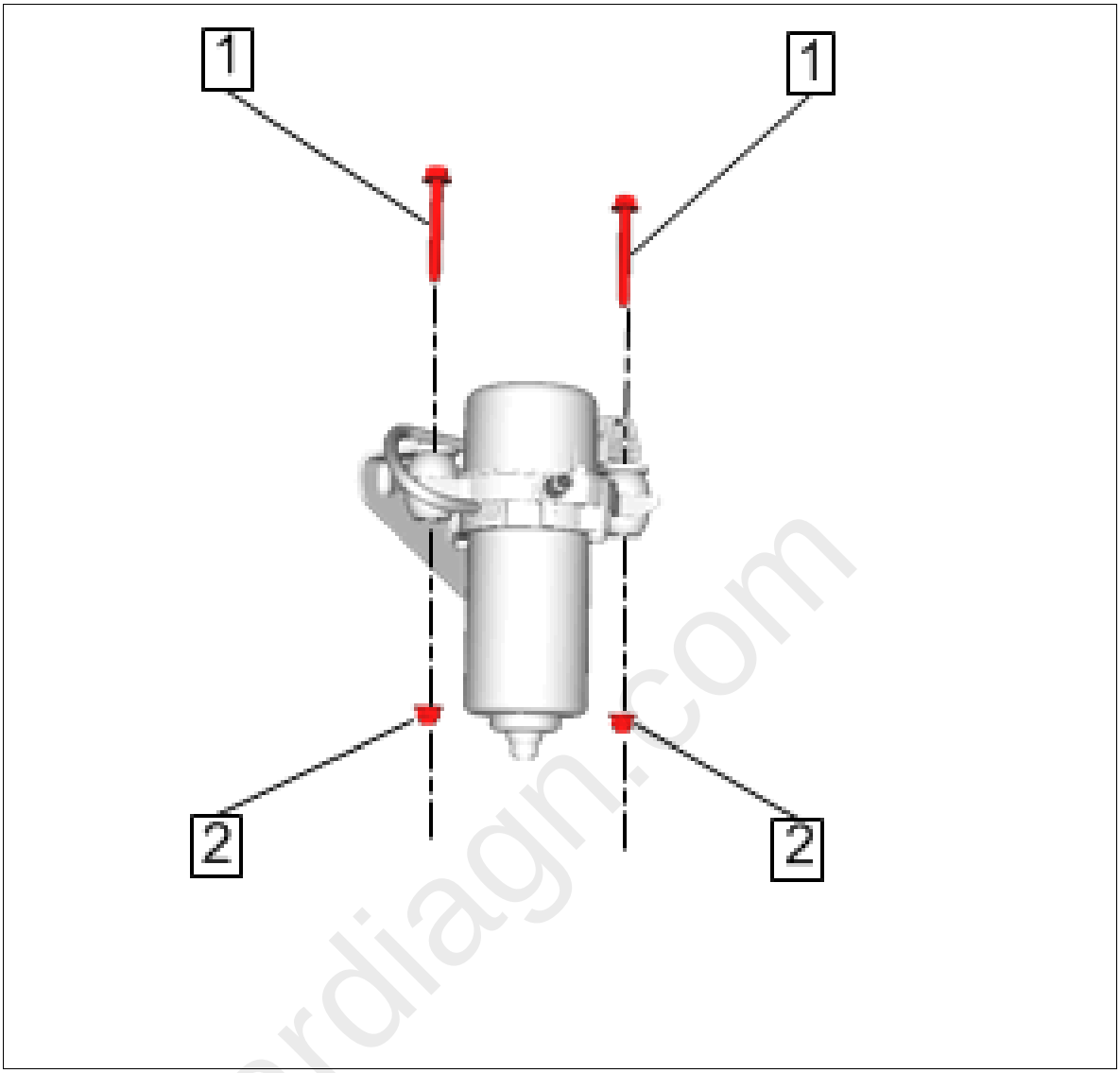
Fig 4: Power Brake Booster Pump



Courtesy of GENERAL MOTORS COMPANY

8. Remove Power Brake Booster Pump (1)

Fig 5: Bolt And Nut

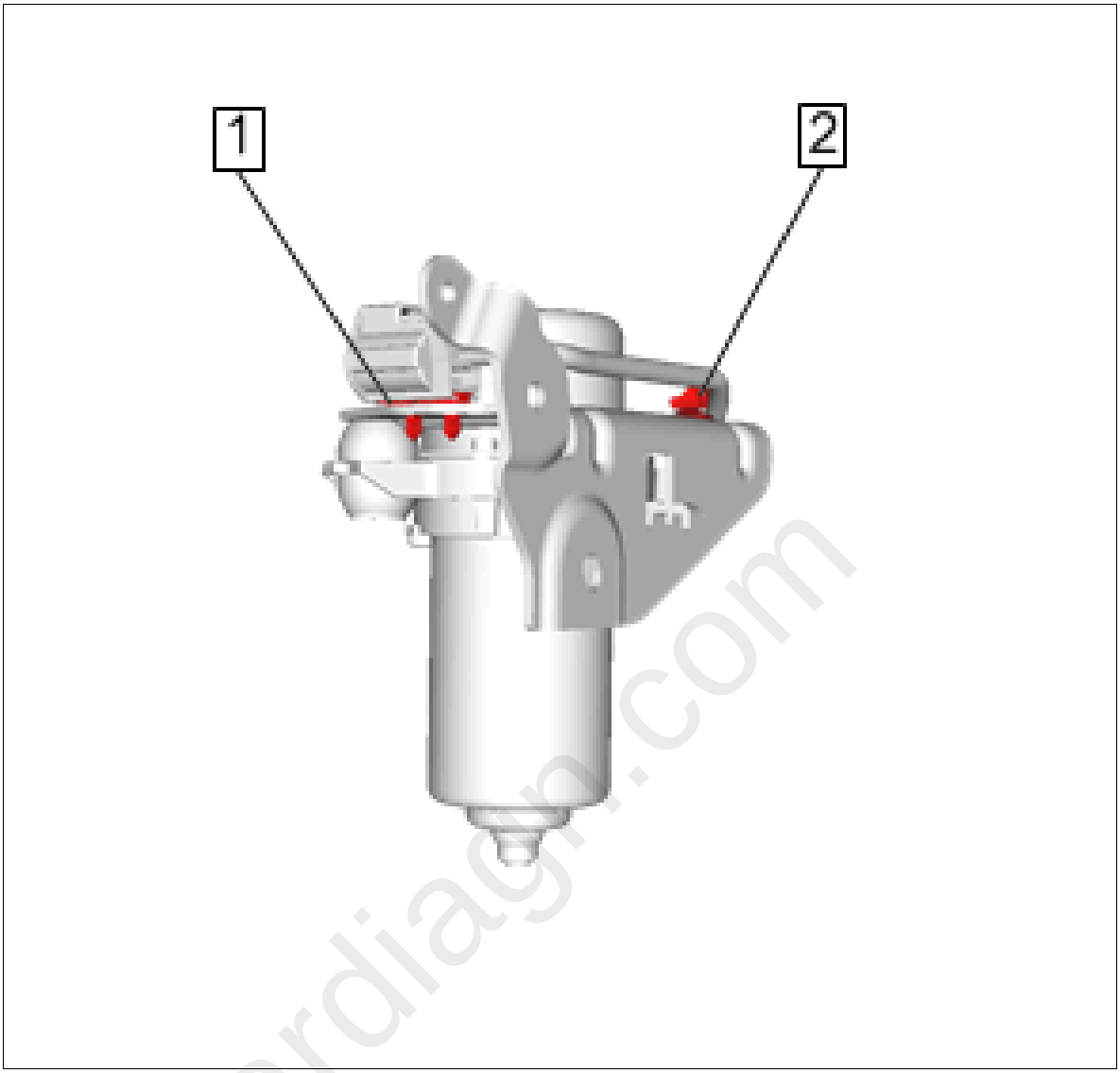


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9. Remove Bolt (1) (Qty: 2) and Nut (2) (Qty: 2)

