Hydraulic Brakes

cardiagn.com

Description and Operation

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DESCRIPTION AND OPERATION
4.

Brake Assist System Description and Operation

System Component Description

The brake assist system consists of the following:

Brake Pedal

Receives, multiplies and transfers brake system input force from 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 driver when applying brake system input force. At rest, source vacuum is applied to both sides of the vacuum diaphragm for single booster. Return springs maintain the booster in a rest position. When brake system input force is applied, vacuum to the rear of the diaphragm is cut off, and air at atmospheric pressure is admitted in its place. This provides a decrease in brake pedal effort required. When input force is removed, vacuum again replaces atmospheric pressure within the booster.

Vacuum Source

Supplies force used by vacuum brake booster to decrease brake pedal effort. The source vacuum for a spark ignition engine is normally derived from the intake manifold.

Vacuum Source Delivery System

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

System Operation

Under normal driving conditions, without the brakes applied, vacuum is allowed to act on both sides of the diaphragm within the vacuum brake booster. When the brake pedal is applied, the effort by the driver is multiplied due to the relative length of the brake pedal in relationship to its pivot point and the point at which the push rod to the vacuum brake booster is attached.

Movement of the push rod causes a valve within the vacuum brake booster to close between the two sides of the diaphragm, thus isolating each side. It also allows a valve to open that allows atmospheric pressure to act on the pedal side of the vacuum brake booster while maintaining vacuum on the vacuum source side of the diaphragm. The movement of the brake pedal pushrod is transferred to the hydraulic brake master cylinder via the vacuum brake booster. The pressure differential within the vacuum brake booster reduces the effort required by the driver in applying the brakes.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DESCRIPTION AND OPERATION
4.

Brake Booster Vacuum Assist Description and Operation

System Component Description

The brake booster vacuum assist system consists of the following:

Brake Booster Auxiliary Vacuum Pump

The brake booster vacuum pump is a secondary vacuum supply to the brake booster to maintain sufficient vacuum for brake assist.

Vacuum Brake Booster

Uses source vacuum to decrease effort required by driver when applying the brake. 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 atmospheric pressure within the booster.

Vacuum Source

Vacuum is supplied by engine vacuum or by the brake booster vacuum pump.

System Operation

The brake booster vacuum switch is activated by the amount of vacuum available to the power brake booster. When the ignition switch is at the ON position and the vacuum within the system drops, the switch within the brake booster vacuum switch closes allowing voltage to be supplied to the brake booster pump motor.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DESCRIPTION AND OPERATION
4.

Brake Warning System Description and Operation

The purpose of the brake warning system is to warn the driver of the park brake being applied while the vehicle is being driven, a brake electronic brake distribution (EBD) failure and/or a low brake fluid level condition.

- When the ignition switch in the ON position and park brake is applied, the brake warning indicator lamp is illuminated. While the ignition switch is turned to the ON position, the battery voltage is provided to the brake warning indicator on the instrument panel cluster (IPC). When the park brake is applied, the park brake switch is grounded and the brake warning indicator is illuminated.
- EBCM monitors the EBD system. If EBCM detects EBD failure condition, EBCM sends a signal to IPC and IPC illuminates the brake warning indicator.
- Brake fluid level indicator switch is negative thermal coefficient (NTC) type. When the brake fluid level is too low, the brake warning indicator is illuminated by being grounded through the brake fluid level indicator switch.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DESCRIPTION AND OPERATION
4.

Hydraulic Brake System Description and Operation

System Component Description

The hydraulic brake system consists of the following:

Hydraulic Brake Master Cylinder Reservoir

> Contains a 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 two 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 on non-ABS equipped vehicles, is achieved through a proportioning valve assembly. Pressure balance control on ABS equipped vehicles, is achieved through electronic brake distribution (EBD), 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.

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 brake linings against rotating brake system components.

cardiagn.com

Diagnostic Information and Procedures

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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:
3.
    - Brake Warning System Description and Operation
    - Hydraulic Brake System Description and Operation
    - Brake Assist System Description and Operation

Visual/Physical Inspection

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

Intermittent

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

Symptom List

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

- Brake Warning Indicator 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

cardiagn.com

1. BRAKES
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Fault Information

Circuit	Short to Ground	Open/High Resistance	Short to Voltage
Brake Booster Pump Relay B+	1	1	â€”
Brake Booster Pump Motor B+	1	1	2
Brake Booster Vacuum Switch Ignition	1	1	â€”
Brake Booster Pump Relay Coil Control	1	1	2
Brake Booster Pump Motor Ground	â€”	1	â€”
Brake Booster Pump Relay Ground	â€”	1	â€”
1. Brake Booster Pump Always Off 2. Brake Booster Pump Always On			

Circuit/System Description

The brake booster vacuum switch monitors the amount of vacuum available to the power brake booster. When the vacuum within the system drops, the switch within the brake booster vacuum switch closes allowing voltage to be supplied to the brake booster pump motor.

Reference Information

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

Component Connector End Views

Description and Operation

Brake Booster Vacuum Assist Description and Operation

Electrical Information Reference

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

Circuit/System Verification

Verify that a vacuum leak is not present within the power brake booster system, refer to Brake Assist System Diagnosis.

Circuit/System Testing

1. Check the F20DA fuse on the X51A instrument panel fuse block if it is normal.
2.

cardiagn.com

- If it is blown, replace the fuse.

3. Check the F9UA fuse on the X50A underhood fuse block if it is normal.
4.
   - If it is blown, replace the fuse.
5. Check the KR14 brake booster pump motor relay on the X50A underhood fuse block if it is normal.
6.
   - If it is inoperative, replace the relay.
7. Ignition OFF, disconnect the harness connector at the B19C brake booster vacuum switch.
8. Ignition ON, verify that a test lamp illuminates between the brake booster vacuum switch ignition circuit terminal 1 and ground.
9.
   - If the test lamp does not illuminate, test the brake booster vacuum switch ignition circuit for a short to ground or an open/high resistance.
10. Ignition Off, test for less than 1â€‰ohm between the terminal 2 of the B19C brake booster vacuum switch and the terminal 85 of the KR14 brake booster pump motor relay.
11.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
12. Test for less than 10â€‰ohm between the ground circuit terminal 86 of the brake booster pump motor relay and ground.
13.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
14. Ignition ON, with the power vacuum brake booster vacuum reserve depleted, check if the KR14 brake booster pump motor relay is activated.
15.
    - If the KR14 brake booster pump motor relay is not active, replace the B19C brake booster vacuum switch.
16. Ignition OFF, disconnect the harness connector at the M9 brake booster pump motor.
17. Test for less than 10â€‰ohm between the ground circuit terminal 2 and ground.
18.
    - If greater than the specified range, test the ground circuit for an open/high resistance.
19. With ignition ON and the power vacuum brake booster vacuum reserve depleted, verify that a test lamp illuminates between the B+ circuit terminal 1 and ground.
20.
    - If the test lamp does not illuminate, test the B+ circuit for a short to ground or an open/high resistance.
21. If all circuits test normal, test or replace the M9 brake booster pump motor.

Component Testing

1. Ignition OFF, disconnect the harness connector at the M9 brake booster pump motor.
2. Connect a 30A fused jumper wire between the B+ terminal 1 and B+.
3. Connect a jumper wire between the ground terminal 2 and ground, verify the M9 brake booster pump motor activates.
4.
   - If the M9 brake booster pump motor does not activate, replace the M9 brake booster pump motor.

cardiagn.com

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

- Power Brake Booster Vacuum Switch Replacement
- Power Brake Booster Pump Replacement

cardiagn.com

1. BRAKES
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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.

Circuit/System Description

While the ignition switch is turned to the ON position, the battery voltage is provided to the brake warning indicator on the instrument panel cluster (IPC). When the brake fluid level indicator switch is grounded as the brake fluid level is too low, or when the park brake is applied and the park brake switch is grounded, the Red Brake Warning Indicator is illuminated.

Reference Information

Schematic Reference

Hydraulic Brake Schematics

Connector End View Reference

Component Connector End Views

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

Circuit/System Verification

Verify the park brake is released and the brake fluid is at or above the proper level.

- If low, refer to Brake Fluid Loss.

Circuit/System Testing

Park Brake Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the park brake switch.
2. Engine running, verify the brake warning indicator on the IPC is illuminated.
3.
    - If illuminated, test the circuit between the terminalâ€‰A of the park brake switch connector and the terminalâ€‰X2-2 of the IPC connector for a short to ground. If the circuit tests normal, inspect the IPC.
4. Install a 3Aâ€‰fused jumper wire between the terminalâ€‰A of the park brake switch connector and ground. Verify the brake warning indicator on the IPC is illuminated.
5.
    - If not illuminated, test the circuit between the terminalâ€‰A of the park brake switch connector and the terminalâ€‰X2-2 of the

cardiagn.com

If not illuminated, test the circuit between the terminalâ€‰1 of the park brake switch connector and the terminalâ€‰X2-2 of the IPC connector for an open or high resistance. If the circuit tests normal, inspect the IPC.

6. If all circuits test normal, test or replace the park brake switch.

Brake Fluid Level Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the brake fluid level switch.
2. Test for less than 1â€‰ohm between the ground circuit terminalâ€‰2 and ground.
3.
   - If greater than the specified range, test the ground circuit for an open/high resistance.
4. Engine running, with the park brake released, verify the brake warning indicator on the IPC is illuminated.
5.
   - If illuminated, test the circuit between the terminalâ€‰1 of the brake fluid level switch connector and the terminalâ€‰X2-2 of the IPC connector for a short to ground. If the circuit tests normal, inspect the IPC.
6. Install a 3Aâ€‰fused jumper wire between the terminalâ€‰1 of the brake fluid level switch and ground. Verify the brake warning indicator on the IPC is illuminated.
7.
   - If not illuminated, test the circuit between the terminalâ€‰1 of the brake fluid level switch connector and the terminalâ€‰X2-2 of the IPC connector for an open or high resistance. If the circuit tests normal, inspect the IPC.
8. If all circuits test normal, test or replace the brake fluid level switch.

Component Testing

Park Brake Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the park brake switch.
2. Test for infinite resistance between the terminalâ€‰A of the park brake switch and ground with the park brake released.
3.
   - If less than the specified value, replace the park brake switch.
4. Test for less than 1â€‰ohm between the terminal A of the park brake switch and ground with the park brake applied.
5.
   - If greater than the specified range, replace the park brake switch.

Brake Fluid Level Switch Malfunction

1. Ignition OFF, disconnect the harness connector at the brake fluid level switch.
2. Test for infinite resistance between the terminalâ€‰1 andâ€‰2 of the brake fluid level switch.
3.
   - If less than the specified value, replace the brake fluid switch.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

Brake Fluid Level Indicator Switch Replacement

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the disc brake system for the following conditions: 2. ◦ Excessive thickness variation of rotor friction surfaces ◦ Excessive assembled lateral runout (LRO) of rotor friction surfaces ◦ Hard spots, heat checks, blueing discoloration of rotor friction surfaces; possibly due to brake drag ◦ Excessive corrosion of rotor friction surfaces; including red, gray or black oxidation ◦ Loose, damaged or missing caliper or lining hardware ◦ Bent of damaged caliper or mounting component ◦ Excessive LRO of wheel hub/axle flange; due to damage and/or loose or excessively worn bearings 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰4	Go to Stepâ€‰3
3	1. Inspect the drum brake system for the following conditions: 2. ◦ Out of round or damaged drum ◦ Excessive radial runout of drum friction surface ◦ Hard spots, heat checks, blueing discoloration of drum friction surface; possibly due to brake drag ◦ Bent of damaged drum ◦ Excessive radial runout of wheel hub/axle flange; due to damage and/or loose or excessively worn bearings 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰4	Go to Symptoms - Hydraulic Brakes
4	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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the disc brake system for the following conditions: 2. ○ Lining wear indicator contact with rotor ○ Debris trapped between rotor and splash shield or backing plate; and/or debris trapped between rotor and linings ○ Contaminated linings ○ Aftermarket linings ○ Glazed linings ○ Distorted, cracked or damaged linings ○ Excessively worn linings ○ Damaged or excessively worn caliper hardware and/or lining hardware ○ Incorrectly installed, loose or missing caliper hardware and/or lining hardware ○ Lack of lubrication or excessive corrosion on metal to metal contact surfaces ○ Bent or damaged splash shield or backing plate ○ Hard spots, heat checks, blueing discoloration of rotor friction surfaces ○ Glazed rotor friction surfaces ○ Bent or damaged caliper or mounting component 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰10	Go to Stepâ€‰3

cardiagn.com

Step	Action	Yes	No
3	1. Inspect the drum brake system for the following conditions: 2. ◦ Glazed linings ◦ Contaminated linings ◦ Aftermarket linings ◦ Distorted, damaged or excessively worn linings ◦ Improper adjustment ◦ Weak or damaged return spring or springs ◦ Weak or damaged hold down spring or springs ◦ Cracked, scored, excessively worn or damaged drum ◦ Out of round or damaged drum ◦ Hard spots, heat checks, blueing discoloration of drum friction surface ◦ Threaded or spiral grooves in drum friction surface ◦ Distorted or damaged backing plate ◦ Lack of lubrication on backing plate ◦ Excessive dust or foreign matter in drum 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰10	Go to Stepâ€‰4
4	1. Inspect the brake assist system for the following conditions: 2. ◦ Lack of lubrication or excessively worn pushrod or pedal pivots or pivot bushings ◦ Bent or damaged pedal pushrod, pedal, or pedal bracket ◦ Damaged or improperly operating vacuum booster and/or check valve, if equipped ◦ Low power steering fluid level, if equipped with hydraulic boost ◦ Improperly tensioned, excessively worn or damaged power steering belt, if equipped with hydraulic boost ◦ Restricted return hose from hydraulic booster, if equipped ◦ Improperly operating hydraulic booster, if equipped ◦ Improperly functioning power steering system, if equipped with a hydraulic booster assembly ◦ Contaminated power steering fluid, if equipped with hydraulic boost 3. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰10	Go to Stepâ€‰5

cardiagn.com

Step	Action	Yes	No
5	1. Inspect the hydraulic brake system for the following conditions. 2. ◦ Improper operation of wheel cylinder pistons, if equipped ◦ Improper operation of caliper pistons ◦ Contaminated brake fluid 3. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰10	Go to Stepâ€‰6
6	Is the vehicle equipped with a drum-in-rotor type of park brake system?	Go to Stepâ€‰7	Go to Stepâ€‰9
7	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 Stepâ€‰8	Go to Stepâ€‰9
8	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 Stepâ€‰10	Go to Stepâ€‰9
9	Inspect the park brake system for proper operation. Refer to Park Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰10	Go to Symptoms - Hydraulic Brakes
10	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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Braking Action Uneven - Pulls to One Side

Test Description

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

5. Suspension components that are not operating properly may cause a disturbance to the vehicle during application of the brake system.
6. Steering components that are not operating correctly 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.			
1	Were you sent here from the Hydraulic Brake Symptom table?	Go to Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the hydraulic brake system for the following conditions: 2. ◦ Kinked, pinched or damaged brake pipe or flexible brake hose ◦ Sticking or improperly operating caliper piston ◦ Sticking or improperly operating wheel cylinder pistons ◦ Brake fluid leak 3. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰3
3	1. Inspect the disc brake system for the following conditions: 2. ◦ Contaminated linings ◦ Glazed linings ◦ Distorted, cracked or damaged linings on one side ◦ Loose, damaged or missing caliper hardware and/or lining hardware ◦ Incorrect linings on one side ◦ Hard spots, heat checks, blueing discoloration of rotor friction surfaces; possibly due to brake drag ◦ Glazed rotor friction surfaces ◦ Bent or damaged caliper or mounting component 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰4

cardiagn.com

Step	Action	Yes	No
4	1. Inspect the drum brake system for the following conditions: 2. ◦ Improper adjustment or improper adjuster operation ◦ Weak or damaged return spring or springs ◦ Glazed linings ◦ Contaminated linings ◦ Distorted or damaged linings ◦ Incorrect linings on one side ◦ Excessively worn or damaged drum on one side 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰5
5	1. Inspect the suspension system for the following conditions: 2. ◦ Incorrect tire pressure ◦ Loose suspension component connections ◦ Excessively worn or damaged suspension components 3. Adjust, repair or replace components as necessary. 4. Refer to Symptoms - Suspension General Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰6
6	1. Inspect the steering system for the following conditions: 2. ◦ Loose steering component connections ◦ Excessively worn or damaged steering components 3. Adjust, repair or replace components as necessary. Refer to Symptoms - Power Steering System. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Symptoms - Hydraulic Brakes
7	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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Braking Action Uneven - Front to Rear