Fig 6: Retainer

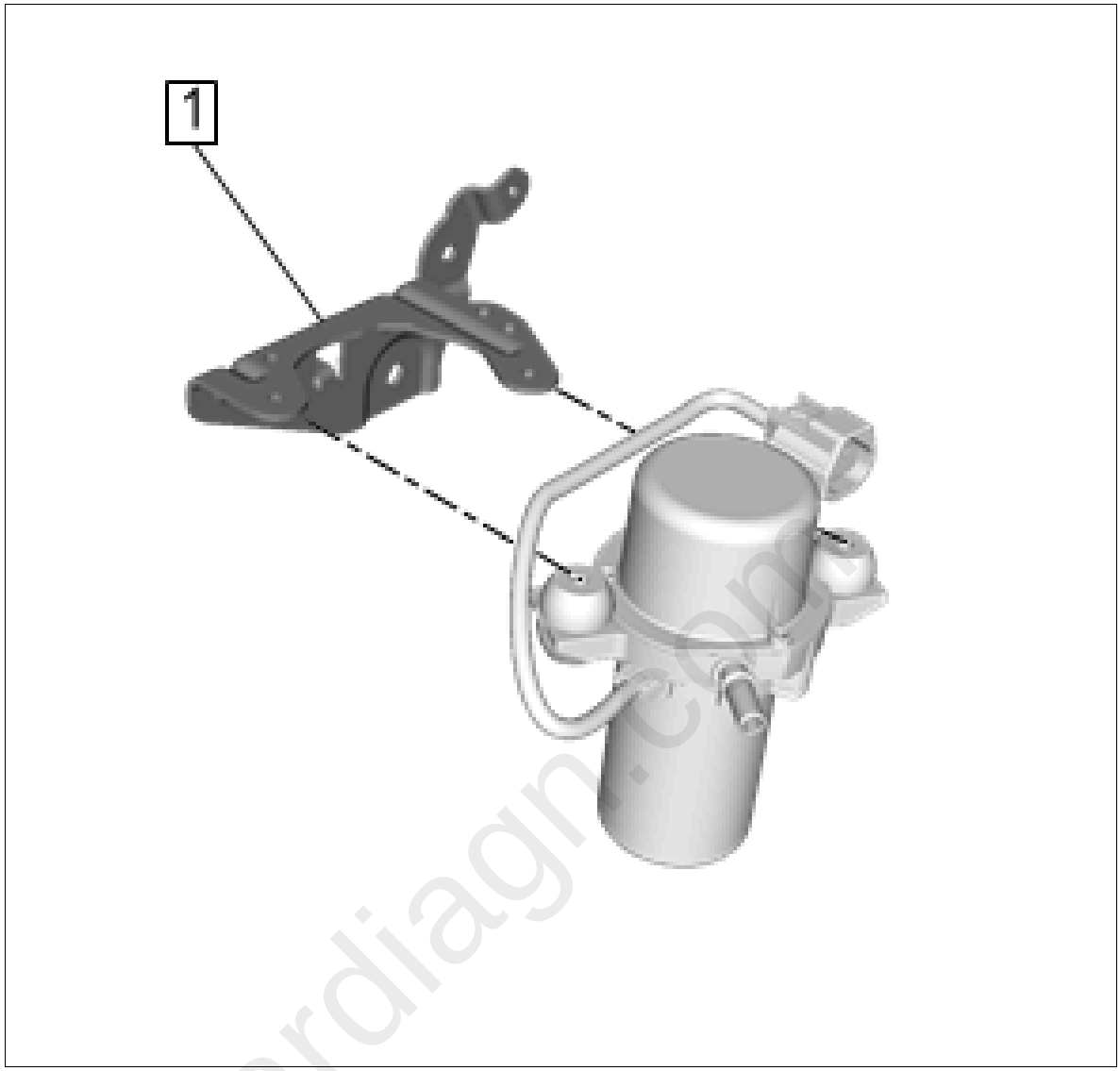


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10. Release Retainer (1)
11. Release Retainer (2)

Fig 7: Power Brake Booster Pump Bracket

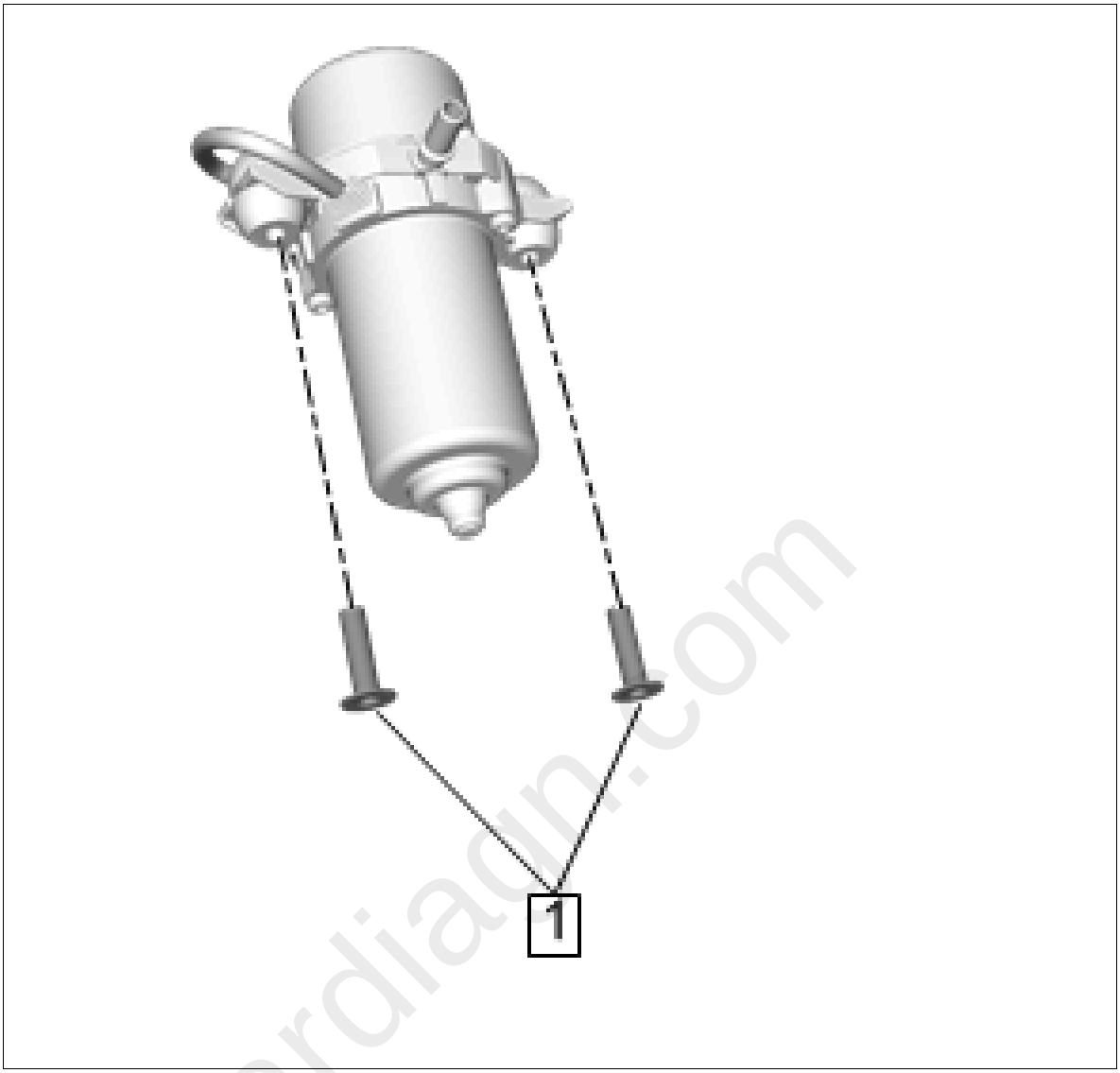


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12. Remove Power Brake Booster Pump Bracket (1)

Fig 8: Power Brake Booster Pump Bushing

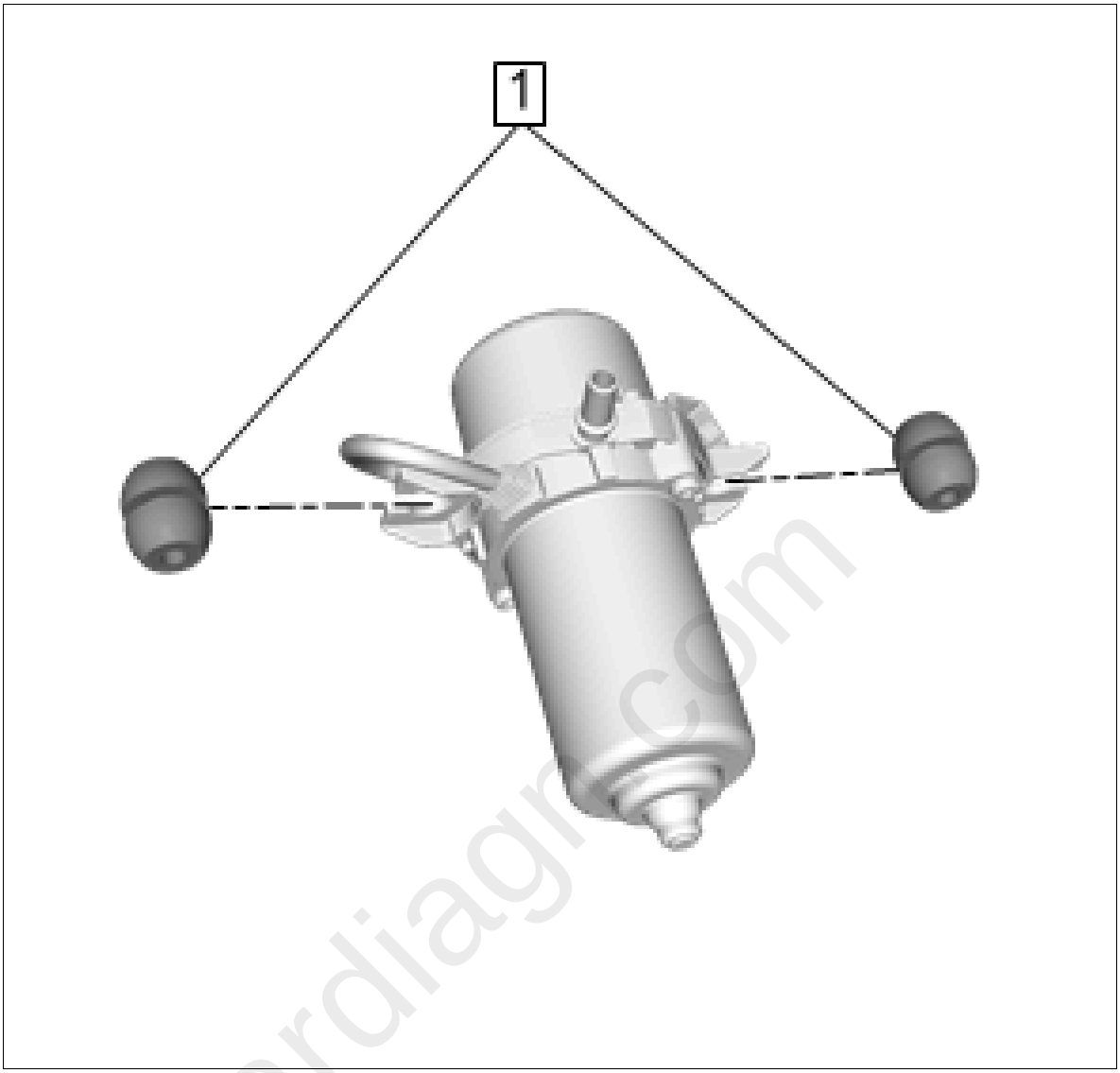


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13. Remove Power Brake Booster Pump Bushing (1) (Qty: 2)