Test Description

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

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

cardiagn.com

Step	Action	Yes	No
4	1. Inspect the drum brake system for the following conditions. 2. ◦ Contaminated linings ◦ Improper adjustment ◦ Excessively worn or damaged linings ◦ Weak or damaged return spring or springs ◦ Excessively worn or damaged drums ◦ Hard spots, heat checks, blueing discoloration of drum friction surface ◦ Distorted or damaged backing plate 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰5
5	1. Inspect the suspension system for the following conditions: 2. ◦ Loose suspension component connections ◦ Excessively worn or damaged suspension components 3. Adjust, repair or replace components as necessary. 4. Refer to Symptoms - Suspension General Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰6
6	1. Inspect the brake assist system for the following conditions: 2. ◦ Binding, bent or damaged pedal pushrod, pedal, or pedal bracket ◦ Damaged or improperly operating vacuum booster, if equipped ◦ Damaged or improperly operating hydraulic booster, if equipped 3. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰7	Go to Symptoms - Hydraulic Brakes
7	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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
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 15â€‰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 Stepâ€‰3	â€”
3	1. Inspect the hydraulic brake system for the conditions listed, based on the following symptoms observed during the pedal travel and feel inspections. 2. ◦ Pedal feel was spongy. Other List:table-list3 ◦ Pedal fell away and/or traveled to or almost to floor. Other List:table-list3 ◦ Pedal was somewhat firm then dropped slightly, or pedal rose with successive applies, or pedal travel was different between slow and quick applies. Other List:table-list3 ◦ Pedal returned to rest slowly after any of the applies. Other List:table-list3 3. Repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. 4. Re-inspect brake pedal apply travel and feel. Did you find and correct a condition?	Go to Stepâ€‰9	Go to Stepâ€‰4

cardiagn.com

Step	Action	Yes	No
4	1. Inspect the drum brake system, if equipped, for the following conditions: 2. ◦ Improper adjustment or improper adjuster operation ◦ Glazed or excessively worn linings ◦ Cracked, distorted or damaged linings ◦ Cracked, excessively worn, distorted or damaged drums ◦ Bell-mouth or barrel-shaped drum friction surface ◦ Hard spots, heat checks, blueing discoloration of drum friction surface 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. 4. Re-inspect brake pedal apply travel and feel. Did you find and correct a condition?	Go to Stepâ€‰9	Go to Stepâ€‰5
5	1. Inspect the disc brake system for the following conditions: 2. ◦ Cracked, excessively worn or damaged linings ◦ Cracked, excessively worn or damaged rotors ◦ Improperly operating, binding or damaged caliper hardware and/or lining hardware ◦ Loose or missing caliper hardware and/or lining hardware ◦ Excessive assembled lateral runout (LRO) of rotor friction surfaces ◦ Bent or damaged caliper or mounting component 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. 4. Re-inspect brake pedal apply travel and feel. Did you find and correct a condition?	Go to Stepâ€‰9	Go to Stepâ€‰6
6	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 Stepâ€‰8	Go to Stepâ€‰7
7	1. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components. 2. ◦ For the brake pedal pushrod component inspection, refer to Brake Pedal Pushrod Inspection. ◦ 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. 3. 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 Stepâ€‰9	Go to Stepâ€‰8

cardiagn.com

Step	Action	Yes	No
8	1. Inspect the brake assist system for the following conditions: 2. ◦ Vacuum leaks and/or improperly operating check valve, if equipped with vacuum assist ◦ Power steering fluid leaks, if equipped with hydraulic power assist ◦ Damaged or improperly operating brake booster assembly 3. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰9	Go to Symptoms - Hydraulic Brakes
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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the brake assist system for the following conditions: 2. ◦ Vacuum leaks, if equipped with vacuum power assist ◦ Power steering fluid leaks, if equipped with hydraulic power assist ◦ Lack of lubrication, binding or excessively worn pushrod or pedal pivots or pivot bushings ◦ Bent or damaged pedal pushrod, pedal, or pedal bracket ◦ Damaged or improperly operating brake booster assembly 3. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰3
3	1. Inspect the hydraulic brake system for the following conditions: 2. ◦ Binding caliper pistons ◦ Binding wheel cylinder pistons, if equipped ◦ Internally damaged flexible brake hoses; hindering fluid flow ◦ External brake fluid leaks ◦ Kinked or damaged flexible brake hoses and/or pipes ◦ Internal brake fluid leaks; improperly operating master cylinder ◦ Poor brake fluid quality; low boiling point 3. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰4

cardiagn.com

Step	Action	Yes	No
4	1. Inspect the disc brake system for the following conditions: 2. ◦ Excessively worn linings ◦ Glazed linings ◦ Cracked, distorted or damaged linings ◦ Contaminated linings ◦ Binding, damaged or excessively worn caliper hardware and/or lining hardware ◦ Lack of lubrication or excessive corrosion on metal to metal contact surfaces ◦ Excessively worn or corroded rotor friction surfaces ◦ Glazed rotor friction surfaces ◦ Hard spots, heat checks, blueing discoloration of rotor friction surfaces 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰5
5	1. Inspect the drum brake system, if equipped, for the following conditions: 2. ◦ Excessively worn linings ◦ Improper adjustment or improper adjuster operation ◦ Glazed linings ◦ Cracked, distorted or damaged linings ◦ Contaminated linings ◦ Out of round or damaged drum ◦ Bell-mouth or barrel-shaped drum friction surface ◦ Hard spots, heat checks, blueing discoloration of drum friction surface ◦ Lack of lubrication on backing plate ◦ Excessive dust or foreign matter in drum 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Symptoms - Hydraulic Brakes
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 Stepâ€‰2	System OK

Related Part Information

Part Name	Catalog Name	Part Code
Brake Pedal	PEDAL,BRK(W/BRKT)	0045A
Brake Pedal	PEDAL PKG,BRK	0049Z
Brake Pedal	PEDAL,BRK	0050A
Brake Pedal	PEDAL,BRK	0050B

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	Is the vehicle equipped with an adjustable stop lamp switch and/or an adjustable cruise control release switch?	Go to Stepâ€‰3	Go to Stepâ€‰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 Stepâ€‰15	Go to Stepâ€‰4
4	Is the vehicle equipped with a drum-in-rotor type of park brake system?	Go to Stepâ€‰5	Go to Stepâ€‰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 Stepâ€‰6	Go to Stepâ€‰8
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 Stepâ€‰15	Go to Stepâ€‰8
7	1. Inspect the drum brake system, if equipped, for the following conditions: 2. ◦ Improper adjustment ◦ Weak or damaged return spring or springs ◦ Distorted or damaged linings ◦ Out of round or damaged drum ◦ Weak or damaged hold down spring or springs ◦ Lack of lubrication on backing plate ◦ Distorted or damaged backing plate 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰15	Go to Stepâ€‰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 Stepâ€‰15	Go to Stepâ€‰9

cardiagn.com

Step	Action	Yes	No
9	1. Inspect the disc brake system for the following conditions: 2. ◦ Binding, incorrectly installed or missing caliper hardware and/or lining hardwareâ€”Ensure free movement of linings and of caliper, if equipped with sliding type caliper. ◦ Lack of lubrication or excessive corrosion on metal to metal contact surfaces ◦ Distorted or damaged linings ◦ Damaged or excessively worn caliper hardware and/or lining hardware ◦ Bent or damaged caliper or mounting component 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰15	Go to Stepâ€‰10
10	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 Stepâ€‰12	Go to Stepâ€‰11
11	1. Inspect the pushrod for improper position 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 Stepâ€‰15	â€”
12	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 Stepâ€‰14	Go to Stepâ€‰13
13	Replace the brake booster assembly. Did you complete the replacement?	Go to Stepâ€‰15	â€”
14	1. Inspect the hydraulic brake system for the following conditions: 2. ◦ Improper operation of wheel cylinder pistons, if equipped ◦ Improper operation of caliper pistons ◦ Contaminated brake fluid ◦ Internally damaged flexible brake hoses; hindering brake release ◦ Damaged or improperly operating master cylinder 3. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰15	Go to Symptoms - Hydraulic Brakes
15	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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the hydraulic brake system for the following conditions: 2. ◦ Improper operation of wheel cylinder pistons, if equipped ◦ Improper operation of caliper pistons ◦ Internally damaged flexible brake hoses; hindering brake release ◦ Contaminated brake fluid ◦ Damaged or improperly operating master cylinder 3. Adjust, repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰3
3	1. Inspect the brake assist system for the following conditions: 2. ◦ Binding, bent or damaged pedal pushrod, pedal, or pedal bracket ◦ Damaged or improperly operating vacuum booster, if equipped ◦ Restricted return hose from hydraulic booster, if equipped ◦ Damaged or improperly operating hydraulic booster, if equipped 3. Adjust, repair or replace components as necessary. Refer to Brake Assist System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰4
4	1. Inspect the drum brake system, if equipped, for the following conditions: 2. ◦ Weak or damaged return spring or springs ◦ Distorted or damaged linings ◦ Out of round or damaged drum ◦ Lack of lubrication on backing plate ◦ Distorted or damaged backing plate 3. Adjust, repair or replace components as necessary. Refer to Drum Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Stepâ€‰5

cardiagn.com

Step	Action	Yes	No
5	1. Inspect the disc brake system for the following conditions: 2. ◦ Damaged or excessively worn caliper hardware and/or lining hardware ◦ Distorted or damaged linings ◦ Lack of lubrication or excessive corrosion on metal to metal contact surfaces ◦ Bent or damaged caliper or mounting component 3. Adjust, repair or replace components as necessary. Refer to Disc Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰6	Go to Symptoms - Hydraulic Brakes
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 Stepâ€‰2	System OK

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Inspect the following hydraulic brake system components for brake fluid leaks: 2. ○ Flexible brake hose connections; threaded and bolted ○ Flexible brake hose crimping joints ○ Brake pipe fittings ○ Caliper piston seals ○ Wheel cylinder piston seals, if equipped ○ Master cylinder reservoir ○ Master cylinder reservoir low pressure hose, if equipped ○ Brake pressure modulator valve (BPMV) assembly, if equipped 3. Repair or replace components as necessary. Refer to Hydraulic Brake System Diagnosis. Did you find and correct a condition?	Go to Stepâ€‰5	Go to Stepâ€‰3
3	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 the brake fluid leak?	Go to Stepâ€‰4	Go to Symptoms - Hydraulic Brakes
4	Replace the brake master cylinder and the vacuum brake booster. Did you complete the replacement?	Go to Stepâ€‰5	â€”
5	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 Stepâ€‰2	System OK

Related Part Information

Part Name	Catalog Name	Part Code
Brake Fluid	FLUID,BRAKE SJ006	

cardiagn.com

1. BRAKES
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 correctly. 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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	Visually inspect the disc brake pads for the following conditions: Refer to Brake Pad Inspection. • Lining thickness below specifications • Uneven and/or abnormal wear â€“ edge-to-edge and/or side-to-side • Looseness or damage â€“ including brake 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 Stepâ€‰3	Go to Stepâ€‰12
3	Are any of the front disc brake pads contaminated?	Go to Stepâ€‰8	Go to Stepâ€‰4
4	Are any of the front disc brake pads worn unevenly?	Go to Stepâ€‰7	Go to Stepâ€‰5
5	Are any of the front disc brake pads and/or brake pad hardware loose or damaged?	Go to Stepâ€‰7	Go to Stepâ€‰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. Did you complete the inspection and replacement?	Go to Stepâ€‰12	â€”

cardiagn.com

Step	Action	Yes	No
7	1. 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. 2. Note: Do NOT disconnect the hydraulic brake flex hoses from the calipers. 3. Remove the front brake caliper, as appropriate, from the mounting bracket and support the brake caliper. Refer to Front Brake Caliper Replacement. 4. Inspect the disc brake caliper mounting bracket and the mounting/sliding hardware for the following conditions: 5. - Binding or seized hardware - Worn, damaged or missing hardware components - Loose, bent, cracked, or damaged brake caliper mounting bracket 6. Replace components as required. Refer to Front Brake Caliper Bracket Replacement 7. Replace the unevenly-worn, loose or damaged disc brake pads as a complete axle set. Refer to Front Disc Brake Pads Replacement. Did you complete the inspection and replacement?	Go to Stepâ€‰12	â€”
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: 3. - Front Brake Caliper Overhaul - Front Brake Caliper Replacement - Front Brake Hose Replacement - Brake Pipe Replacement Did you find and correct the source of the leak causing contamination of the brake pads?	Go to Stepâ€‰11	Go to Stepâ€‰9
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 brake pads. Refer to Front Wheel Drive Shaft Outer Joint Replacement. Did you find and correct the source of the leak causing contamination of the brake pads?	Go to Stepâ€‰11	Go to Stepâ€‰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. Replace any components found to be leaking 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 Stepâ€‰11	â€”

cardiagn.com

Step	Action	Yes	No
11	1. Clean the remaining disc brake system components to remove any traces of the contaminant. 2. 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. 3. Note: Do NOT disconnect the hydraulic brake flex hoses from the calipers. 4. Remove the front disc brake caliper from the brake caliper mounting bracket and support the brake caliper. Refer to Front Brake Caliper Replacement. 5. Inspect the disc brake caliper mounting/sliding hardware for the following conditions: 6. Refer to Front Disc Brake Mounting and Hardware Inspection. 7. ◦ Binding or seized hardware ◦ Distorted, worn, damaged or missing hardware components 8. Replace the brake mounting/sliding hardware components as required. Refer to Front Disc Brake Mounting and Hardware Inspection. 9. Replace the contaminated brake pads as a complete axle set. Refer to Front Disc Brake Pads Replacement. Did you complete the cleaning, inspection and replacement?	Go to Stepâ€‰12	â€”
12	1. Check the thickness of each of the disc brake rotors. 2. Note: Make the following determination and answer the question individually for EACH rotor. 3. Make a determination for each brake rotor if the brake rotor can be REFINISHED and REMAIN ABOVE the minimum requirements. Refer to Brake Rotor Thickness Measurement. Does the brake rotor meet the minimum requirements for REFINISHING?	Go to Stepâ€‰13	Go to Stepâ€‰16
13	Note: Make the following determination and answer the question individually for EACH rotor. Inspect each of the 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 Stepâ€‰15	Go to Stepâ€‰14

cardiagn.com

Step	Action	Yes	No
14	1. Inspect each of the brake rotors for the following surface and wear conditions: 2. Refer to Brake Rotor Surface and Wear Inspection. 3. ◦ Heavy rust and/or pitting ◦ Cracks and/or heat spots ◦ Excessive blueing discoloration ◦ Deep or excessive scoring beyond maximum acceptable level 4. Note: Make the following determination and answer the question individually for EACH rotor. 5. Make a determination for each brake rotor if the brake rotor requires refinishing based upon the results of the inspection. 6. If the brake rotor exhibits any of the conditions listed previously, it requires refinishing. Does the brake rotor require REFINISHING?	Go to Stepâ€‰15	Go to Stepâ€‰20
15	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 Stepâ€‰20	Go to Stepâ€‰19
16	Is the brake disc at or below the DISCARD requirements?	Go to Stepâ€‰19	Go to Stepâ€‰17
17	Note: Make the following determination and answer the question individually for EACH rotor. Inspect each of the 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 Stepâ€‰19	Go to Stepâ€‰18
18	1. Inspect each of the brake rotors for the following surface and wear conditions: 2. Refer to Brake Rotor Surface and Wear Inspection. 3. ◦ Heavy rust and/or pitting ◦ Cracks and/or heat spots ◦ Excessive blueing discoloration ◦ Deep or excessive scoring beyond maximum acceptable level 4. Note: Make the following determination and answer the question individually for EACH rotor. 5. Make a determination for each brake rotor if the rotor requires replacement based upon the results of the inspection. 6. If the brake rotor exhibits any of the conditions listed previously, it requires replacement. Does the brake rotor require REPLACEMENT?	Go to Stepâ€‰19	Go to Stepâ€‰20

cardiagn.com

Step	Action	Yes	No
19	Note: Whenever a brake rotor is replaced, the assembled lateral runout (LRO) of the brake rotor must be measured to ensure optimum performance of the disc brakes. Replace the brake rotor. Refer to Front Brake Rotor Replacement. Did you complete the replacement?	Go to Stepâ€‰22	â€”
20	Note: Make the following determination and answer the question individually for EACH rotor. Inspect each of the 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?	Go to Stepâ€‰21	Go to Stepâ€‰22
21	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 Stepâ€‰22	â€”
22	Install or connect components that were removed or disconnected during diagnosis. Did you complete the operation?	Disc Brake System OK Return to Symptom Table	â€”