Fig 9: Power Brake Booster Pump Dampener



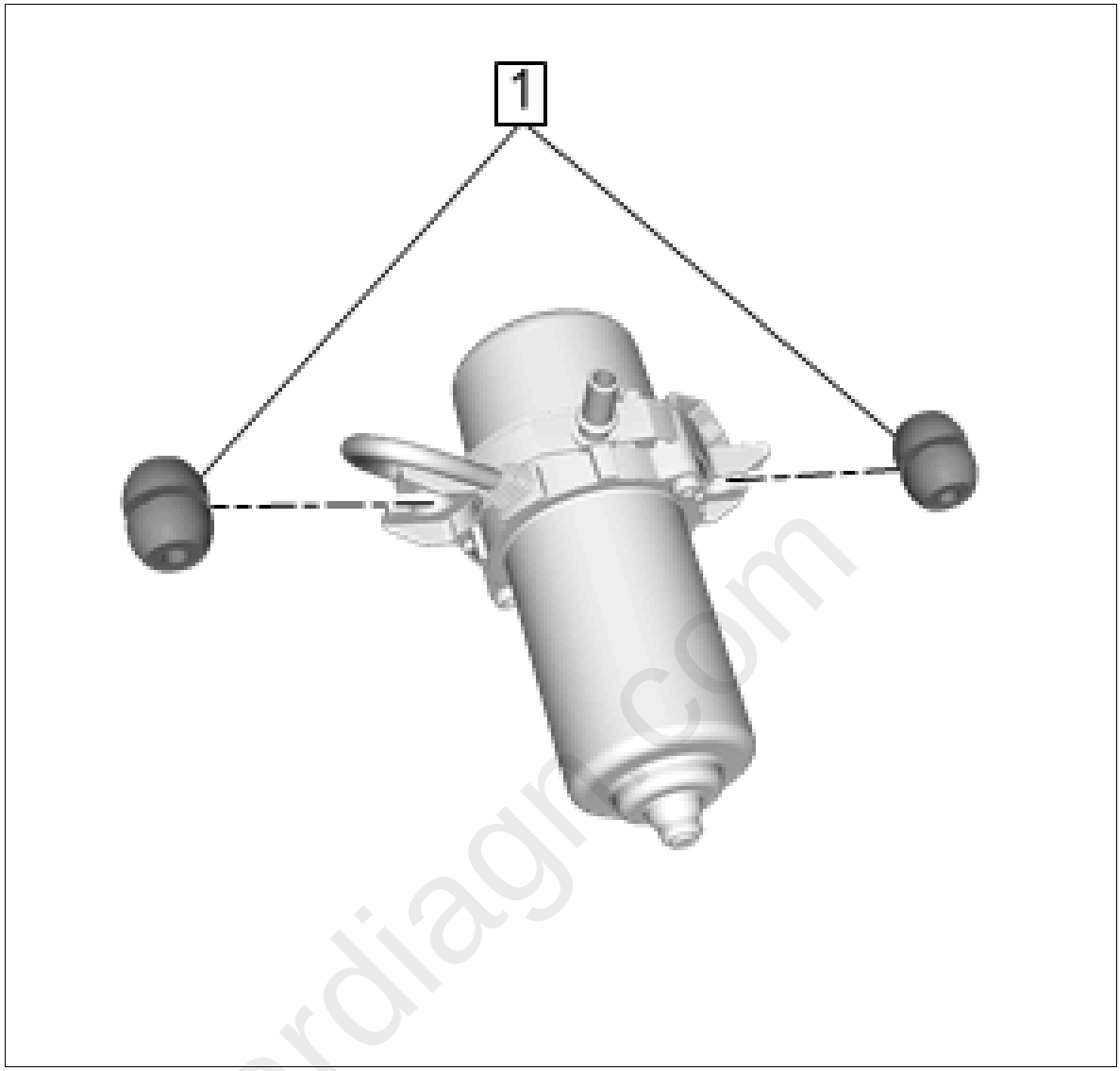
Courtesy of GENERAL MOTORS COMPANY

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14. Remove Power Brake Booster Pump Dampener (1) (Qty: 2)

REPAIR INSTRUCTIONS > POWER BRAKE BOOSTER PUMP REPLACEMENT > INSTALLATION PROCEDURE

Fig 1: Power Brake Booster Pump Dampener

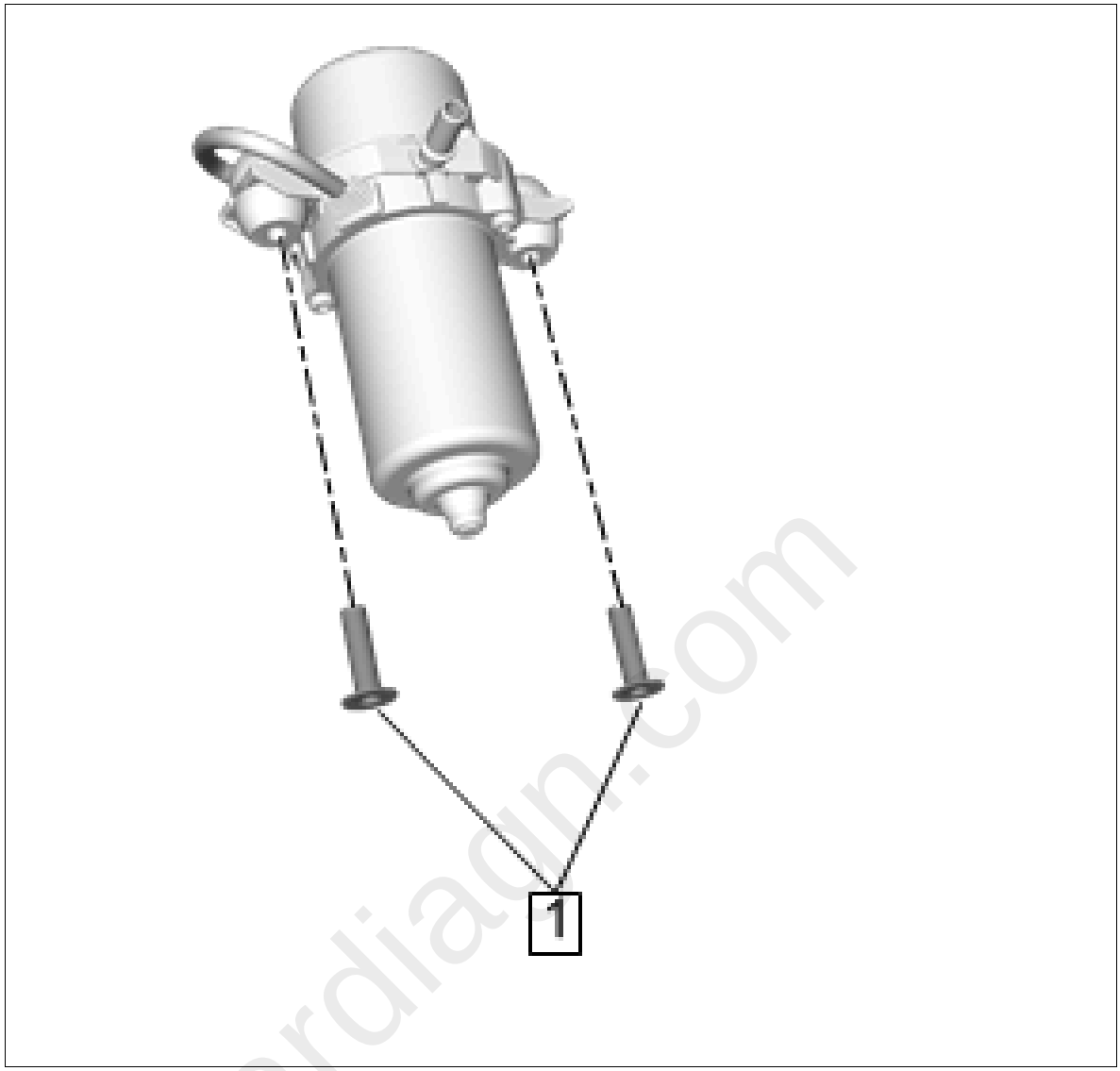


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1. Install Power Brake Booster Pump Dampener (1) (Qty: 2)