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Drum Brake System Diagnosis

Test Description

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

18. Drum brake backing plates that come in contact with brake drums may cause brake system noise.

Step	Action	Yes	No
DEFINITION: This diagnostic table is designed to diagnose ONLY the components of the DRUM brake system in order to determine if the DRUM 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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	1. Remove the brake drums. Refer to Brake Drum Replacement. 2. Inspect the drum brake shoes for the following conditions: 3. ◦ Lining thickness below specifications ◦ Uneven and/or abnormal wear â€“ edge-to-edge and/or side-to-side ◦ Looseness, damage, glazing, or incorrect lining material Did you find any conditions to indicate a concern with any of the drum brake shoes?	Go to Stepâ€‰3	Go to Stepâ€‰7
3	Are any of the brake shoes contaminated?	Go to Stepâ€‰4	Go to Stepâ€‰5
4	1. Inspect the wheel cylinders for evidence of an external brake fluid leak. 2. Replace any wheel cylinder that is found to be leaking brake fluid. Refer to Rear Brake Cylinder Replacement. Did you complete the inspection and replacement?	Go to Stepâ€‰6	â€”
5	1. Inspect the drum brake hardware for any components which are worn, damaged, discolored due to stress, broken or missing. Refer to Drum Brake Hardware Inspection. 2. Replace components as required. Refer to Drum Brake Hardware Replacement. 3. Replace the drum brake shoes. Refer to Brake Shoe Replacement. Did you complete the inspection and replacement?	Go to Stepâ€‰8	â€”
6	1. Clean the remaining drum brake system components to remove any traces of the contaminants. 2. Inspect the drum brake hardware for any components which are worn, damaged, discolored due to stress, broken or missing. Refer to Drum Brake Hardware Inspection. 3. Replace the drum brake hardware components as required. Refer to Drum Brake Hardware Replacement. 4. Replace the contaminated brake shoes. Refer to Brake Shoe Replacement. Did you complete the cleaning, inspection and replacement?	Go to Stepâ€‰8	â€”
7	1. Inspect the drum brake hardware for any components which are worn, damaged, discolored due to stress, broken or missing. Refer to Drum Brake Hardware Inspection. 2. Replace components as required. Refer to Drum Brake Hardware Replacement. Did you complete the inspection and, if necessary, the replacement?	Go to Stepâ€‰8	â€”

cardiagn.com

Step	Action	Yes	No
8	1. Check the diameter of each of the brake drums. 2. Note: Make the following determination and answer the question individually for EACH rotor. 3. Make a determination for each brake drum if the drum can be REFINISHED and REMAIN ABOVE the minimum requirements. Refer to Brake Drum Diameter Measurement. Does the brake drum meet the minimum requirements for REFINISHING?	Go to Stepâ€‰9	Go to Stepâ€‰11
9	1. Inspect each of the brake drums for the following surface and wear conditions: 2. Refer to Brake Drum Surface and Wear Inspection. 3. ◦ Braking surface conditions Other List:table-list3 ◦ Braking surface wear conditions Other List:table-list3 4. Note: Make the following determination and answer the question individually for EACH rotor. 5. Make a determination for each brake drum if the drum requires refinishing based upon the results of the inspection. 6. If the brake drum exhibits any of the following conditions, it requires refinishing: 7. ◦ Drum exhibits one or more of the braking surface conditions listed previously. ◦ Drum is beyond the acceptable level in one or more of the braking surface wear conditions listed previously Does the brake drum require REFINISHING?	Go to Stepâ€‰10	Go to Stepâ€‰14
10	1. Refinish the brake drum. Refer to Brake Drum Refinishing. 2. Inspect the brake drum diameter. Refer to Brake Drum Diameter Measurement. Were you able to REFINISH the brake drum within the minimum requirements?	Go to Stepâ€‰14	Go to Stepâ€‰13
11	Is the brake drum at or below the DISCARD requirements?	Go to Stepâ€‰13	Go to Stepâ€‰12

cardiagn.com

Step	Action	Yes	No
12	1. Inspect each of the brake drums for the following surface and wear conditions: 2. Refer to Brake Drum Surface and Wear Inspection. 3. ◦ Braking surface conditions Other List:table-list3 ◦ Braking surface wear conditions Other List:table-list3 4. Note: Make the following determination and answer the question individually for EACH rotor. 5. Make a determination for each brake drum if the drum requires replacement based upon the results of the inspection. 6. If a brake drum exhibits any of the following conditions, it requires replacement: 7. ◦ Drum exhibits one or more of the braking surface conditions listed previously ◦ Drum is beyond the acceptable level in one or more of the braking surface wear conditions listed previously Does the brake drum require REPLACEMENT?	Go to Stepâ€‰13	Go to Stepâ€‰14
13	Replace the brake drum. Refer to Brake Drum Replacement. Did you complete the replacement?	Go to Stepâ€‰14	â€”
14	Inspect the brake shoes for proper adjustment. Refer to Drum Brake Adjustment. Are the brake shoes adjusted properly?	Go to Stepâ€‰18	Go to Stepâ€‰15
15	Inspect the components of the brake drum adjustment hardware system for free movement and correct operation. Refer to Drum Brake Adjusting Hardware Inspection. Do the drum brake adjusting hardware components operate freely and correctly?	Go to Stepâ€‰17	Go to Stepâ€‰16
16	Replace the drum brake adjusting hardware components as necessary. Refer to Drum Brake Adjusting Hardware Replacement. Is the replacement complete?	Go to Stepâ€‰17	â€”
17	Adjust the drum brake shoes. Refer to Drum Brake Adjustment. Were you able to complete the adjustment?	Go to Stepâ€‰20	Return to Symptom Table
18	Inspect the drum brake backing plate for the following: • Excessive wear or rust • Damage and/or evidence of contact with the brake drum Does the drum brake backing plate exhibit any of these conditions?	Go to Stepâ€‰19	Go to Stepâ€‰20
19	Repair or replace the drum brake backing plate as necessary. Refer to Rear Brake Backing Plate Replacement. Did you complete the repair or replacement?	Go to Stepâ€‰20	â€”
20	Install or connect components that were removed or disconnected during diagnosis. Did you complete the operation?	Drum Brake System OK Return to Symptom Table	â€”

carlagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰2	Go to Symptoms - Hydraulic Brakes
2	Inspect and adjust the brake fluid level in the brake master cylinder. Refer to Brake Master Cylinder Reservoir Filling. Was the brake fluid level low?	Go to Stepâ€‰3	Go to Stepâ€‰4
3	1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination: 2. ◦ Fluid separation, indicating two types of fluid are present Other List:table-list3 ◦ Fluid discoloration Other List:table-list3 3. 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 Stepâ€‰5	Go to Stepâ€‰6
4	1. Inspect the brake fluid for the following conditions, indicating brake fluid contamination: 2. ◦ Fluid separation, indicating two types of fluid are present Other List:table-list3 ◦ Fluid discoloration Other List:table-list3 3. 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 Stepâ€‰5	Go to Stepâ€‰12

cardiagn.com

Step	Action	Yes	No
5	1. Flush the hydraulic brake system. Refer to 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. Refer to the procedures indicated. 3. 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 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. Other List:table-list3 4. 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. 5. Refill and bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding. Did you complete the operation and any required repairs and/or replacements?	Go to Stepâ€‰9	â€”
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. Refer to the appropriate procedures: 2. ◦ Brake master cylinder reservoir cap diaphragm ◦ Brake Master Cylinder Replacement ◦ Front Brake Hose Replacement ◦ Rear Brake Hose Replacement ◦ Brake Pipe Replacement ◦ Front Brake Caliper Overhaul ◦ Front Brake Caliper Replacement ◦ Brake Proportion Valve Replacement , if equipped ◦ Brake Pressure Modulator Valve Replacement , if equipped 3. If you repaired or replaced any of the brake system components listed, bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding. While bleeding the hydraulic brake system, observe for the following conditions: 4. ◦ The presence of air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder, and/or the proportioning valve assembly, was replaced ◦ An unrestricted and even flow of brake fluid per axle during the bleeding procedure Did you find and correct a condition?	Go to Stepâ€‰7	Go to Stepâ€‰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, and/or the proportioning valve assembly, was replaced?	Go to Stepâ€‰19	Go to Stepâ€‰8
8	Was the flow of brake fluid unrestricted and even per axle during the bleeding procedure?	Go to Stepâ€‰9	Go to Stepâ€‰10

cardiagn.com

Step	Action	Yes	No
9	Inspect the hydraulic function of the brake calipers and/or wheel cylinders, if equipped for proper operation. Refer to Hydraulic Brake Component Operation Visual Inspection. Was the hydraulic function of the brake calipers/wheel cylinders operating properly?	Go to Stepâ€‰21	Go to Stepâ€‰14
10	Was the flow of brake fluid restricted or uneven through front axle hydraulic components during the bleeding procedure?	Go to Stepâ€‰13	Go to Stepâ€‰11
11	Was the flow of brake fluid restricted or uneven through rear axle hydraulic components during the bleeding procedure?	Go to Stepâ€‰17	â€”
12	Inspect the hydraulic function of the brake calipers/wheel cylinders for proper operation. Refer to Hydraulic Brake Component Operation Visual Inspection. Was the hydraulic function of the brake calipers/wheel cylinders operating properly?	Go to Stepâ€‰15	Go to Stepâ€‰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. Refer to Lifting and Jacking the Vehicle. 2. Remove the tire and wheel assemblies. Refer to Tire and Wheel Removal and Installation. 3. Open the suspected brake caliper bleeder valve. 4. Using a large C-clamp, compress the brake caliper piston and observe for an unrestricted flow of brake fluid and for free movement of the brake caliper piston. 5. Close the caliper bleeder valve. Was the flow of brake fluid unrestricted and did the caliper piston move freely?	Go to Stepâ€‰17	Go to Stepâ€‰14
14	Repair or replace any brake caliper/wheel cylinder that was not operating properly. Refer to the appropriate procedure. • Front Brake Caliper Overhaul • Front Brake Caliper Replacement • Rear Brake Cylinder Replacement Did you complete the repair and/or replacement?	Go to Stepâ€‰21	â€”
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. Refer to Hydraulic Brake System Bleeding. Was there air in the system?	Go to Stepâ€‰19	Go to Stepâ€‰16
16	Was the flow of brake fluid unrestricted and even per axle during the bleeding procedure?	Go to Stepâ€‰21	Go to Stepâ€‰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. Refer to 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. Refer to the following procedures as necessary: 3. ◦ Front Brake Hose Replacement ◦ Rear Brake Hose Replacement 4. 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 Stepâ€‰21	Go to Stepâ€‰18
18	1. If equipped with non-ABS, replace the proportioning valve assembly. Refer to Brake Proportion Valve Replacement. 2. If equipped with ABS, replace the brake modulator assembly, in order to correct the hydraulic brake dynamic rear proportioning mechanical operation. Refer to Brake Pressure Modulator Valve Replacement. Did you complete the replacement?	Go to Stepâ€‰21	â€”

cardiagn.com

Step	Action	Yes	No
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 be installed incorrectly or seeping brake fluid. Did you find and correct a condition?	Go to Stepâ€‰21	Go to Stepâ€‰20
20	1. Inspect the brake master cylinder for internal fluid leaks. Refer to Brake System Internal Leak Test. 2. Repair or replace the brake master cylinder if it is found to be leaking brake fluid internally. Refer to Brake Master Cylinder Replacement. Did you find and correct a condition?	Go to Stepâ€‰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	â€”

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Stepâ€‰3	Go to Stepâ€‰2
2	Were you sent here directly from an electrical diagnostic to investigate vacuum as a possible concern?	Go to Stepâ€‰5	Symptoms - Hydraulic Brakes
3	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 Stepâ€‰5	Go to Stepâ€‰4
4	1. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components. 2. ◦ For the brake pedal pushrod component inspection, refer to Brake Pedal Pushrod Inspection. ◦ Inspect the brake pedal bushings for excessive wear and/or damage and inspect the brake pedal for a misaligned, bent and/or damaged condition. 3. 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 Stepâ€‰5	Go to Hydraulic Brake System Diagnosis
5	Check the engine vacuum source that supplies vacuum to the vacuum brake booster. Refer to Brake System Vacuum Source Test. Is the vacuum reading within the acceptable limits?	Go to Stepâ€‰6	Go to Engine Controls Diagnostics Information
6	Does the condition occur during cold start-up conditions?	Go to Stepâ€‰7	Go to Stepâ€‰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 Stepâ€‰22	Go to Stepâ€‰9
8	During the vacuum source test, did the vacuum booster check valve operate properly?	Go to Stepâ€‰10	Go to Stepâ€‰9
9	Replace the vacuum booster check valve. Refer to Power Brake Booster Vacuum Check Valve and Hose Replacement. Did you complete the replacement?	Go to Stepâ€‰10	â€”
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 Stepâ€‰11	Go to Stepâ€‰12
11	Replace the vacuum sensor grommet. Did you complete the replacement?	Go to Stepâ€‰12	â€”
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 Stepâ€‰13	Go to Stepâ€‰12

cardiagn.com

Step	Action	Yes	No
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 60â€‰seconds. 6. Note: Vacuum readings will decrease by approximately 2.7â€‰kPa (0.8â€‰inâ€‰Hg) for every 305â€‰m (1000â€‰ft) of elevation above seal level. 7. Determine the rate of vacuum leak. 8. Specification Maximum allowable vacuum leak rate: 10â€‰kPa (3â€‰inâ€‰Hg) in 60â€‰seconds Was the rate of vacuum leak within the specified allowable range?	Go to Stepâ€‰18	Go to Stepâ€‰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. Refer to Brake 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 brake booster. Refer to Brake Master Cylinder Replacement. Did you complete the operation?	Go to Stepâ€‰15	â€”
15	Perform the vacuum booster leak-down test using a scan tool: 1. Release the brake pedal. 2. Accelerate the engine to approximately 3000â€‰RPM, then release the throttle. Wait 2â€“3â€‰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 60â€‰seconds. 6. Note: Vacuum readings will decrease by approximately 2.7â€‰kPa (0.8â€‰inâ€‰Hg) for every 305â€‰m (1000â€‰ft) of elevation above seal level. 7. Determine the rate of vacuum leak. 8. Specification Maximum allowable vacuum leak rate: 10â€‰kPa (3â€‰inâ€‰Hg) in 60â€‰seconds Was the rate of vacuum leak within the specified allowable range?	Go to Stepâ€‰22	Go to Stepâ€‰21

cardiagn.com

Step	Action	Yes	No
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. Refer to Brake 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 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?	Go to Stepâ€‰17	Go to Stepâ€‰18
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 install the master cylinder to the brake booster. Refer to Brake Master Cylinder Replacement. Did you complete the replacement?	Go to Stepâ€‰18	â€”
18	Perform the vacuum booster functional test: 1. If still separated, reinstall the master cylinder to the booster. Refer to Brake Master Cylinder Replacement. 2. If the engine was started after reinstalling the master cylinder to the booster, perform the following: 3. ◦ With the engine OFF, depress the brake pedal several times to deplete the vacuum reserve. ◦ Depress and maintain moderate foot pressure on the brake pedal ◦ Start the engine and observe pedal operation. ◦ 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 Stepâ€‰21	Go to Stepâ€‰19
19	Did the brake pedal fall slightly after the engine was started, then hold?	Go to Stepâ€‰20	Go to Stepâ€‰21
20	Perform the vacuum booster leak-down test: 1. Release the brake pedal. 2. Accelerate the engine to approximately 3000â€‰RPM, then release the throttle. Wait 2â€“3â€‰seconds and repeat once. 3. Turn the ignition OFF. 4. Wait 60â€‰seconds. 5. Depress the brake pedal 2â€‰times to check for vacuum booster available vacuum reserve. Observe pedal effort. 6. ◦ Both pedal applies should be assisted. ◦ The amount of assist could diminish slightly with the second apply. Were both pedal applies power assisted?	Go to Stepâ€‰22	Go to Stepâ€‰21
21	Replace the vacuum brake booster. Refer to Power Vacuum Brake Booster Replacement. Did you complete the replacement?	Go to Stepâ€‰22	â€”

cardiagn.com

Step	Action	Yes	No
22	Install or connect the components that were removed or disconnected during diagnosis. Did you complete the operation?	Brake Assist System OK Return to Symptom Table	â€”

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 Brake 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.

Road Testing Procedure

1. 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.
2. Start the engine and allow it to idle.
3. Visually inspect if the brake warning indicator lamp remains illuminated.
4. 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.
5. 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.
6. With the transmission in PARK or Neutral, lightly apply the brake pedal. Observe both the pedal feel and the pedal travel.
7.
   - If the brake pedal apply felt spongy, or the pedal travel was excessive, DO NOT drive the vehicle until it is repaired.
   - If the brake pedal apply did not feel spongy and the pedal travel was excessive, proceed to stepâ€‰6.
8. Release and apply the brakes.
9. While continuing to apply the brakes, shift the transmission into DRIVE or 1st, 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.
    - If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to stepâ€‰9.
12. 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 the assistant.
13. 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.
14. Select a smooth, dry, clean and level road that is as free of heavy traffic as possible for brake system moderate speed road testing.

cardiagn.com

15. Drive the vehicle at a moderate speed. Observe for a pull and/or incorrect tracking of the vehicle without the brakes applied.
16. 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.
17.
    - 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.
    - If the brake pedal apply effort was not excessive and the pedal travel was not excessive, proceed to stepâ€‰14.
18. 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 â€“ either side to side, or front to rear.
19. A small amount of vehicle front end dip is expected during a moderate apply of the brakes.
20. 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.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Brake Pedal Travel Measurement and Inspection

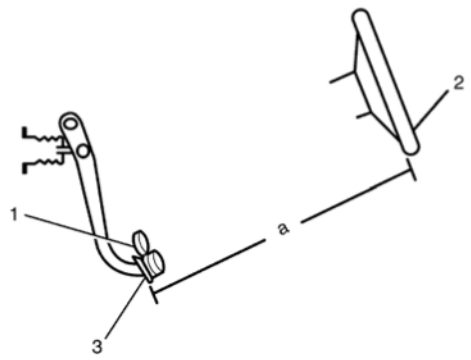
Special Tools

CH-28662 Brake Pedal Effort Gauge

For equivalent regional tools, refer to Special Tools.

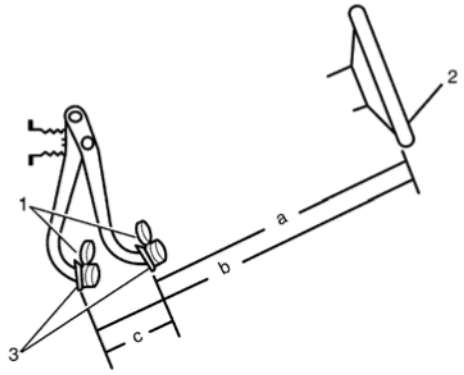
1. With the ignition OFF and the brakes cool, apply the brakes 3â€“5â€‰times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.

cardiagn.com



2. Click here for full size
3. Install the *CH-28662* gaugeâ€‰(1), or equivalent, to the brake pedalâ€‰(3).
4. Measure and record the distance (a) from the brake pedalâ€‰(3) to the rim of the steering wheelâ€‰(2). Note the points of measurement.

cardiagn.com



cardiagn.com

Click here for full size

6. Apply and maintain a force of 445â€‰N (100â€‰lb) to the brake pedal, as indicated on the *CH-28662* gaugeâ€‰(1), or equivalent.
7. While maintaining 445â€‰N (100â€‰lb) of force to the brake pedalâ€‰(3), measure and record the distanceâ€‰(b) from the same point on the brake pedalâ€‰(3) to the same point on the rim of the steering wheelâ€‰(2).
8. Release the brake pedalâ€‰(3) and repeat stepsâ€‰4 andâ€‰5 to obtain a second measurement. After obtaining a second measurement, proceed to stepâ€‰7.
9. Average the first and second measurements recorded for the 2â€‰applies of the brakes.
10. Subtract the initial unapplied distanceâ€‰(a), from the average applied distanceâ€‰(b) to obtain the brake pedal travel measurementâ€‰(c).
11. Compare the measurement obtained with the specification. Refer to Brake System Specifications.

Related Part Information

Part Name	Catalog Name	Part Code
Brake Pedal	PEDAL,BRK(W/BRKT)	0045A
Brake Pedal	PEDAL PKG,BRK	0049Z
Brake Pedal	PEDAL,BRK	0050A
Brake Pedal	PEDAL,BRK	0050B

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Brake System Vacuum Source Test

Note:

- Engine temperature, accessory load, and elevation level will affect engine vacuum.
- Vacuum readings will decrease by approximately 2.7â€‰kPa (0.8â€‰inâ€‰Hg) for every 305â€‰m (1000â€‰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 or NEUTRAL with the park brake on, 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.
5. Specification

   26â€“52â€‰kPa (8â€“15â€‰inâ€‰Hg)
6. Turn the ignition OFF.
7. If the engine vacuum reading is within the specified normal range, proceed to stepâ€‰10.
8. If the engine vacuum reading is NOT within the specified normal range, inspect the engine vacuum hose for the following conditions.
9.
   - Loose connection to the engine
   - Collapse, deformation or contamination
   - Cracks, cuts, or brittleness
10. If any of these conditions were found with the engine vacuum hose, replace the hose, then repeat stepsâ€‰2â€“4.
11. 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.
12. Remove the vacuum brake booster check valve from the booster.
13. Install the check valve to the engine vacuum hose.
14. Install the vacuum gauge to the check valve.
15. Start the engine and allow the engine to idle in park or neutral with the park brake on and with the A/C system OFF, until normal operating temperatures are reached.
16. Turn the ignition OFF.
17. Visually inspect the engine vacuum reading is maintained within the specified normal engine vacuum range.
18. Specification

    26â”52â€‰kPa (8â”15â€‰inâ€‰Hg)
19. If the engine vacuum reading is maintained within the specified normal range, proceed to stepâ€‰18.
20. If the engine vacuum reading is NOT maintained within the specified normal range, replace the vacuum brake booster check valve, then repeat stepsâ€‰11â€“15.
21. Inspect the vacuum brake booster check valve grommet for the following conditions:
22.

cardiagn.com

- Loose connection to the vacuum brake booster
- Deformation or contamination
- Cracks, cuts or brittleness

23. If any of these conditions were found with the check valve grommet, replace the grommet.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

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 inspect the fluid level in the master cylinder.
2. 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.
3. If the fluid level is abnormally low, adjust the brake fluid level. Refer to Brake Master Cylinder Reservoir Filling.
4. Start the engine and allow it to idle.
5. Apply constant, moderate foot pressure to the brake pedal.
6. If the brake pedal gradually falls away while under foot pressure, there may be a brake fluid leak.
7. Turn the ignition OFF.
8. 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 â€“ even though the brake pedal may feel firm and hold steady:
9.
    - Master cylinder brake pipe fittings
    - All brake pipe connections
    - Brake pipes
    - Brake hoses and connections
    - Brake calipers and/or wheel cylinders
10. 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.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Brake System Internal Leak Test

Warning**:**

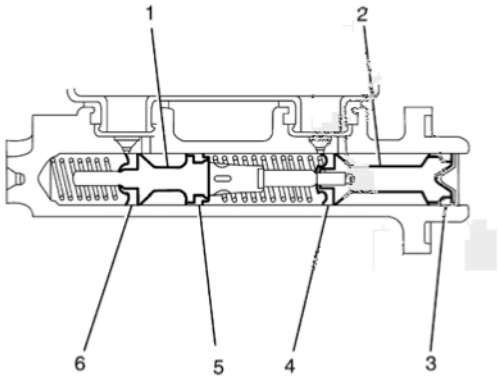
Refer to Brake Fluid Irritant Warning.

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 the ignition OFF.
4. If the brake pedal apply felt spongy, but the brake pedal travel was not excessive, perform the following steps:
5.
    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 system. Refer to Hydraulic Brake System Bleeding.

cardiagn.com



cardiagn.com

6. Click here for full size

7. If the brake pedal apply did not feel spongy, but the brake pedal travel was excessive, perform the following steps:

8.
    1. Loosen the master cylinder-to-vacuum brake booster retaining nuts.
    2. Carefully pull the master cylinder away from the vacuum brake booster just enough to inspect the mounting surface of the master cylinder.
    3. Inspect the master cylinder mounting surface at the primary pistonâ€‰(2) for brake fluid leaks.

9. If the master cylinder exhibits any leakage around the primary pistonâ€‰(2), then the primary piston primary sealâ€‰(4) and/or secondary sealâ€‰(3) is leaking and the master cylinder requires overhaul or replacement.

10. If the master cylinder primary pistonâ€‰(2) does not exhibit any leakage, pressure bleed the brake system. Refer to Hydraulic Brake System Bleeding.

11. 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 pistonâ€‰(1) from the secondary piston primary sealâ€‰(6) or secondary sealâ€‰(5).

12. 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.

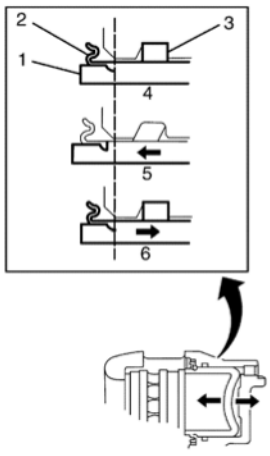
cardiagn.com

1. BRAKES
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Hydraulic Brake Component Operation Visual Inspection

Disc Brake

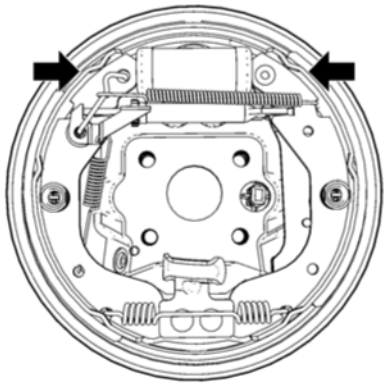
cardiagn.com



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

Drum Brakes

cardiagn.com



cardiagn.com

1. Click here for full size
2. With the rear tire and wheel assemblies and the brake drums removed, visually inspect the wheel cylinder pistons boot sealing areas to ensure that there are no brake fluid leaks.
3. If any evidence of a brake fluid leak is present, the brake wheel cylinder requires replacement.
4. Using firm hand pressure, simultaneously and evenly apply force on both brake shoes in order to compress the wheel cylinder pistons into their bore.
5. Evenly release the force from both brake shoes to allow the wheel cylinder pistons to return.
6. If one or both of the wheel cylinder pistons did not exhibit unrestricted and even movement during apply and/or release of force, the wheel cylinder may require replacement.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Brake Pipe and Hose Inspection

Warning**:**

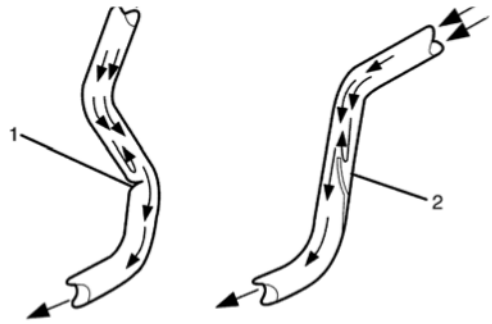
Refer to Brake Fluid Irritant Warning.

Caution**:**

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

1. Visually inspect all of the brake pipes for the following conditions:
2.
    - Kinks, incorrect routing, missing or damaged retainers
    - Leaking fittings, excessive corrosion
3. If any of the brake pipes exhibited any of the conditions listed, then the identified pipe, or pipes, require replacement.
4. Ensure that the vehicle axles are correctly supported at ride height in order to maintain the proper relationship of the flexible brake hoses to the chassis.

cardiagn.com

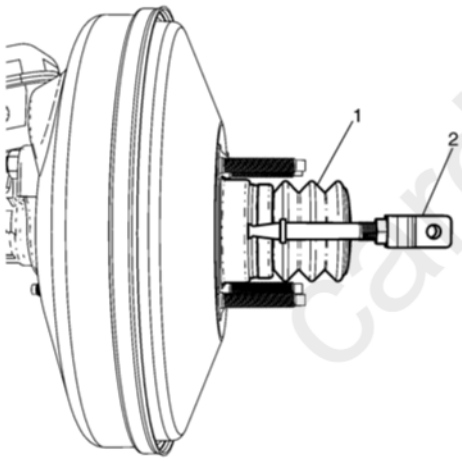


cardiagn.com

5. Click here for full size
6. Visually inspect all of the flexible brake hoses for the following conditions:
7.
    - Kinksâ€‰(1), improper routing, twists, chafing, missing or damaged retainers
    - Leaking connections, perished, cracked, blistered, brittle or bulging hoses
8. If any of the flexible brake hoses exhibited any of the conditions listed, then the identified flexible brake hose, or hoses require replacement.
9. Squeeze the flexible brake hoses with firm finger pressure to inspect for soft spotsâ€‰(2), indicating an internal restriction. Inspect the entire length of each flexible brake hose.
10. If any of the flexible brake hoses were found to have soft spotsâ€‰(2), then the identified flexible brake hose, or hoses require replacement.

1. BRAKES
2. HYDRAULIC BRAKES
3. DIAGNOSTIC INFORMATION AND PROCEDURES
4.

Brake Pedal Pushrod Inspection



cardiagn.com

1. Click here for full size
2. Disconnect the brake pedal pushrodâ€‰(2) from the brake pedal.
3. Reposition the pedal pushrod bootâ€‰(1) toward the front of the vehicle to expose as much of the pedal pushrodâ€‰(2) as possible.
4. Inspect the brake pedal pushrodâ€‰(2) for straightness.
5. If the brake pedal pushrodâ€‰(2) is not straight, then the pushrod requires replacement.
6. Return the pedal pushrod bootâ€‰(1) to its original position on the pedal pushrodâ€‰(2).
7. Connect the brake pedal pushrodâ€‰(2) to the brake pedal.

Related Part Information

Part Name	Catalog Name	Part Code
Brake Pedal Push Rod	ROD,BRK PED PUSH	1850A
Brake Pedal Push Rod	ROD,BRK PED PUSH	1900A

cardiagn.com

Repair Instructions

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

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. Brake 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
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. Brake 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:
10.
    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

Related Part Information

Part Name	Catalog Name	Part Code
Hydraulic Brake Fluid	FLUID,HYD BRK (GLYCOL)	0800A

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Reservoir Filling

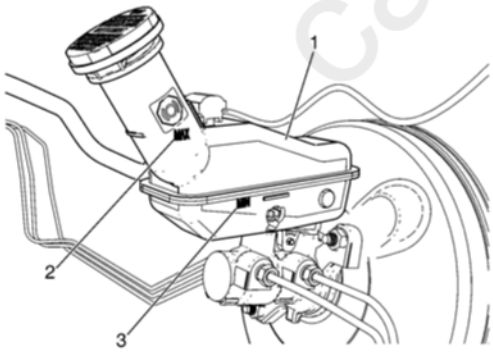
Warning**:**

Refer to Brake Fluid Irritant Warning.

Caution**:**

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

cardiagn.com



1. Click here for full size

2. Visually inspect the brake fluid level through the brake master cylinder reservoirâ€‰(1).

3. If the brake fluid level is at or below the minimum allowable levelâ€‰(3) during routine fluid checks, the brake system should be inspected for wear and possible brake fluid leaks.

4. Note**:**

   If brake fluid is to be added to the brake master cylinder reservoirâ€‰(1), clean the outside of the reservoir and around the reservoir cap prior to removing the cap.

5. If the brake fluid level is at or below the minimum allowable levelâ€‰(3) and an inspection of the brake system did not reveal wear or brake fluid leaks, the brake fluid may be topped up to the maximum fill levelâ€‰(2).

6. If a brake system service was just completed, the brake fluid may be topped up to the maximum fill levelâ€‰(2).

7. If the brake fluid level is above the minimum allowable levelâ€‰(3), adding brake fluid is not recommended under normal conditions.