Fig 2: Power Brake Booster Pump Bushing

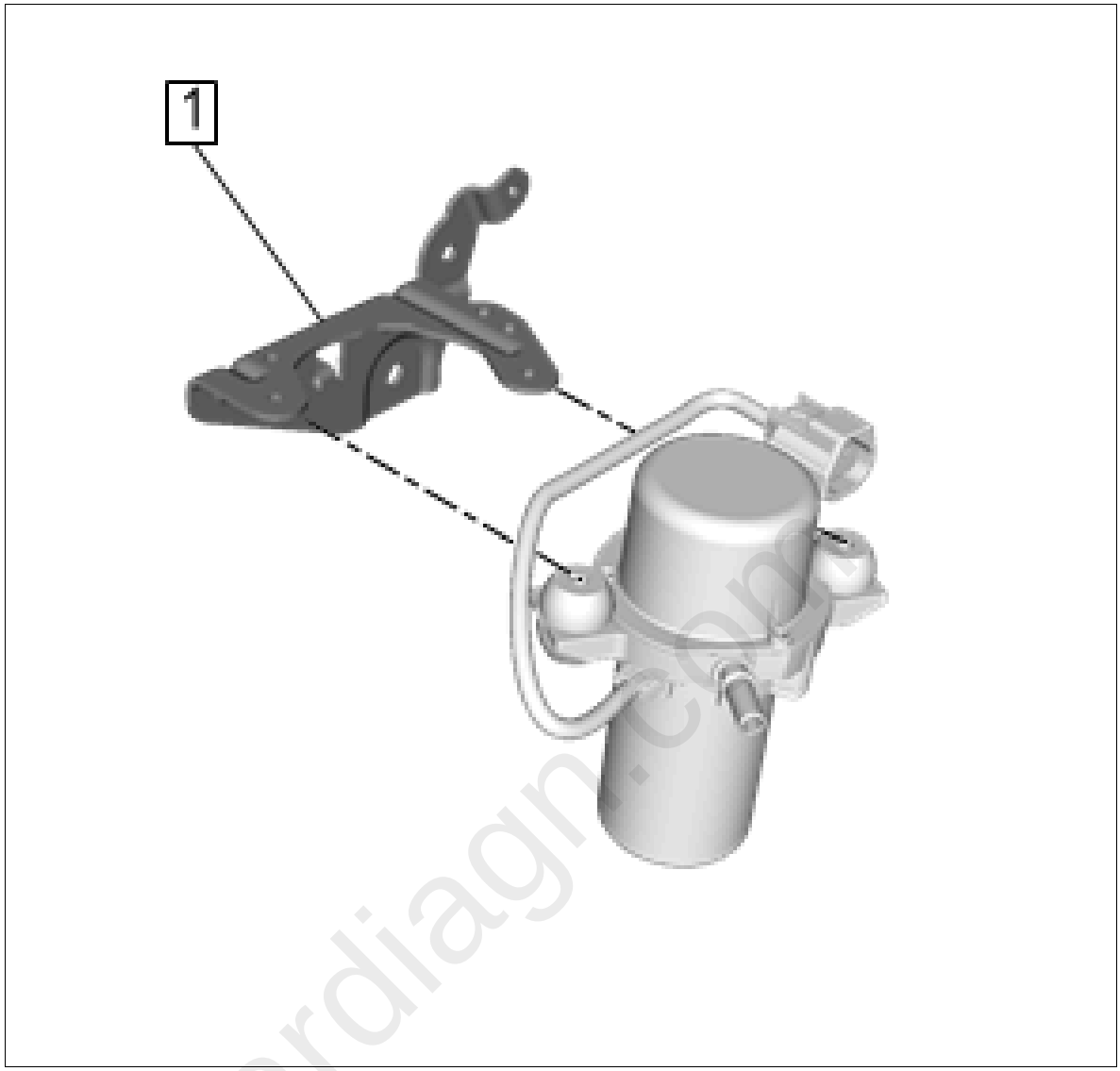


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2. Install Power Brake Booster Pump Bushing (1) (Qty: 2)

Fig 3: Power Brake Booster Pump Bracket

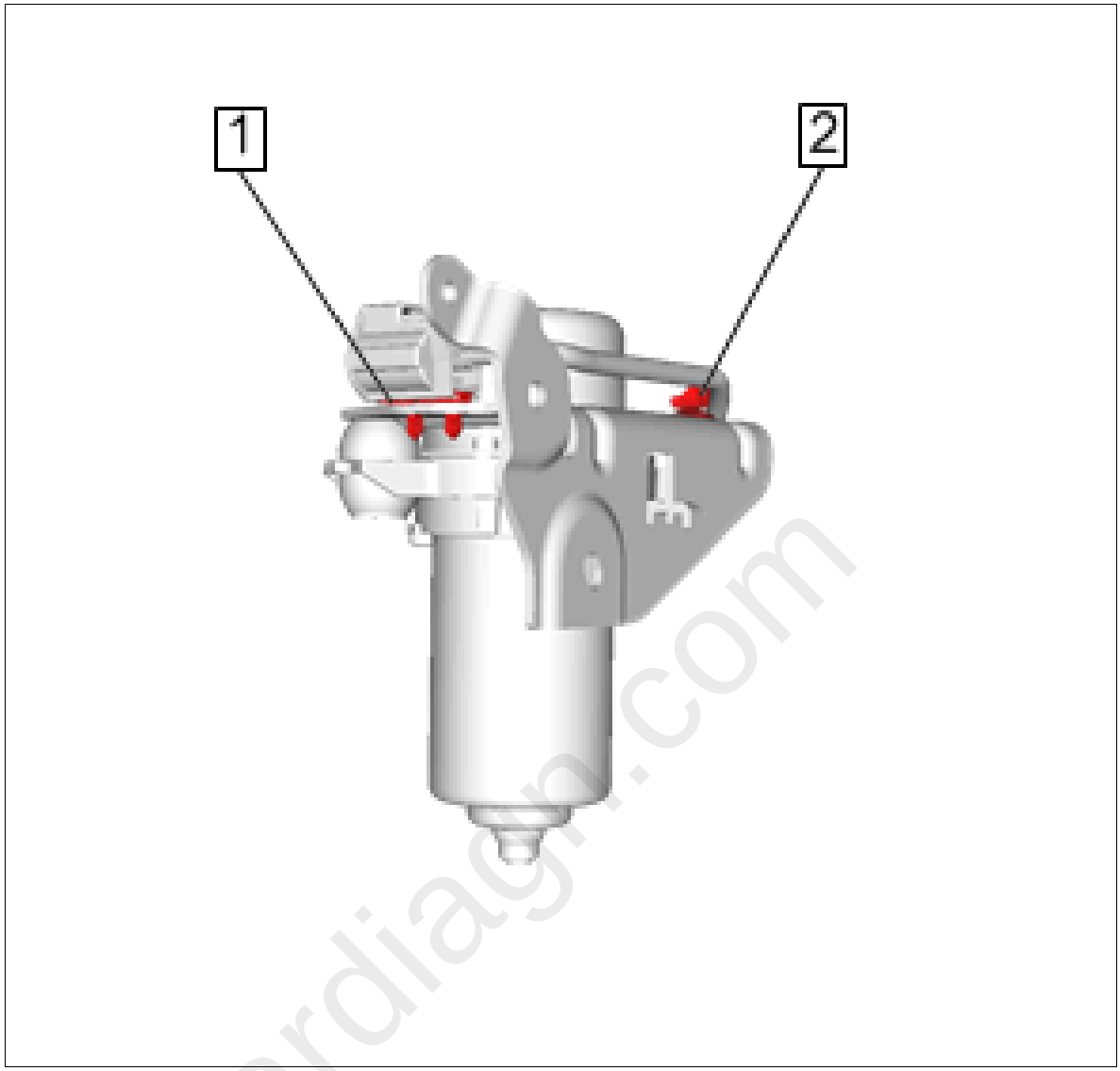


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3. Install Power Brake Booster Pump Bracket (1)