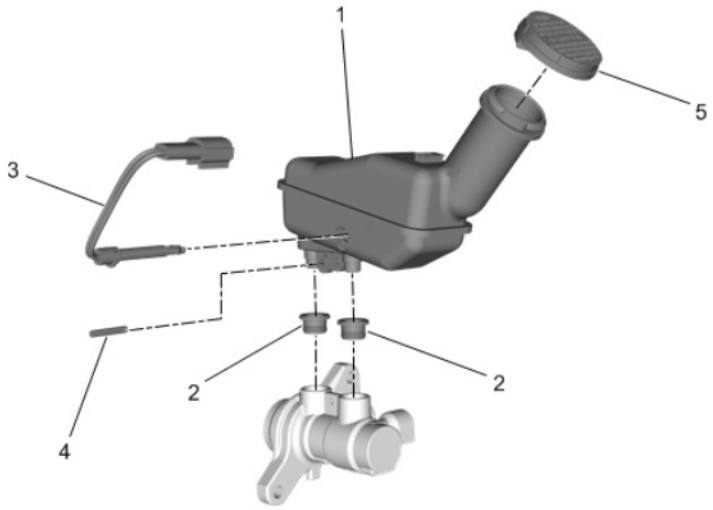
Related Part Information

Part Name	Catalog Name	Part Code
Brake Master Cylinder Reservoir	RESERVOIR KIT,BRK M/CYL	0159Z
Brake Master Cylinder Reservoir	RESERVOIR,BRK M/CYL	0160A
Brake Master Cylinder Reservoir	RESERVOIR,BRK M/CYL	X0015

carmagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Reservoir Replacement



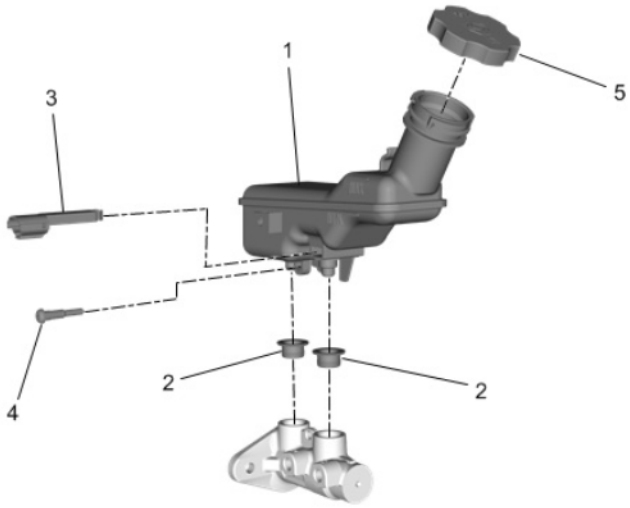
Click here for full size

Callout	Component Name
Warning: Refer to Brake Fluid Irritant Warning Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution Preliminary Procedure Brake Master Cylinder Replacement	
1	Brake Master Cylinder Reservoir
2	Brake Master Cylinder Reservoir Seal Procedure Apply a small amount of the clean recommended brake fluid to the seals when installing.
3	Brake Fluid Level Indicator Switch
4	Brake Master Cylinder Reservoir Pin
5	Brake Master Cylinder Reservoir Cap

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Reservoir Replacement (PMC)



Click here for full size

Callout	Component Name
Warning: Refer to Brake Fluid Irritant Warning Caution: Refer to Brake Fluid Effects on Paint and Electrical Components Caution Preliminary Procedure Brake Master Cylinder Replacement	
1	Brake Master Cylinder Reservoir
2	Brake Master Cylinder Reservoir Seal Procedure Apply a small amount of the clean recommended brake fluid to the seals when installing.
3	Brake Fluid Level Sensor
4	Brake Master Cylinder Reservoir Bolt Caution: Refer to Fastener Caution. Tighten 4.2â€‰N-m (37â€‰lbâ€‰in)
5	Brake Master Cylinder Reservoir Cap

Related Part Information

Part Name	Catalog Name	Part Code
Brake Master Cylinder Reservoir	RESERVOIR KIT,BRK M/CYL	0159Z

cardiagn.com

Part Name	Catalog Name	Part Code
Brake Master Cylinder Reservoir	RESERVOIR,BRK M/CYL	0160A
Brake Master Cylinder Reservoir	RESERVOIR,BRK M/CYL	X0015

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Replacement

Removal Procedure

Warning**:**

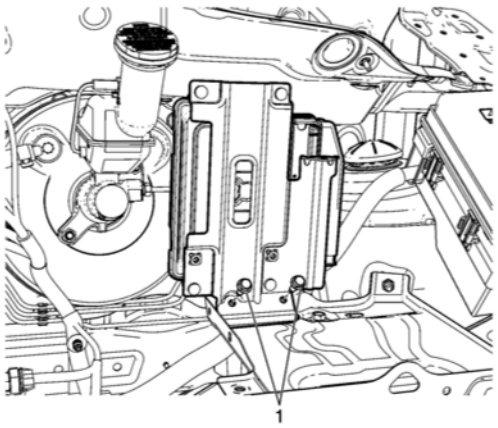
Refer to Brake Fluid Irritant Warning.

Caution**:**

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

1. Place the ignition switch in the OFF position.
2. Remove the battery. Refer to Battery Replacement.
3. Remove the air cleaner and air inlet hose as an assembly. Refer to Air Cleaner Assembly Replacement.

cardiagn.com



4. Click here for full size

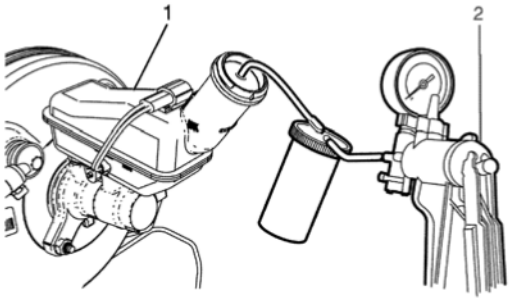
5. Remove the engine control module (ECM) bracket boltsâ€‰(1), and position the ECM and ECM bracket aside. Refer to Engine Control Module Replacement.

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

7. Thoroughly clean the master cylinder reservoir and the master cylinder body to remove any dirt and debris.

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

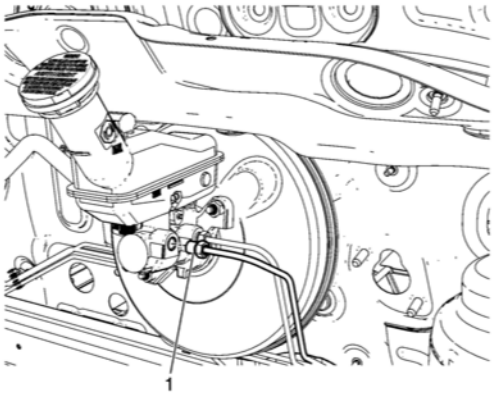
cardiagn.com



cardiagn.com

9. Click here for full size

10. Siphon the brake fluid out of the master cylinder reservoirâ€‰(1) using an air vacuum pump or a hand vacuum pumpâ€‰(2).

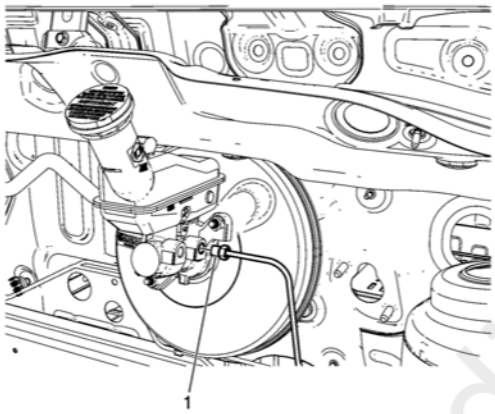


cardiagn.com

11. Click here for full size

12. Disconnect the master cylinder secondary brake pipe fittingâ€‰(1).

13. Cap the brake pipe fitting and plug the master cylinder outlet port to prevent brake fluid loss and contamination.



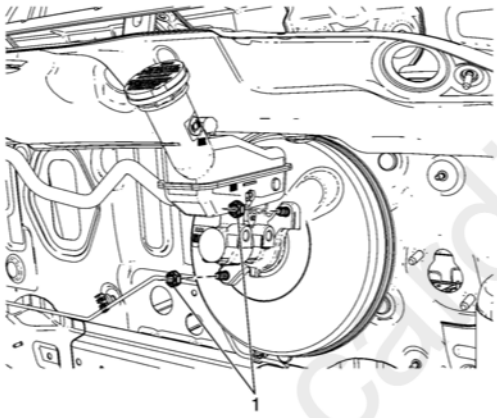
cardiagn.com

14.

Click here for full size

15. Disconnect the master cylinder primary brake pipe fittingâ€‰(1).

16. Cap the brake pipe fitting and plug the master cylinder outlet port to prevent brake fluid loss and contamination.

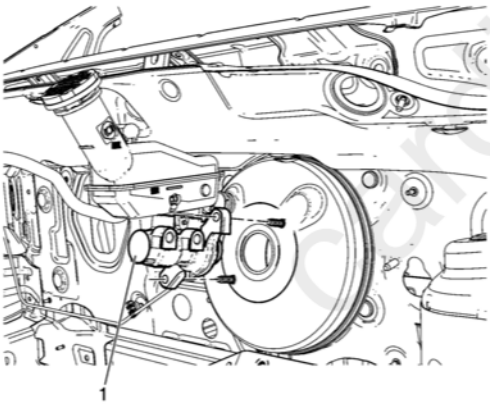


cardiagn.com

17.

Click here for full size

18. Remove the master cylinder nutsâ€‰(1).



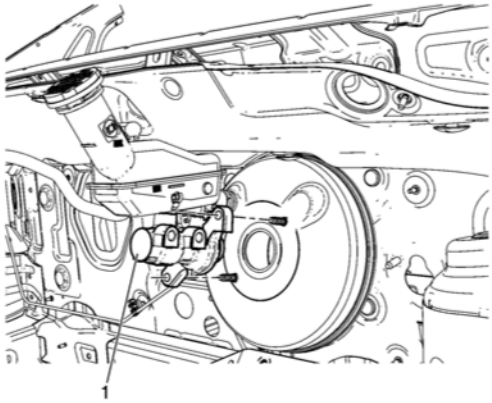
cardiagn.com

19. Click here for full size
20. Remove the master cylinderâ€‰(1) from the power vacuum brake booster.
21. Remove the brake fluid level indicator switch, if necessary. Refer to Brake Fluid Level Indicator Switch Replacement.
22. Remove the master cylinder reservoir, if necessary. Refer to Brake Master Cylinder Reservoir Replacement.

Installation Procedure

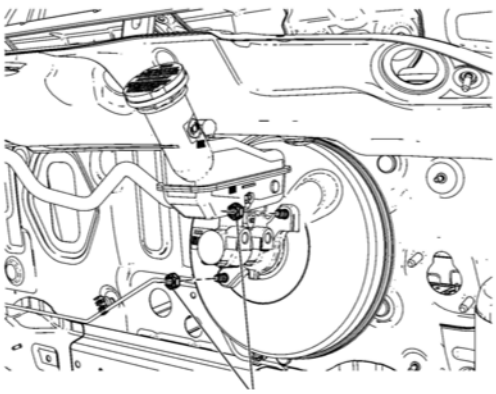
1. Install the master cylinder reservoir, if removed. Refer to Brake Master Cylinder Reservoir Replacement.
2. Bench bleed the master cylinder. Refer to Brake Master Cylinder Bench Bleeding.
3. Install the brake fluid level indicator switch, if removed. Refer to Brake Fluid Level Indicator Switch Replacement.

cardiagn.com



4.
Click here for full size

5. Install the master cylinderâ€‰(1) to the power vacuum brake booster.



cardiagn.com

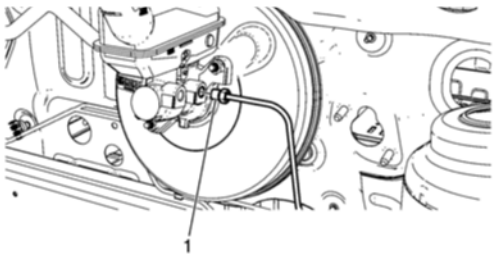
6.
Click here for full size
7. Caution:

   Refer to Fastener Caution.

8. Install the master cylinder nutsâ€‰(1) and tighten to 13â€‰N-m (115â€‰lbâ€‰in).



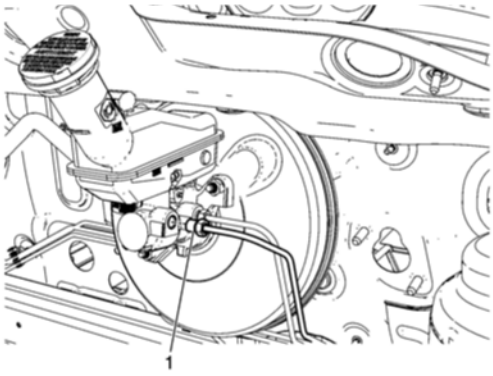
cardiagn.com



9. Click here for full size

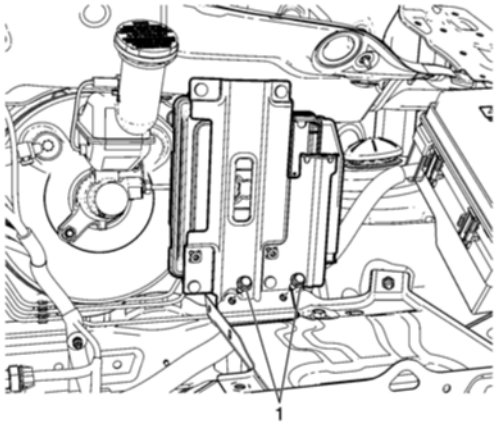
10. Connect the master cylinder primary brake pipe fittingâ€‰(1) and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).

cardiagn.com



11. Click here for full size
12. Connect the master cylinder secondary brake pipe fittingâ€‰(1) and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).
13. Connect the brake fluid level indicator switch electrical connector.

cardiagn.com



cardiagn.com

14. Click here for full size
15. Position the ECM and ECM bracket to the original place, and install the ECM bracket boltsâ€‰(1). Refer to Engine Control Module Replacement.
16. Install the air cleaner and air inlet hose as an assembly. Refer to Air Cleaner Assembly Replacement.
17. Install the battery. Refer to Battery Replacement.
18. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.

Related Part Information

Part Name	Catalog Name	Part Code
Brake Master Cylinder	CYLINDER,BRK MAS	0050A
Brake Master Cylinder	CYLINDER KIT,BRK MAS	0050B
Brake Master Cylinder	CYLINDER,BRK MAS	0050C
Brake Master Cylinder	CYLINDER,BRK MAS (RPR)	0051A
Brake Master Cylinder	CYLINDER,BRK MAS(W/BRK PRESS MOD VLV)	0054A
Brake Master Cylinder	CYLINDER,BRK MAS(W/P/B BOOS)	0055A

Part Name	Catalog Name	Part Code
Brake Master Cylinder	CYLINDER,BRK MAS (W/ P/B BOOS & ELEK BRK CONT MDL)	0056A
Brake Master Cylinder	CYLINDER,BRK MAS (W/ BRK PED EMU & TRAV SEN)	0058A
Brake Master Cylinder	CYLINDER,BRK MAS (W/ BRK PED TRAV SEN & PUSH ROD)	0062A

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Replacement (PMC)

Removal Procedure

Warning**:**

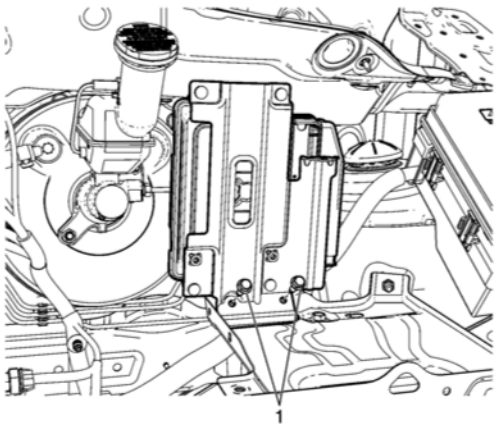
Refer to Brake Fluid Irritant Warning.

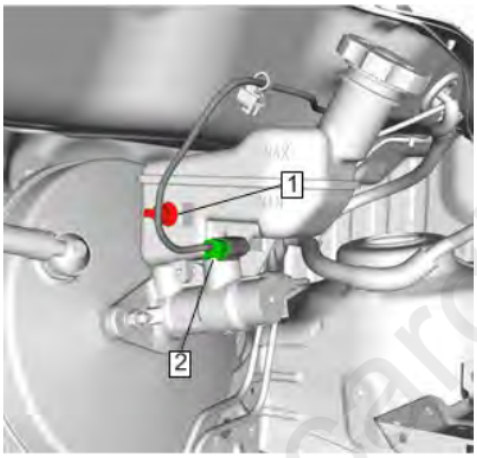
Caution**:**

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

1. Battery @ Vehicle >> Remove - Battery Replacement
2. Remove the air cleaner and air inlet hose as an assembly. Air Cleaner Assembly Replacement

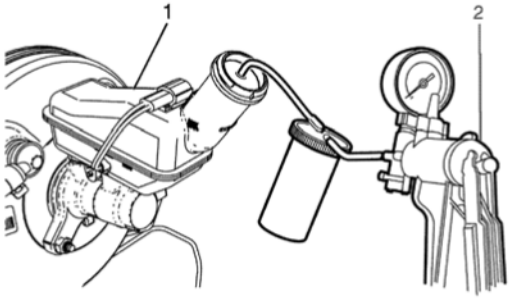
cardiagn.com



3. Click here for full size
4. Remove the engine control module (ECM) bracket boltsâ€‰(1), and position the ECM and ECM bracket aside. Engine Control Module Replacement
5. Apply and release the brake pedal several times until the pedal becomes firm to deplete the power vacuum brake booster vacuum reserve.
6. Thoroughly clean the master cylinder reservoir and the master cylinder body to remove any dirt and debris.
7. 

Click here for full size
8. Retainer (1) @ Brake Master Cylinder Reservoir >> Remove
9. Electrical Connector (2) @ Brake Fluid Level Indicator Switch >> Disconnect

cardiagn.com

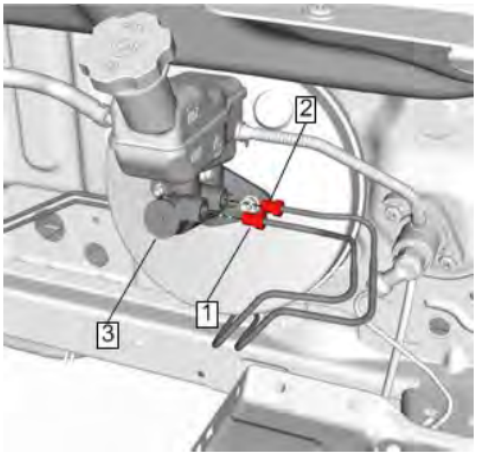


cardiagn.com

10. Click here for full size

11. Siphon the brake fluid out of the master cylinder reservoirâ€‰(1) using an air vacuum pump or a hand vacuum pumpâ€‰(2).

12. { If equipped } Clutch Master Cylinder Reservoir Hose @ Brake Master Cylinder Reservoir >> Remove - Clutch Master Cylinder Reservoir Hose Replacement

13. 

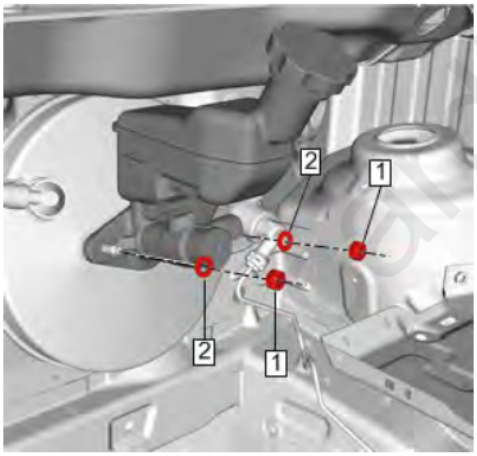
Click here for full size

14. Note:

    Cap the brake pipe fittings to prevent brake fluid loss and contamination.

15. Brake Pressure Modulator Valve Rear Pipe Fitting (1) @ Brake Master Cylinder (3) >> Remove

16. Brake Pressure Modulator Valve Front Pipe Fitting (2) @ Brake Master Cylinder (3) >> Remove

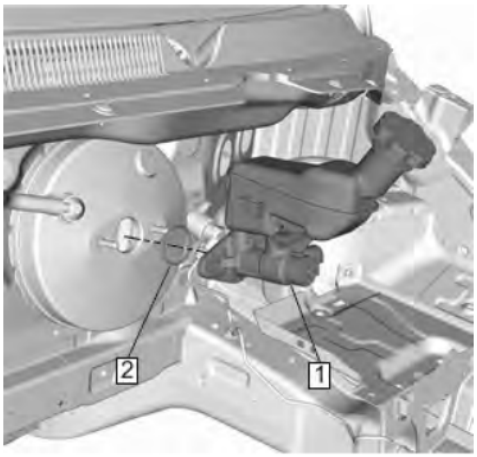
17. 

Click here for full size

18. Brake Master Cylinder Nut (1) >> Remove [2x]

19. Brake Master Cylinder Washer (2) >> Remove [2x]

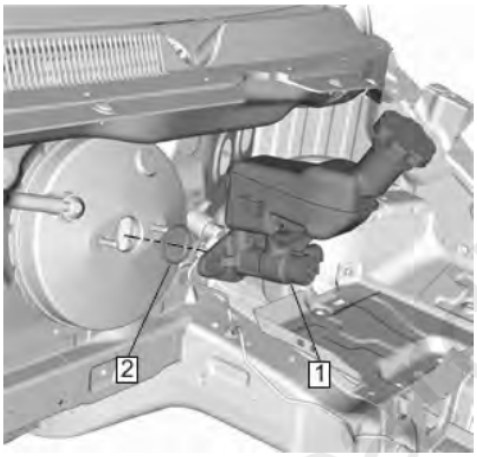
eldiagn.com

20. 

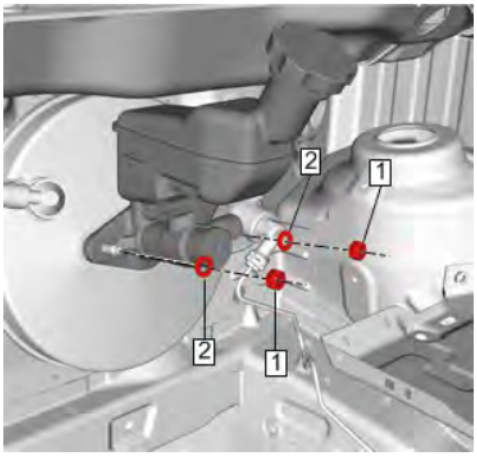
Click here for full size

21. Brake Master Cylinder (1) >> Remove
22. Brake Master Cylinder Seal (2) >> Remove
23. Brake Master Cylinder Reservoir >> Remove - Brake Master Cylinder Reservoir Replacement

Installation Procedure

1. Brake Master Cylinder Reservoir >> Install - Brake Master Cylinder Reservoir Replacement
2. Bench bleed the brake master cylinder. Brake Master Cylinder Bench Bleeding
3. 

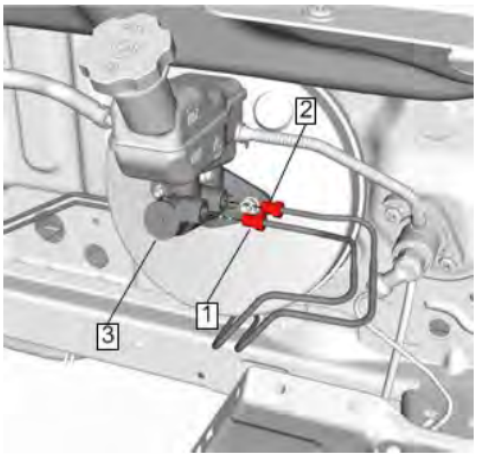
Click here for full size
4. Note**:**

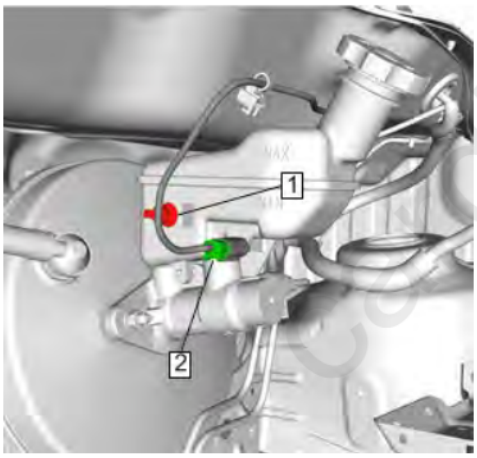
   Ensure the brake master cylinder seal is seated completely and is not twisted.
5. Brake Master Cylinder Seal (2) >> Install
6. Brake Master Cylinder (1) >> Install
7. 

Click here for full size

cardiagn.com

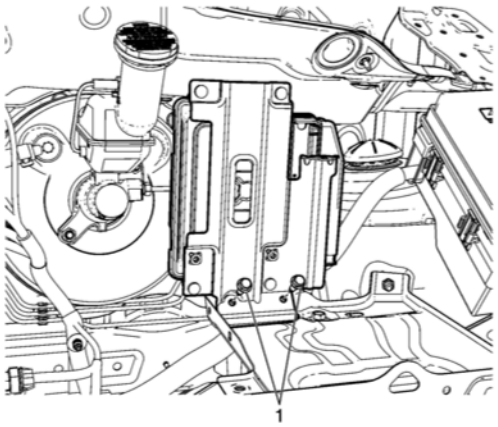
8. Brake Master Cylinder Washer (2) >> Install [2x]
9. Caution:

   Refer to Fastener Caution.
10. Brake Master Cylinder Nut (1) >> Install and tighten [2x] 14.8â€‰N-mâ€‰ (11â€‰lbâ€‰ft)
11. 

    Click here for full size
12. Brake Pressure Modulator Valve Front Pipe Fitting (2) @ Brake Master Cylinder (3) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
13. Brake Pressure Modulator Valve Rear Pipe Fitting (1) @ Brake Master Cylinder (3) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
14. { If equipped } Clutch Master Cylinder Reservoir Hose @ Brake Master Cylinder Reservoir >> Install - Clutch Master Cylinder Reservoir Hose Replacement
15. 

    Click here for full size
16. Electrical Connector (2) @ Brake Fluid Level Indicator Switch >> Connect
17. Retainer (1) @ Brake Master Cylinder Reservoir >> Install

cardiagn.com

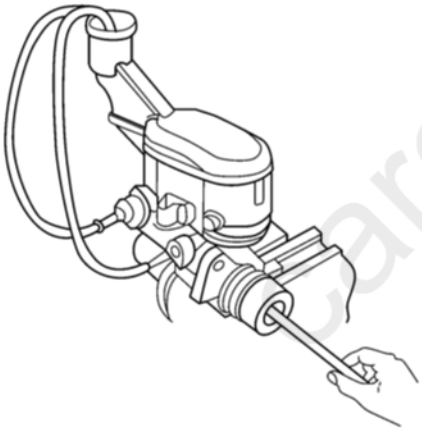


cardiagn.com

18. Click here for full size
19. Position the ECM and ECM bracket to the original place, and install the ECM bracket boltsâ€‰(1). Engine Control Module Replacement
20. Install the air cleaner and air inlet hose as an assembly. Air Cleaner Assembly Replacement
21. Battery @ Vehicle >> Install - Battery Replacement
22. Bleed the brake system. Hydraulic Brake System Bleeding

1. BRAKES
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Master Cylinder Bench Bleeding



Cardiagn.com

1. Click here for full size
2. Warning:

   Refer to Brake Fluid Irritant Warning.

3. Caution:

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

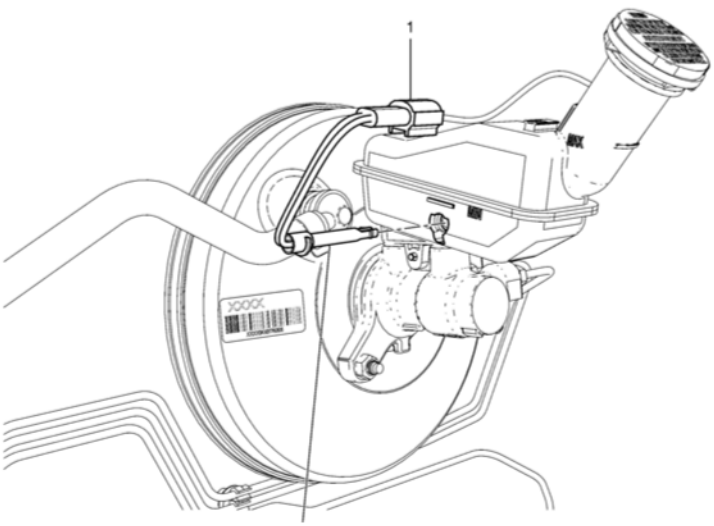
4. Secure the mounting flange of the brake master cylinder in a bench vice so that the rear of the primary piston is accessible.
5. Remove the master cylinder reservoir cap and diaphragm.
6. Install suitable fittings to the master cylinder ports that match the type of flare seat required and also provide for hose attachment.
7. Install transparent hoses to the fittings installed to the master cylinder ports, then route the hoses into the master cylinder reservoir.
8. Fill the master cylinder reservoir to the maximum fill level with brake fluid from a clean, sealed brake fluid container. Refer to Brake Master Cylinder Reservoir Filling.
9. Ensure that the ends of the transparent hoses running into the master cylinder reservoir are fully submerged in the brake fluid.
10. Using a smooth, round-ended tool, depress and release the primary piston as far as it will travel, a depth of about 25â€‰mm (1â€‰in), several times. Observe the flow of fluid coming from the ports.
11. 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.
12. Continue to depress and release the primary piston until fluid flows freely from the ports with no evidence of air bubbles.
13. Remove the transparent hoses from the master cylinder reservoir.
14. Install the master cylinder reservoir cap and diaphragm.
15. 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.
16. Remove the master cylinder from the vice.

cardiagn.com

1. BRAKES
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Fluid Level Indicator Switch Replacement

cardiagn.com



cardiagn.com

Click here for full size

Callout	Component Name
1	Brake Fluid Indicator Switch Connector
2	Brake Fluid Level Indicator Switch Tip Using needle nose pliers, carefully depress the retaining tab on the indicator switch and remove indicator switch from the reservoir.

Related Part Information

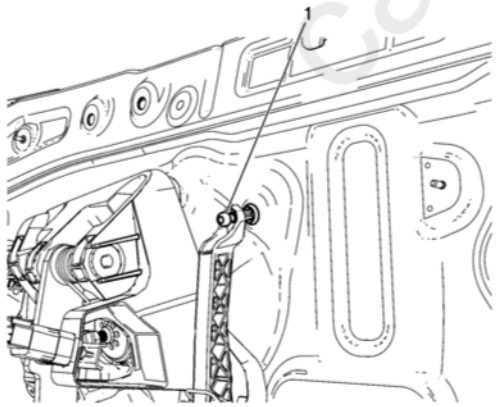
Part Name	Catalog Name	Part Code
Brake Fluid Level Indicator Switch	SWITCH,BRK FLUID LVL IND	2655A

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Pedal Assembly Replacement (RHD)

Removal Procedure

1. Remove the instrument panel (I/P) pad assembly. Refer to Instrument Panel Assembly Replacement.
2. Remove the I/P tie bar. Refer to Instrument Panel Tie Bar Replacement.
3. If equipped with the electronic throttle control, disconnect the electrical wiring harness connector from the accelerator pedal position sensor.

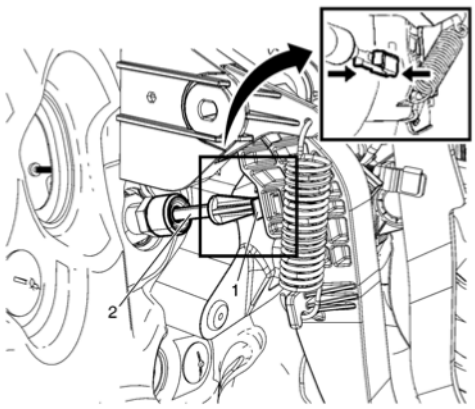


cardiagn.com

4.
Click here for full size

5. If equipped with the manual throttle control, disconnect the accelerator cable from the accelerator pedal by pulling and raising the cable endâ€‰(1).

cardiagn.com

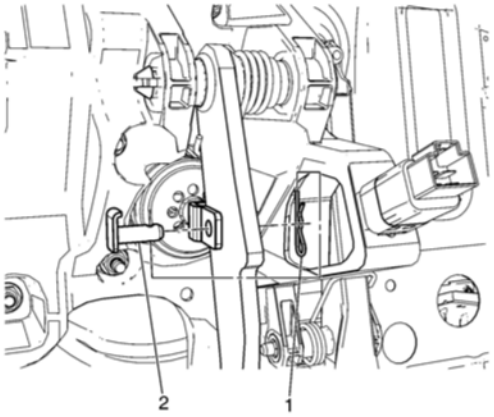


6.

Click here for full size

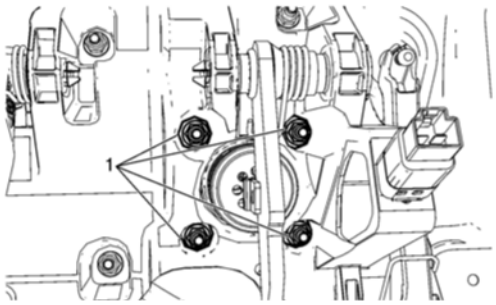
7. If equipped, disconnect the push rod retainerâ€‰(1) from the clutch pedal.

cardiagn.com



8. Click here for full size
9. Remove the retaining clipâ€‰(1) and pinâ€‰(2) from the brake pedal.
10. Release the brake booster pushrod from the brake pedal.