Fig 4: Retainer

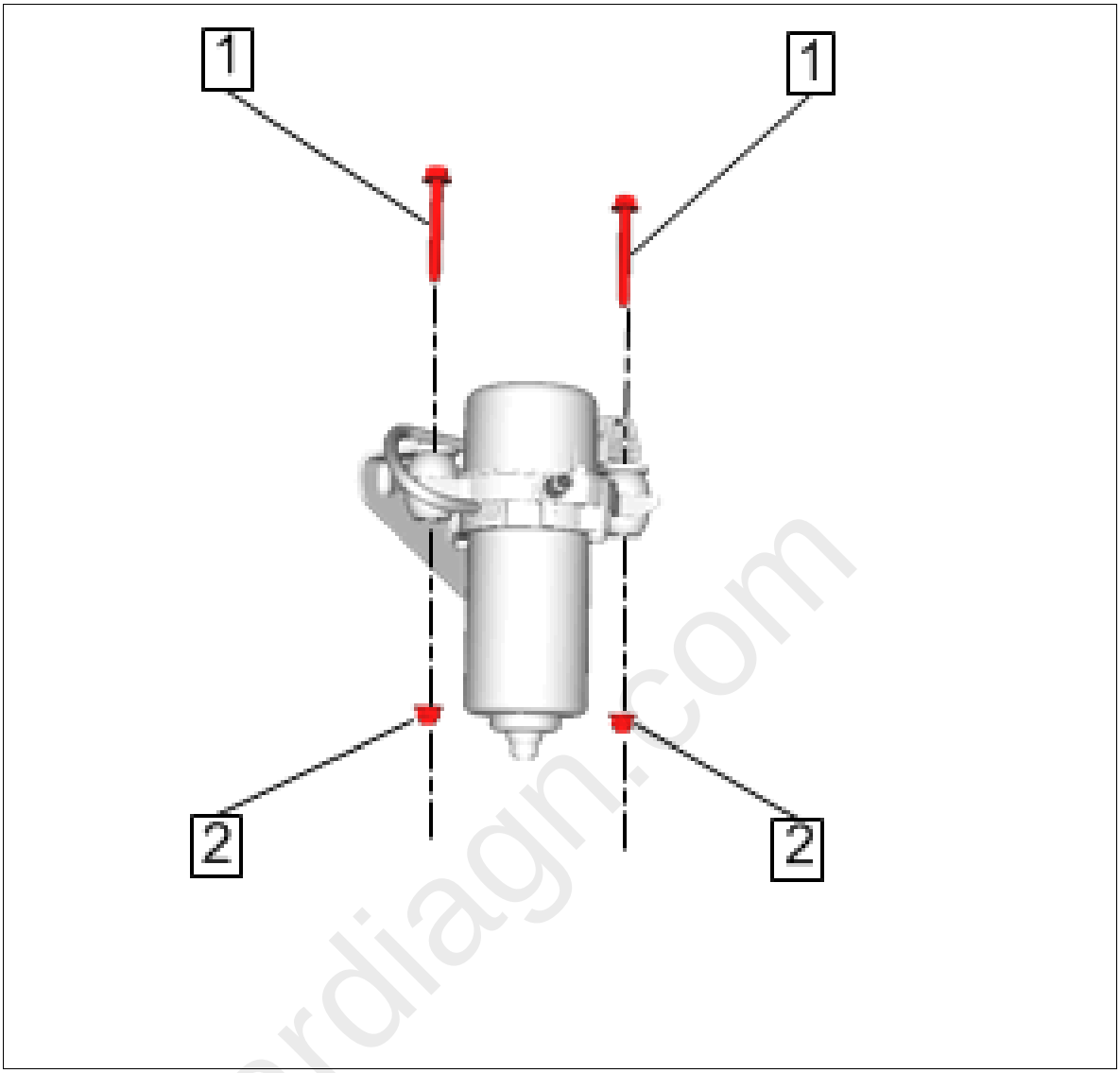


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4. Install Retainer (1)
5. Install Retainer (2)

Fig 5: Bolt And Nut



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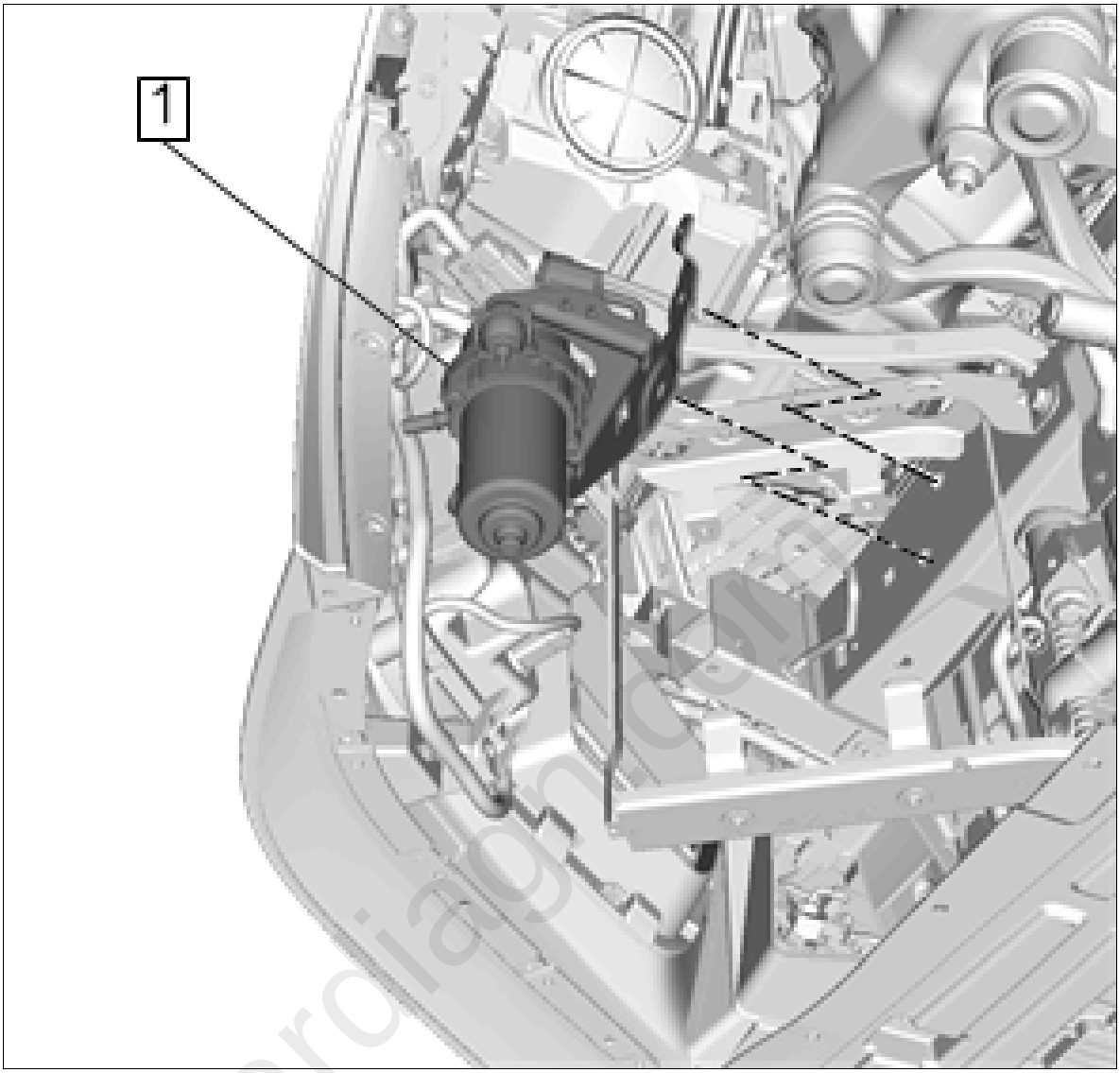
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⚠ *CAUTION:*

Refer to Fastener Caution .