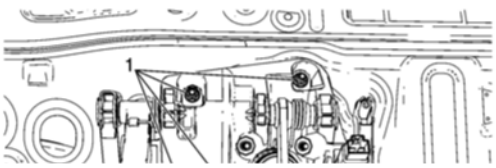
cardiagn.com



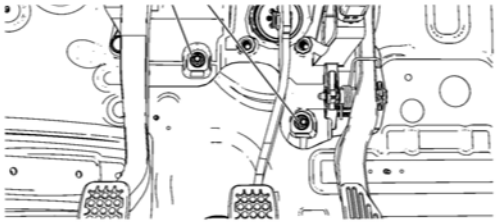


11. Click here for full size

12. Remove the brake booster-to-accelerator, brake and clutch (ABC) pedal module retaining nutsâ€‰(1) from the ABC pedal module.



cardiagn.com

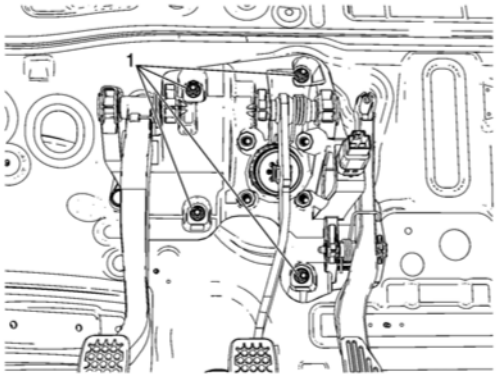


13. Click here for full size
14. Remove the ABC module-to-dash panel retaining nutsâ€‰(1) from the ABC pedal module.
15. Remove the ABC pedal module from the vehicle.
16. Remove the accelerator pedal from the ABC pedal module, if necessary.

Installation Procedure

1. Install the accelerator pedal to the ABC pedal module, if necessary.
2. Install the ABC pedal module into the vehicle.

cardiagn.com

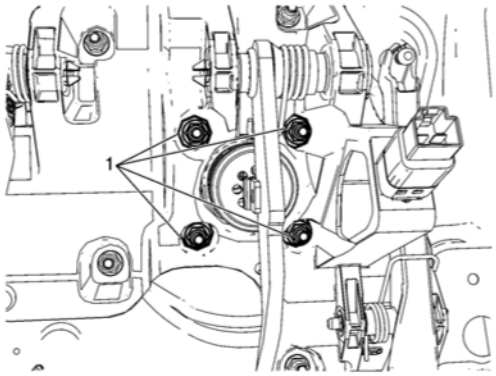


cardiagn.com

3. [Click here for full size]
4. Caution:

   Refer to Fastener Caution.

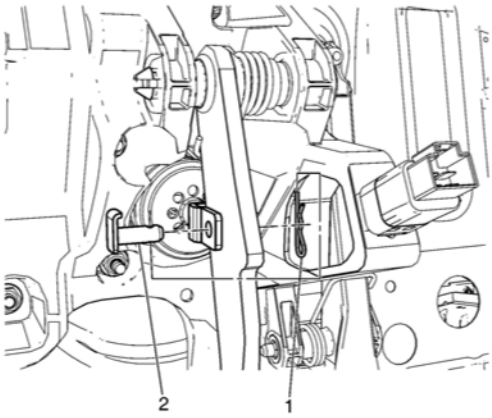
5. Install the ABC module-to-dash panel retaining nutsâ€‰(1) and tighten to 22â€‰N-m (16â€‰lbâ€‰ft).



cardiagn.com

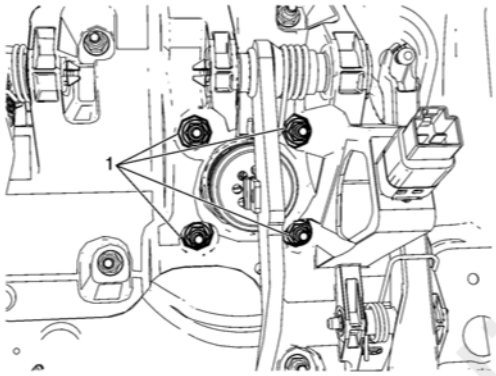
6. Click here for full size

7. Loosely install the brake booster-to-ABC pedal module retaining nutsâ€‰(1).



cardiagn.com

8. Click here for full size
9. Connect the brake booster pushrod to the brake pedal.
10. Install the pushrod pinâ€‰(2) to the brake pedal and insert the retaining clipâ€‰(1) to the pinâ€‰(2).



cardiagn.com

11.

Click here for full size

12. Completely tighten the brake booster-to-ABC pedal module retaining nutsâ€‰(1) to 22â€‰N-m (16â€‰lbâ€‰ft).
13. Connect the push rod retainer to the clutch pedal.
14. If equipped with the manual throttle control, connect the accelerator cable to the accelerator pedal.
15. If equipped with the electronic throttle control, connect the electrical wiring harness connector to the accelerator pedal position sensor.
16. Install the I/P pad assembly. Refer to Instrument Panel Assembly Replacement.
17. Install the I/P tie bar. Refer to Instrument Panel Tie Bar Replacement.

cardiagn.com

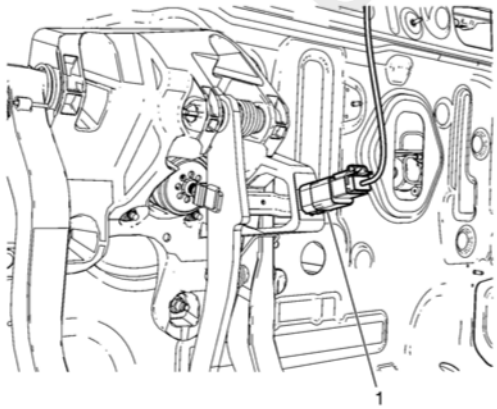
1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Pedal Assembly Replacement (LHD)

Removal Procedure

1. Remove the steering column opening filler. Refer to Steering Column Opening Filler Replacement.
2. Remove the left floor air outlet duct. Refer to Floor Air Outlet Duct Replacement - Left Side.
3. Remove the steering column lower trim cover. Refer to Steering Column Lower Trim Cover Replacement.
4. Remove the intermediate steering shaft if the electrical power steering is not equipped or remove the steering column if the electrical power steering is equipped. Refer to Intermediate Steering Shaft Replacement or Steering Column Replacement.

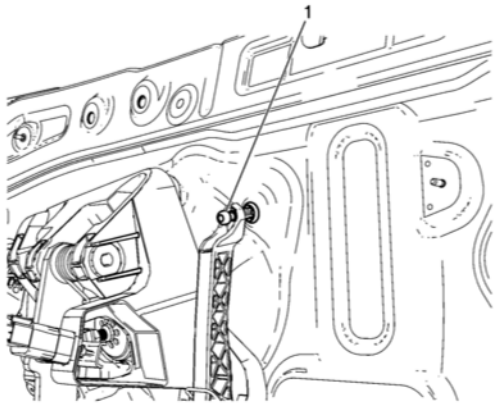
cardiagn.com



5.
Click here for full size

6. Disconnect the electrical connector of the stop lamp switchâ€‰(1).
7. If equipped with the electronic throttle control, disconnect the electrical wiring harness connector from the accelerator pedal position sensor.

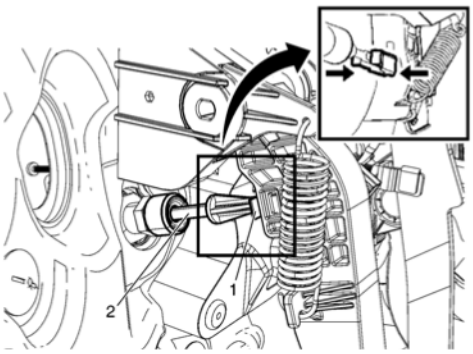
cardiagn.com



8.
Click here for full size

9. If equipped with the manual throttle control, disconnect the accelerator cable from the accelerator pedal by pulling and raising the cable endâ€‰(1).

cardiagn.com

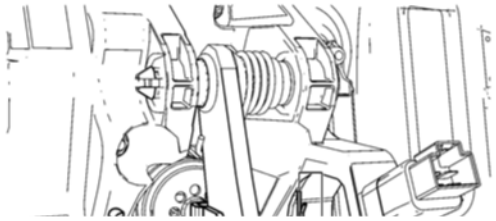


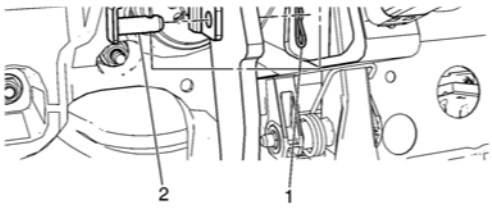


10. Click here for full size

11. If equipped, disconnect the push rod retainerâ€‰(1) from the clutch pedal.

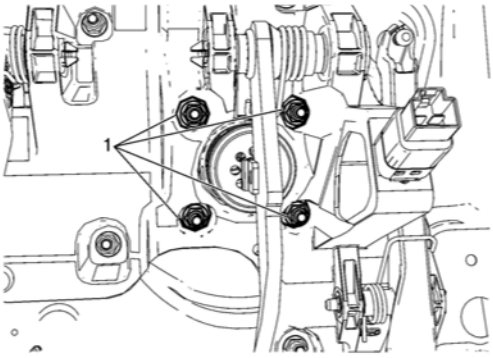
cardiagn.com





12. Click here for full size
13. Remove the retaining clipâ€‰(1) and pinâ€‰(2) from the brake pedal.
14. Release the brake booster pushrod from the brake pedal.

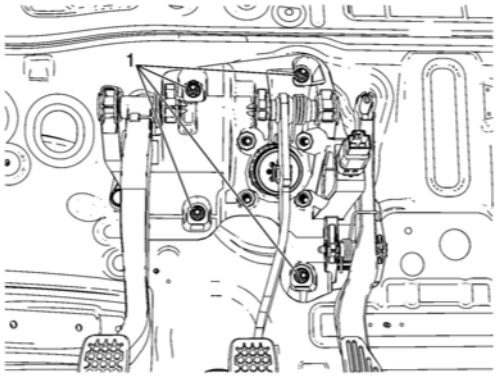
cardiagn.com



15. Click here for full size

16. Remove the brake booster-to-accelerator, brake and clutch (ABC) pedal module retaining nutsâ€‰(1) from the ABC pedal module.

cardiagn.com

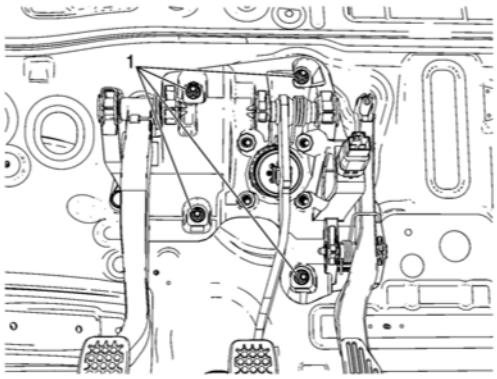


17. Click here for full size
18. Remove the ABC module-to-dash panel retaining nutsâ€‰(1) from the ABC pedal module.
19. Remove the ABC pedal module from the vehicle.
20. Remove the accelerator pedal from the ABC pedal module, if necessary.

Installation Procedure

1. Install the accelerator pedal to the ABC pedal module, if necessary.
2. Install the ABC pedal module into the vehicle.

cardiagn.com

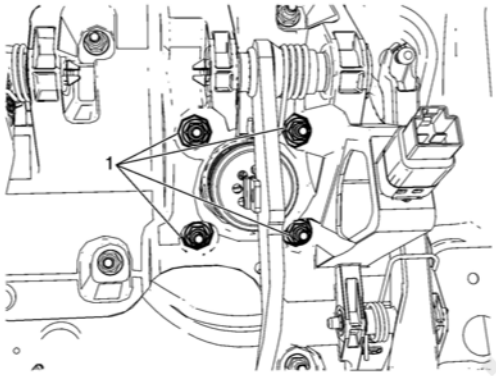


cardiagn.com

3. Click here for full size
4. Caution:

   Refer to Fastener Caution.

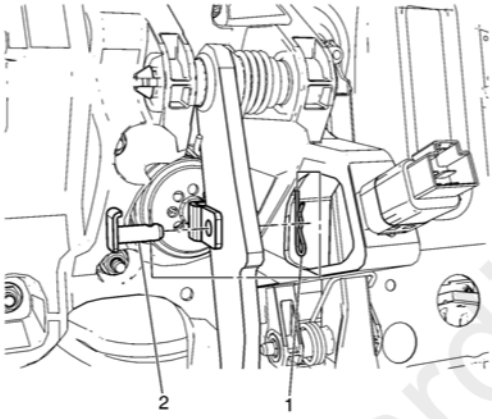
5. Install the ABC module-to-dash panel retaining nutsâ€‰(1) and tighten to 22â€‰N-m (16â€‰lbâ€‰ft).



cardiagn.com

6. Click here for full size

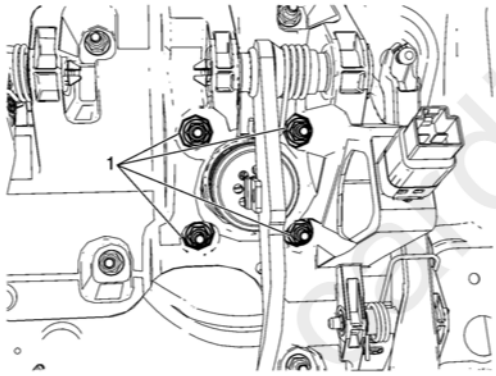
7. Loosely install the brake booster-to-ABC pedal module retaining nutsâ€‰(1).



cardiagn.com

Click here for full size

9. Connect the brake booster pushrod to the brake pedal.
10. Install the pushrod pinâ€‰(2) to the brake pedal and insert the retaining clipâ€‰(1) to the pinâ€‰(2).



2cdiagn.com

11. Click here for full size

12. Completely tighten the brake booster-to-ABC pedal module retaining nutsâ€‰(1) and tighten to 22â€‰N-m (16â€‰lbâ€‰ft).
13. Connect the push rod retainer to the clutch pedal, if equipped.
14. If equipped with the manual throttle control, connect the accelerator cable to the accelerator pedal.
15. If equipped with the electronic throttle control, connect the electrical wiring harness connector to the accelerator pedal position sensor.
16. Connect the electrical connector of the stop lamp switch.
17. Install the intermediate steering shaft or the steering column as necessary. Refer to Intermediate Steering Shaft Replacement or Steering Column Replacement.
18. Install the steering column lower trim cover. Refer to Steering Column Lower Trim Cover Replacement.
19. Install the left floor air outlet duct. Refer to Floor Air Outlet Duct Replacement - Left Side.
20. Install the steering column opening filler. Refer to Steering Column Opening Filler Replacement.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Proportion Valve Replacement

Removal Procedure

Warning**:**

Refer to Brake Fluid Irritant Warning.

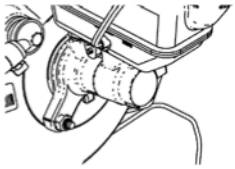
Caution**:**

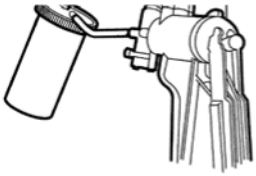
Refer to Brake Fluid Effects on Paint and Electrical Components Caution.