6. Install Bolt (1) (Qty: 2) and Nut (2) (Qty: 2) and tighten to 22 N.m (16 lb ft)

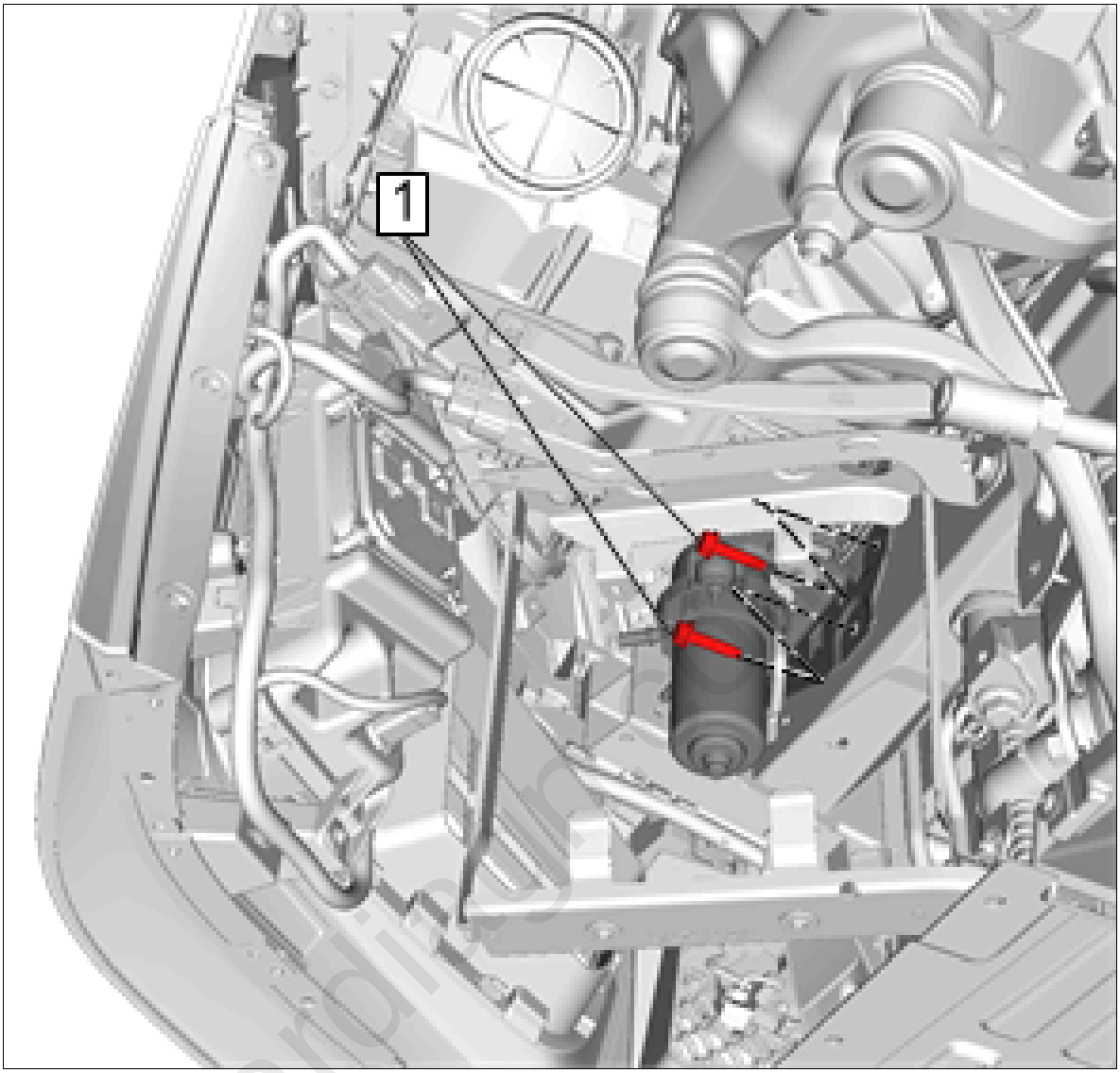
Fig 6: Power Brake Booster Pump



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7. Install Power Brake Booster Pump (1)

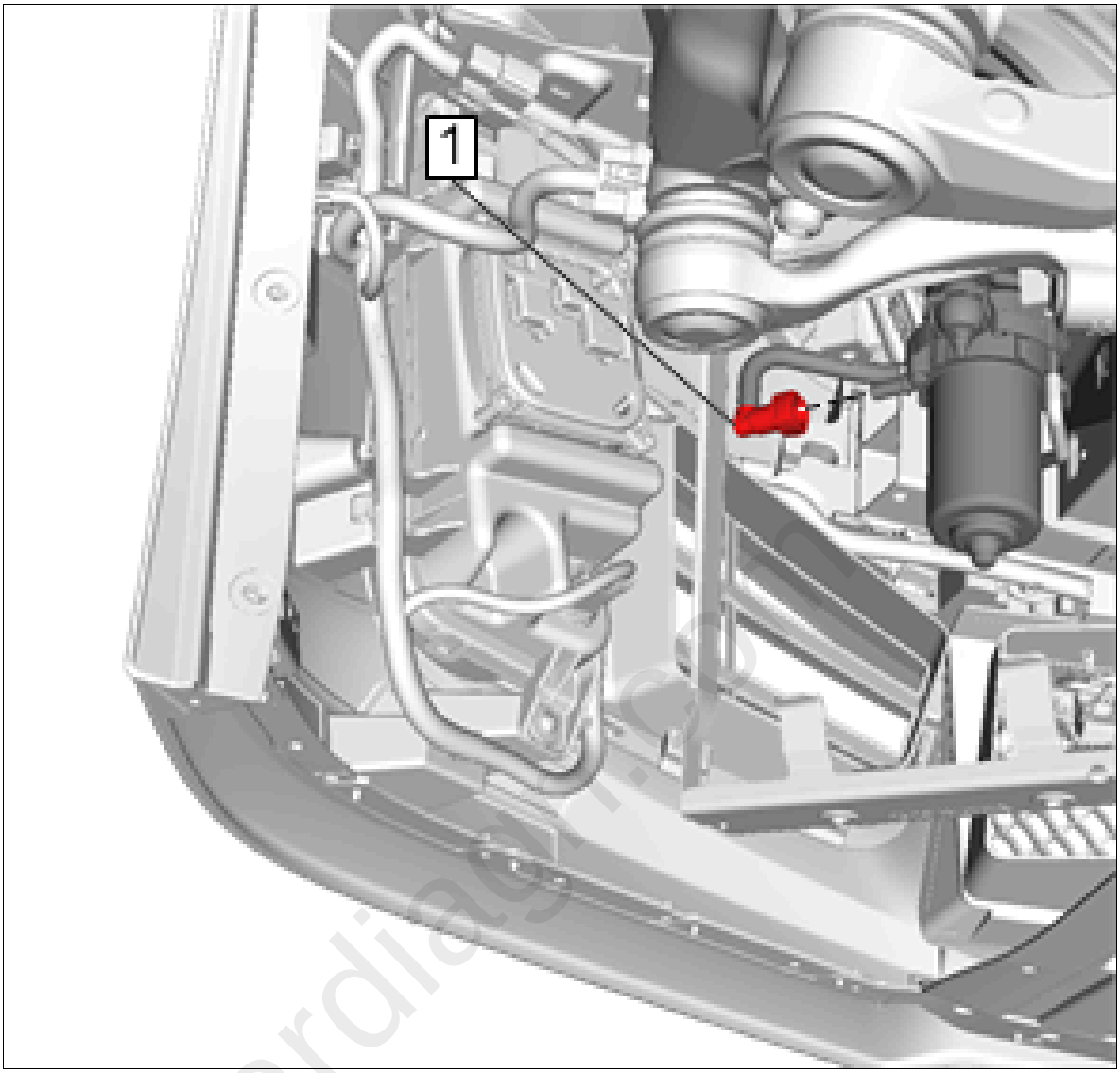
Fig 7: Bolt



Courtesy of GENERAL MOTORS COMPANY

8. Install Bolt (1) and tighten to 25 N.m (18 lb ft) (Qty: 2)

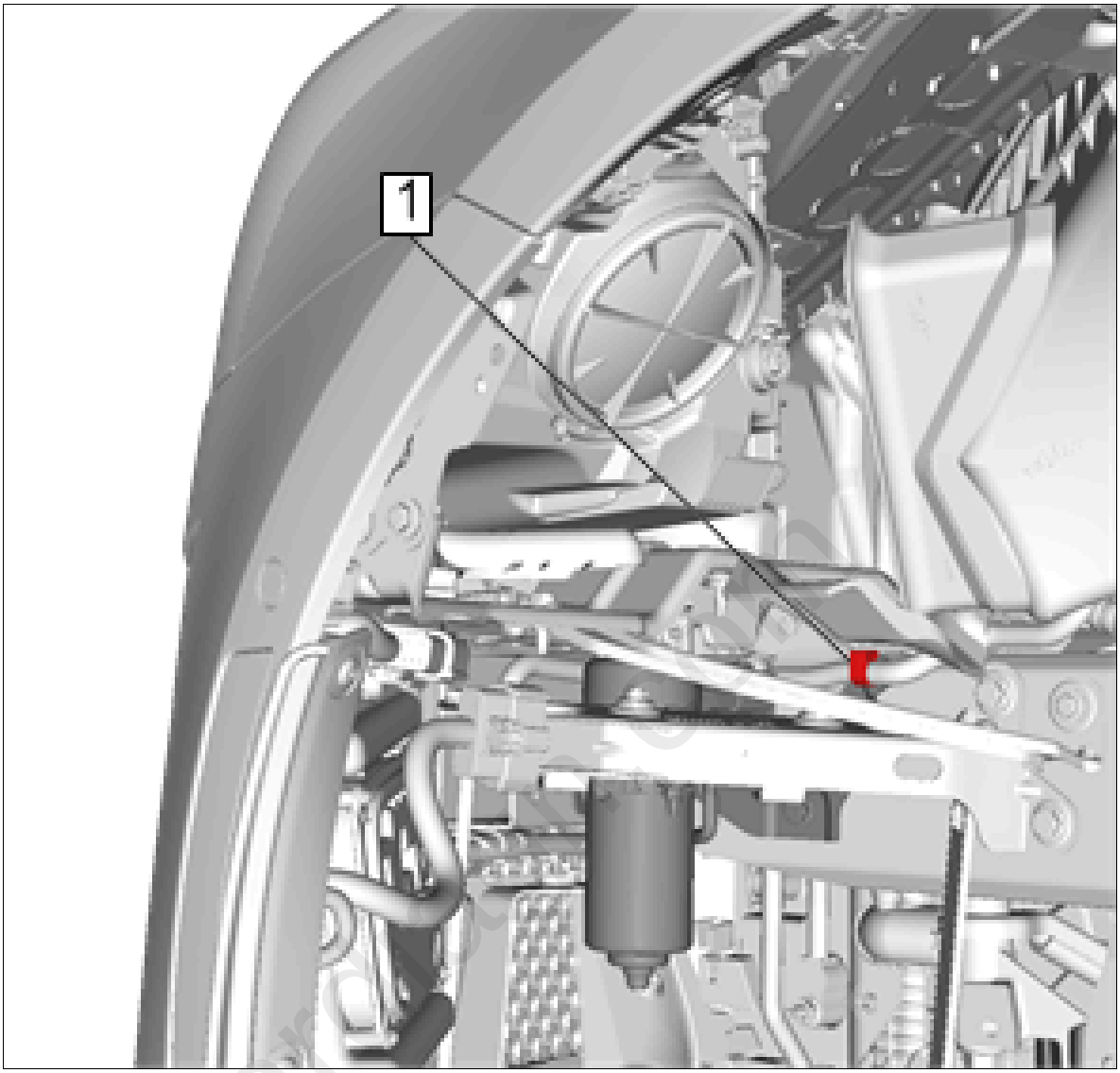
Fig 8: Quick Connect Fitting



Courtesy of GENERAL MOTORS COMPANY

9. Connect Quick Connect Fitting (1)

Fig 9: Retainer



Courtesy of GENERAL MOTORS COMPANY

10. Install Retainer (1)
11. Connect the power brake booster pump vent hose.
12. Connect the power brake booster pump electrical connector.
13. Install Charge Air Cooler Left Side - Charge Air Cooler Replacement - Left Side (LGX with V18)Charge Air Cooler Replacement - Left Side (LT1 V18)Charge Air Cooler Replacement - Left Side (LTG with V18)

DESCRIPTION AND OPERATION > BRAKE ASSIST SYSTEM DESCRIPTION AND OPERATION > SYSTEM COMPONENT DESCRIPTION

The brake assist system consists of the following:

Brake Pedal

Multiplies the braking effort applied by the driver.

Brake Pedal Pushrod

Transfers multiplied input force received from the brake pedal to the vacuum brake booster.

Vacuum Brake Booster

Uses source vacuum to decrease effort required by the driver when applying the brakes.

Vacuum Brake Booster Control Valve

Regulates the vacuum/atmospheric pressure within the vacuum brake booster. The calibration of the control valve gives more powerful vacuum assistance during low brake pedal pressure.

Vacuum Source

The source vacuum is either derived from the intake manifold or delivered from a pump, mechanically or electrically driven. For further information refer to Brake Booster Vacuum Assist Description and Operation .

Vacuum Source Delivery System

Enables delivery and retention of source vacuum for vacuum brake booster.

DESCRIPTION AND OPERATION > BRAKE ASSIST SYSTEM DESCRIPTION AND OPERATION > SYSTEM OPERATION

Brake system input force from the driver is multiplied by the brake pedal and transferred by the pedal pushrod to the hydraulic brake master cylinder. Effort required to apply the brake system is reduced by the operation of the vacuum brake booster.

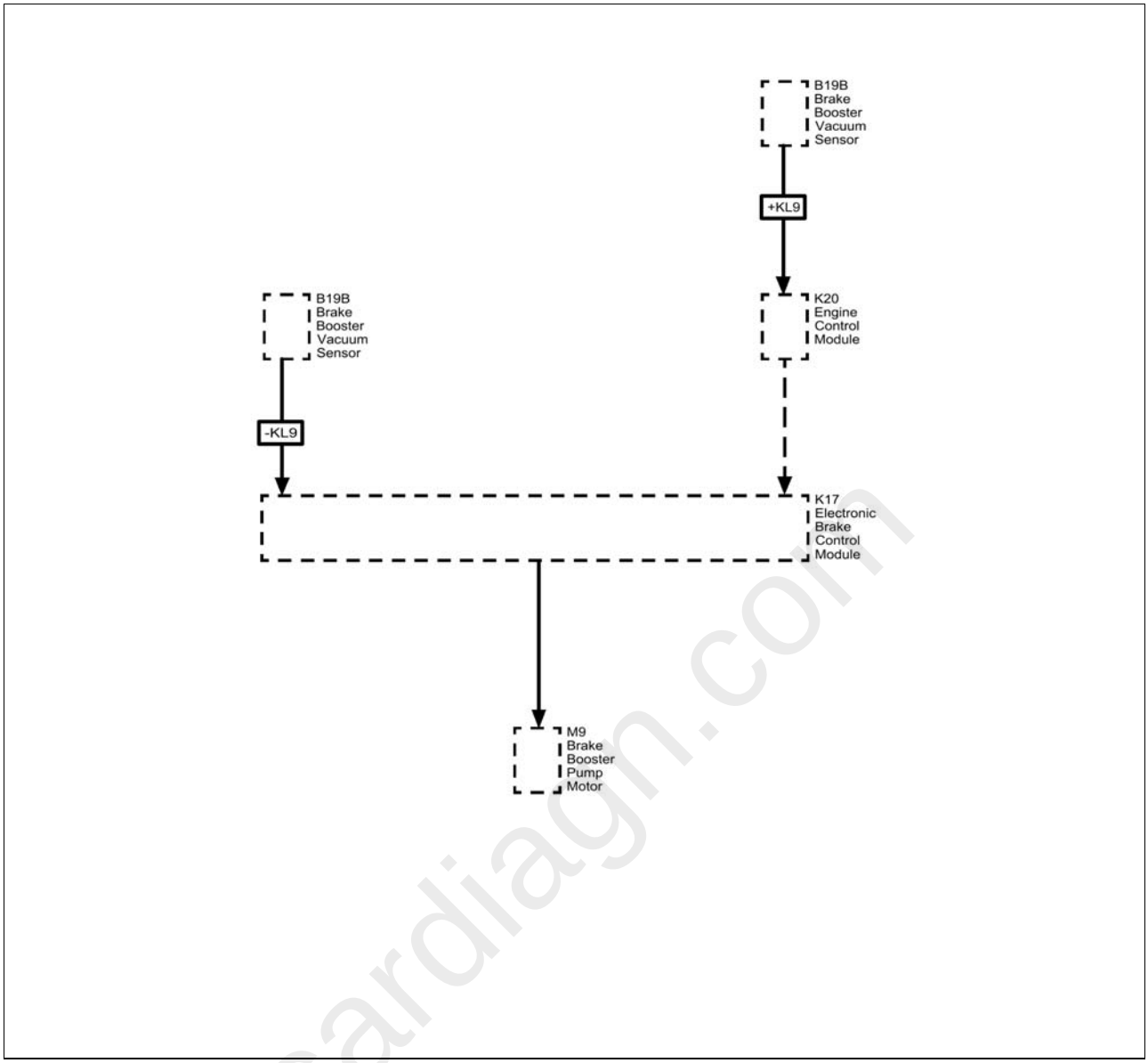
At rest, source vacuum is applied to both sides of each of the diaphragms in the dual booster. Return springs maintain the booster in a rest position.

When brake system force is applied, vacuum to the rear of the diaphragms is cut off, and air at atmospheric pressure is admitted in its place. The vacuum acts to pull the diaphragms forward, while the atmospheric pressure acts to push from behind. As a result, the amount of effort required by the driver is reduced. When input force is removed, vacuum again replaces atmospheric pressure within the vacuum power brake booster to help return the booster to rest. Return springs maintain the system in a rest position.

DESCRIPTION AND OPERATION > BRAKE BOOSTER VACUUM ASSIST DESCRIPTION AND OPERATION > SYSTEM COMPONENT DESCRIPTION

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Fig 1: Hydraulic Brakes Block Diagram



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Callout	Component Name
KL9	ENG CONTROL: STOP/START SYS
B19B	B19B Brake Booster Vacuum Sensor
K20	K20 Engine Control Module
B19B	B19B Brake Booster Vacuum Sensor
K17	K17 Electronic Brake Control Module
M9	M9 Brake Booster Pump Motor

The Brake Booster Vacuum Assist system consists of the following:

Brake Booster Auxiliary Vacuum Pump (electric or mechanical)

The Brake Booster Vacuum Pump is a secondary vacuum supply to the brake booster used to maintain sufficient vacuum for brake assist.

Brake Booster Vacuum Sensor Without KL9

The vacuum sensor is used to measure the level of vacuum available in the brake booster. The Electronic Brake Control Module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor is located in the brake booster or vacuum hose. The Brake Booster Vacuum Sensor supplies a voltage signal in relation to the pressure in the brake booster to the Electronic Brake Control Module.

Brake Booster Vacuum Sensor With KL9

The vacuum sensor is used to measure the level of vacuum available in the brake booster. The Engine Control Module supplies a 5 V reference and a low reference circuit to the brake booster vacuum sensor. The vacuum sensor is located in the brake booster or vacuum hose. The Brake Booster Vacuum Sensor supplies a voltage signal in relation to the pressure in the brake booster to the Engine Control Module.

Electronic Brake Control Module

The Electronic Brake Control Module monitors the vacuum in the brake booster using the Brake Booster Vacuum Sensor. When the vacuum within the system drops, below 42 kPa (6 psi) the Electronic Brake Control Module turns ON the Brake Booster Auxiliary Vacuum Pump by providing a ground to the Brake Booster Pump Relay. The relay activates and supplies voltage to the Brake Booster Auxiliary Vacuum Pump. The Electronic Brake Control Module shuts the pump off when the vacuum pressure is above 55 kPa (8 psi) by removing the ground to the Brake Booster Pump Relay.

Vacuum Brake Booster

When brake system input force is applied, air at atmospheric pressure is admitted to the rear of both vacuum diaphragms, providing a decrease in brake pedal effort required. When input force is removed, vacuum replaces the atmospheric pressure within the booster. The booster uses source vacuum to decrease the effort required by driver when applying the brake.

Vacuum Source

Vacuum is supplied by the engine vacuum or by the Brake Booster Auxiliary Vacuum Pump.

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DESCRIPTION AND OPERATION > BRAKE BOOSTER VACUUM ASSIST

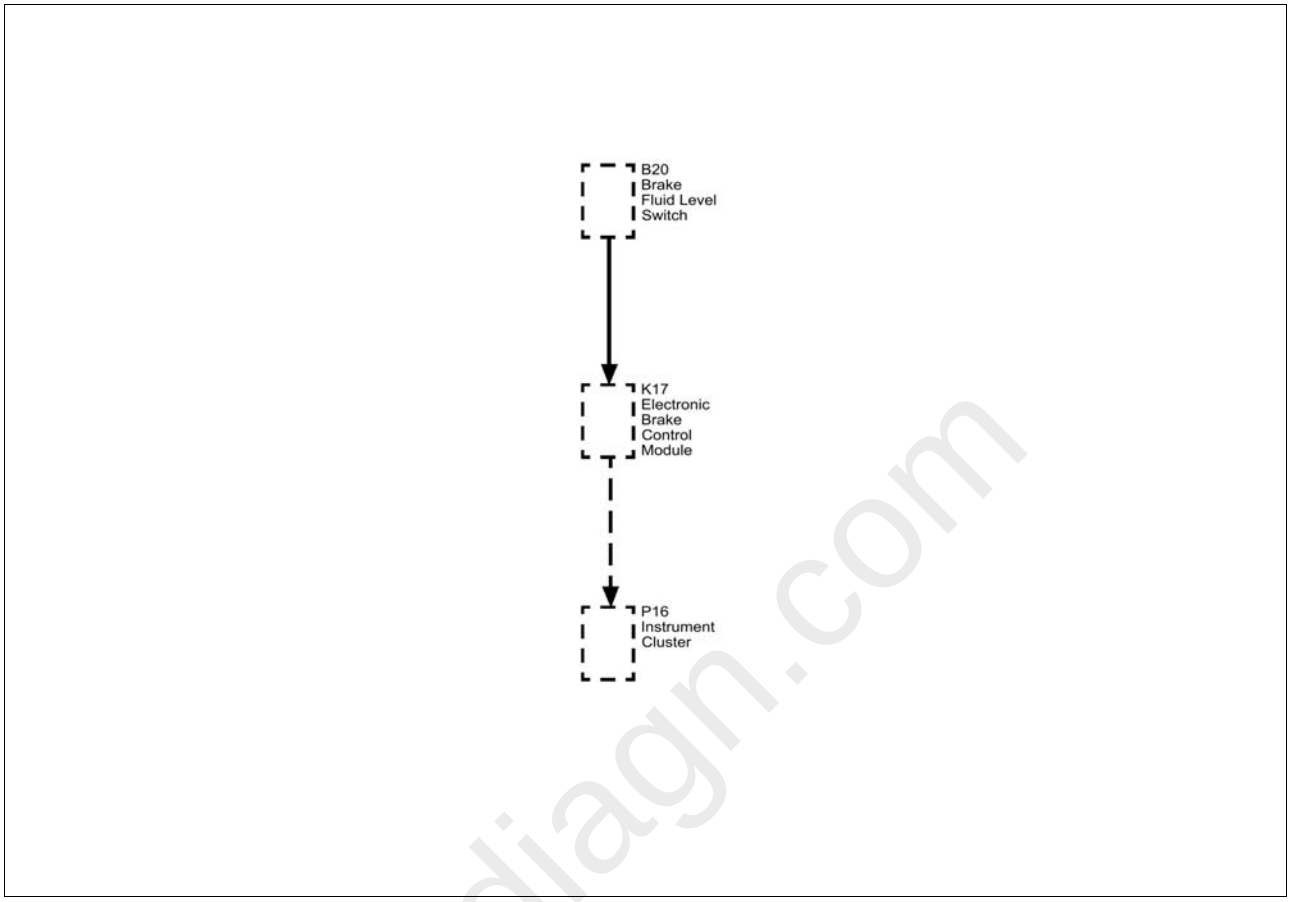
DESCRIPTION AND OPERATION > SYSTEM OPERATION

The pump can be switched on and off by the Electronic Brake Control Module based on the required vacuum. Pressure variations during braking can be measured, and the pump can be activated to generate additional vacuum if required to increase the braking force.

The pump runs for the first 5 seconds after engine running to perform a self test. Engine running, the pump may run another 30 seconds and then turns off, due to the timer relay. The pump has a maximum run time of 180 seconds per ignition cycle with engine running, when it reaches the maximum run time the pump shuts down to cool off and will not allow the pump to run again until the next engine run cycle.

DESCRIPTION AND OPERATION > BRAKE WARNING SYSTEM DESCRIPTION AND OPERATION > BRAKE WARNING INDICATOR

Fig 1: Brake Warning Block Diagram



Courtesy of GENERAL MOTORS COMPANY

Callout	Component Name
P16	P16 Instrument Cluster
B20	B20 Brake Fluid Level Switch
K17	K17 Electronic Brake Control Module

The instrument cluster turns the brake warning indicator ON when the following occurs:

- The instrument cluster performs the bulb check. The brake warning indicator illuminates for 5 s.
- When the electronic brake control module (EBCM) detects low brake fluid level it sets DTC C0267 and sends a serial data message to the instrument cluster, which will illuminate the red brake indicator.

DESCRIPTION AND OPERATION > BRAKE WARNING SYSTEM DESCRIPTION AND

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OPERATION > DRIVER INFORMATION CENTER MESSAGES

When the electronic brake control module (EBCM) detects low brake fluid level it sets DTC C0267 and sends a serial data message to the driver information center, which will display Brake Fluid Low message.

DESCRIPTION AND OPERATION > HYDRAULIC BRAKE SYSTEM DESCRIPTION AND OPERATION > SYSTEM COMPONENT DESCRIPTION

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Fluid Reservoir

Contains supply of brake fluid for the hydraulic brake system.

Hydraulic Brake Master Cylinder

Converts mechanical input force into hydraulic output pressure.
Hydraulic output pressure is distributed from the master cylinder through 2 hydraulic circuits, supplying diagonally-opposed wheel apply circuits.

Hydraulic Brake Pressure Balance Control System

Regulates brake fluid pressure delivered to hydraulic brake wheel circuits, in order to control the distribution of braking force.
Pressure balance control is achieved through dynamic rear proportioning (DRP), which is a function of the ABS modulator.

Hydraulic Brake Pipes and Flexible Brake Hoses

Carries brake fluid to and from hydraulic brake system components.

Hydraulic Brake Wheel Apply Components

Converts hydraulic input pressure into mechanical output force.

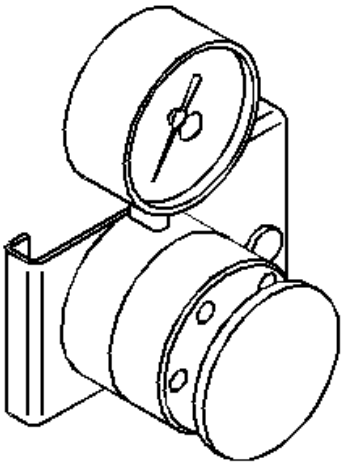
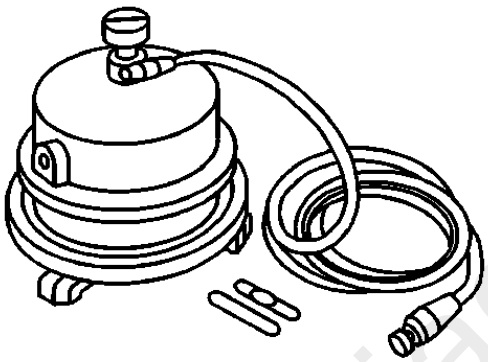
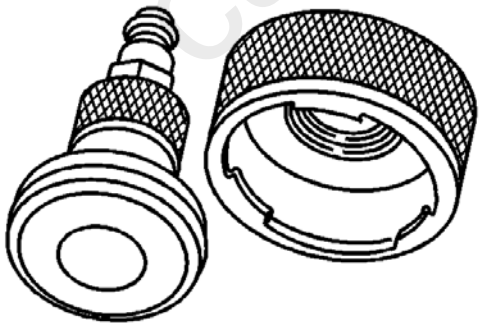
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DESCRIPTION AND OPERATION > HYDRAULIC BRAKE SYSTEM DESCRIPTION AND OPERATION > SYSTEM OPERATION

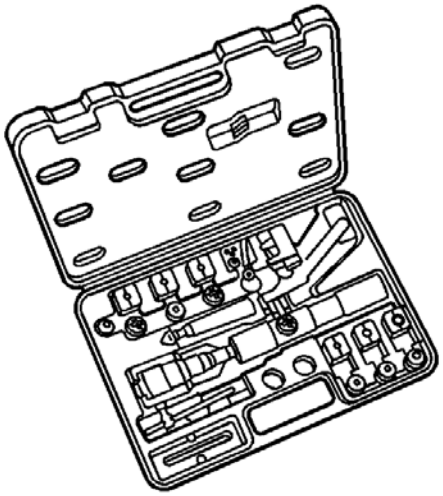
Mechanical force is converted into hydraulic pressure by the master cylinder, regulated to meet braking system demands by the pressure balance control system, and delivered to the hydraulic brake wheel circuits by the pipes and flexible hoses. The wheel apply components then convert the hydraulic pressure back into mechanical force which presses linings against rotating brake system components.

SPECIAL TOOLS AND EQUIPMENT > SPECIAL TOOLS

Illustration	Tool Number/ Description

	CH 28662 J 28662 Brake Pedal Effort Gauge
	CH 29532-A J 29532-B Pressure Brake Bleeder
	CH 44894-A J 44894-A Brake Bleeder Adapter

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	CH 45405 J 45405 Brake Pipe Flaring Kit

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