1. Apply and release the brake pedal several times until the pedal becomes firm to deplete the power vacuum brake booster vacuum reserve.
2. Thoroughly clean the master cylinder reservoir and the master cylinder body to remove any dirt and debris.
3. Disconnect the brake fluid indicator switch electrical connector.

cardiagn.com



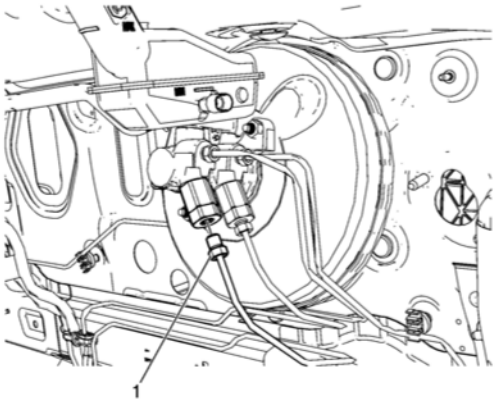




cardiagn.com

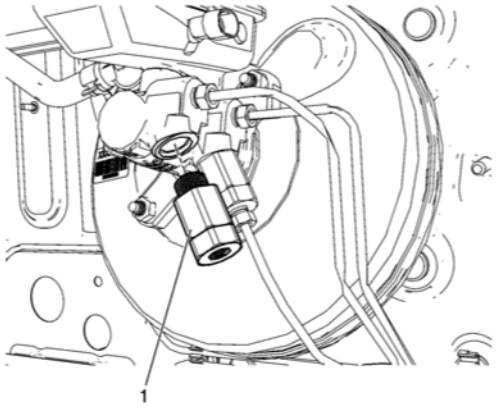
4. Click here for full size

5. Siphon the brake fluid out of the master cylinder reservoirâ€‰(1) using an air vacuum pump or a hand vacuum pumpâ€‰(2).



cardiagn.com

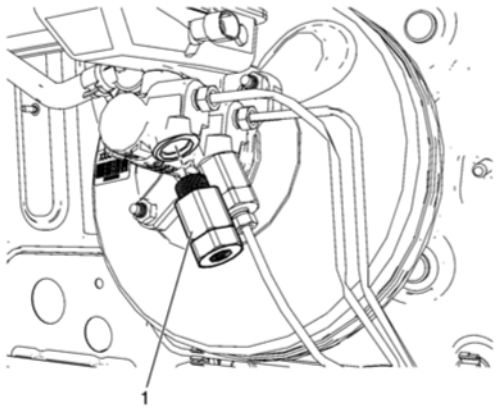
6. Click here for full size
7. Disconnect the proportion valve outlet brake pipe fittingâ€‰(1).
8. Cap the brake pipe fitting to prevent brake fluid loss and contamination.



cardiagn.com

9. Click here for full size
10. Remove the proportion valveâ€‰(1) from the master cylinder.

Installation Procedure

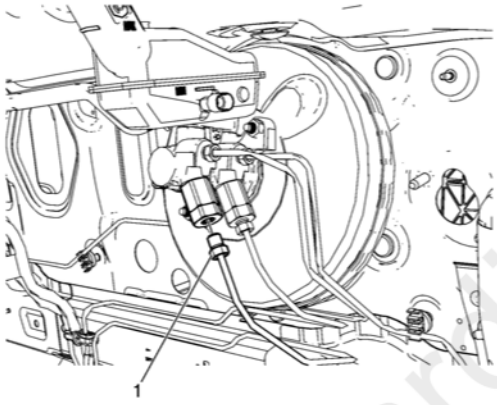


cardiagn.com

1. Click here for full size
2. Caution:

   Refer to Fastener Caution.

3. Install the brake proportion valveâ€‰(1) to the master cylinder and tighten to 35â€‰N-m (26â€‰lbâ€‰ft).



cardiagn.com

Click here for full size

5. Connect the proportion valve outlet brake pipe fittingâ€‰(1) and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).
6. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.

Related Part Information

Part Name	Catalog Name	Part Code
Brake Proportioning Valve	VALVE,BRK PROPN (W/BRK PRESS DIFF SW)	4625H
Brake Proportioning Valve	VALVE SET,BRK PROPN	4624A
Brake Proportioning Valve	VALVE KIT,BRK PROPN	4624Z
Brake Proportioning Valve	VALVE,BRK PROPN	4625A
Brake Proportioning Valve	VALVE,BRK PROPN	X0007

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Pressure Modulator Valve Front Brake Pipe Replacement

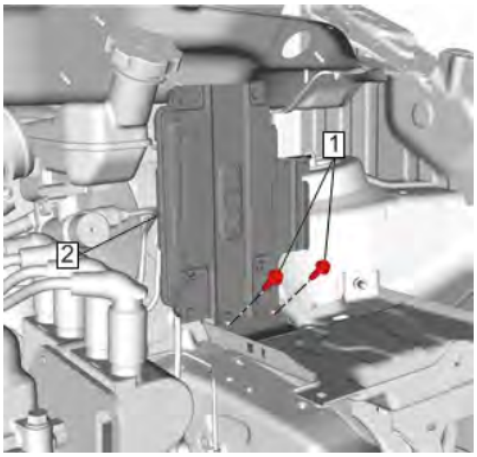
Removal Procedure

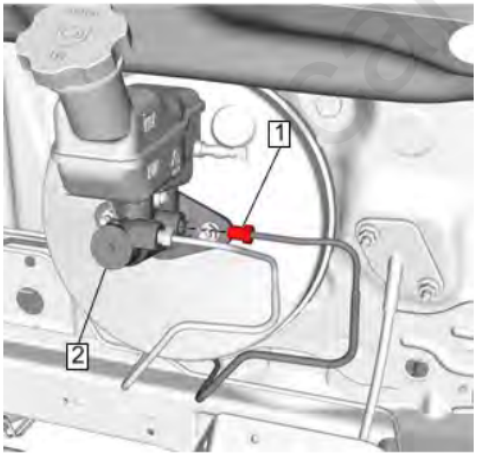
Warning:

Refer to Brake Fluid Irritant Warning.

Caution:

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

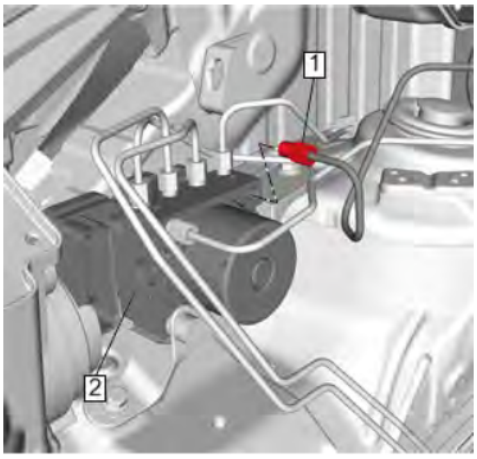
1. Battery @ Vehicle >> Remove - Battery Replacement
2. 

Click here for full size
3. Engine Control Module Bracket Bolt (1) @ Battery Tray >> Remove
4. Engine Control Module and Bracket (2) >> Position aside
5. Clean all dirt and foreign material from the brake pipe fitting.
6. 

Click here for full size
7. Note:

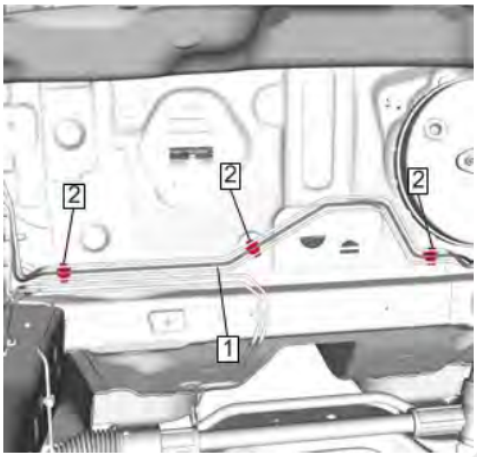
   Cap the brake pipe fitting and plug the brake master cylinder outlet port to prevent brake fluid loss and contamination.
8. Brake Pressure Modulator Valve Front Brake Pipe Fitting (1) @ Brake Master Cylinder (2) >> Remove

cardiagn.com

9. 

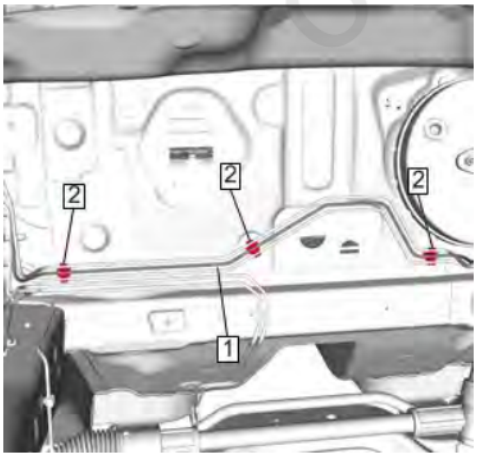
Click here for full size
10. Note:

    Cap the brake pipe fitting and plug the brake pressure modulator valve inlet port to prevent brake fluid loss and contamination.

11. Brake Pressure Modulator Valve Front Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Remove
12. 

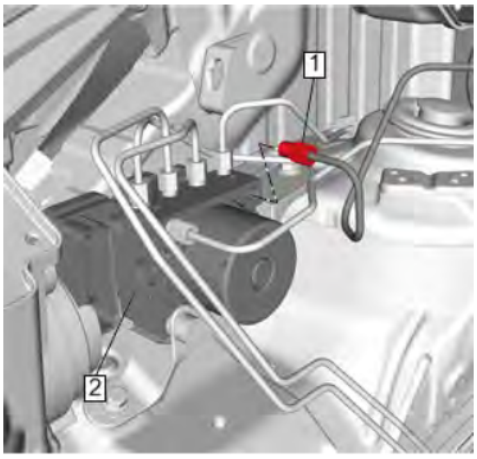
Click here for full size
13. Brake Pressure Modulator Valve Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip [3x]
14. Brake Pressure Modulator Valve Front Brake Pipe (1) @ Vehicle >> Remove

Installation Procedure

1. 

Click here for full size
2. Brake Pressure Modulator Valve Front Brake Pipe (1) @ Vehicle >> Install
3. Brake Pressure Modulator Valve Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install [3x]

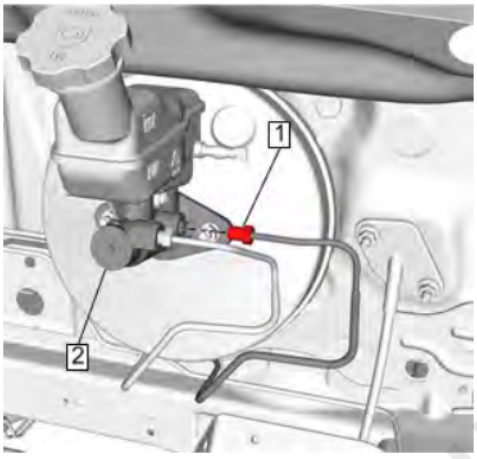
cardiagn.com

4. 

Click here for full size
5. Caution:

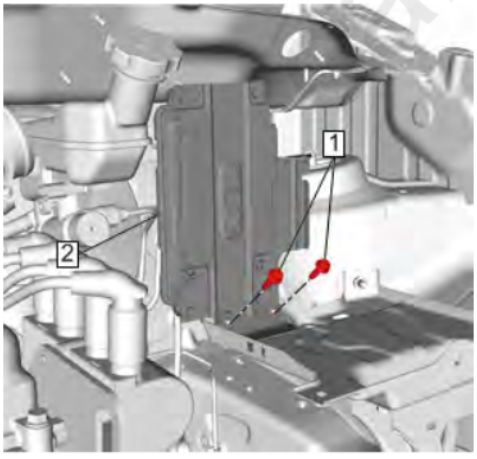
   Refer to Fastener Caution.

6. Brake Pressure Modulator Valve Front Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Install and tighten 21â€‰N-mâ€‰ (15â€‰lbâ€‰ft)

7. 

Click here for full size

8. Brake Pressure Modulator Valve Front Brake Pipe Fitting (1) @ Brake Master Cylinder (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)

9. 

Click here for full size

10. Engine Control Module and Bracket (2) >> Reposition
11. Engine Control Module Bracket Bolt (1) @ Battery Tray >> Install and tighten - Engine Control Module Replacement
12. Battery @ Vehicle >> Install - Battery Replacement
13. Bleed the brake system. Hydraulic Brake System Bleeding

ardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Pressure Modulator Valve Rear Brake Pipe Replacement

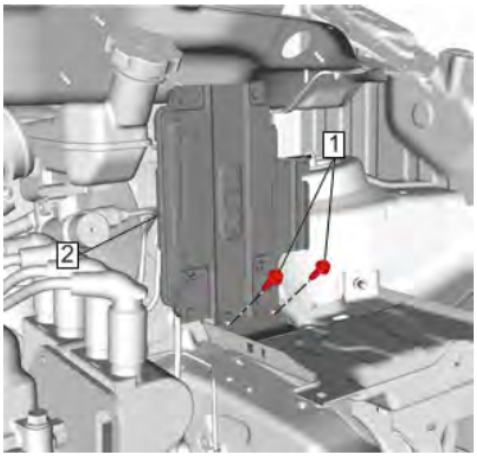
Removal Procedure

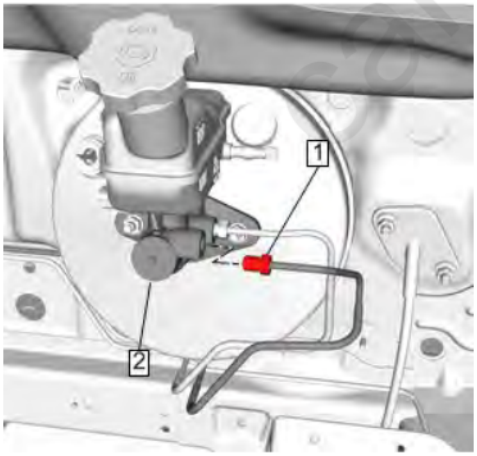
Warning:

Refer to Brake Fluid Irritant Warning.

Caution:

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

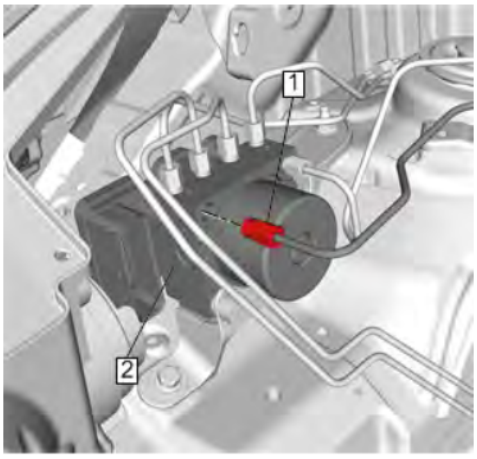
1. Battery @ Vehicle >> Remove - Battery Replacement
2. 

Click here for full size
3. Engine Control Module Bracket Bolt (1) @ Battery Tray >> Remove
4. Engine Control Module and Bracket (2) >> Position aside
5. Clean all dirt and foreign material from the brake pipe fitting.
6. 

Click here for full size
7. Note:

   Cap the brake pipe fitting and plug the brake master cylinder outlet port to prevent brake fluid loss and contamination.
8. Brake Pressure Modulator Valve Rear Brake Pipe Fitting (1) @ Brake Master Cylinder (2) >> Remove

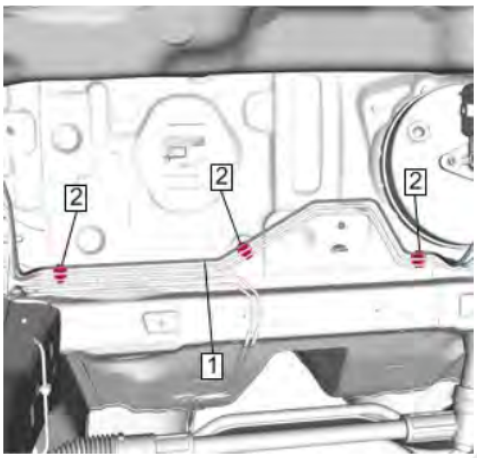
cardiagn.com

9. 

Click here for full size
10. Note:

    Cap the brake pipe fitting and plug the brake pressure modulator valve inlet port to prevent brake fluid loss and contamination.

11. Brake Pressure Modulator Valve Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Remove

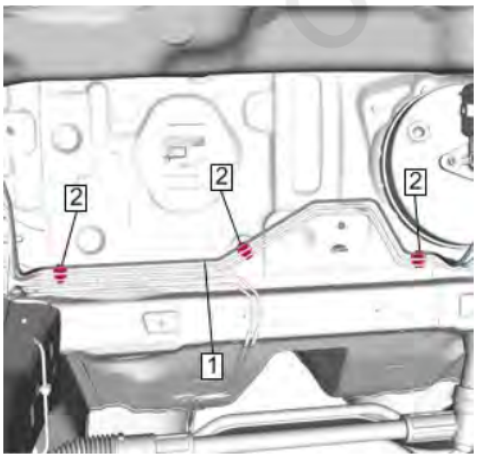
12. 

Click here for full size

13. Brake Pressure Modulator Valve Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip [3x]

14. Brake Pressure Modulator Valve Rear Brake Pipe (1) @ Vehicle >> Remove

Installation Procedure

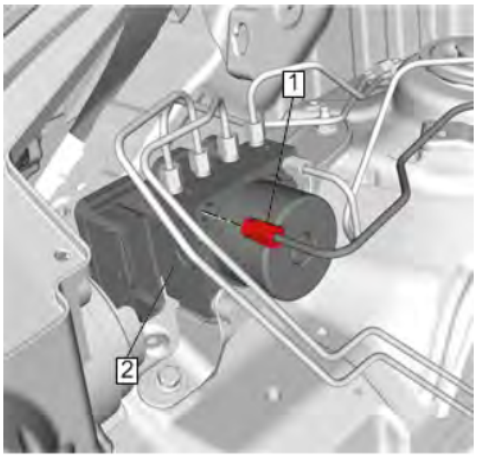
1. 

Click here for full size

2. Brake Pressure Modulator Valve Rear Brake Pipe (1) @ Vehicle >> Install

3. Brake Pressure Modulator Valve Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Install [3x]

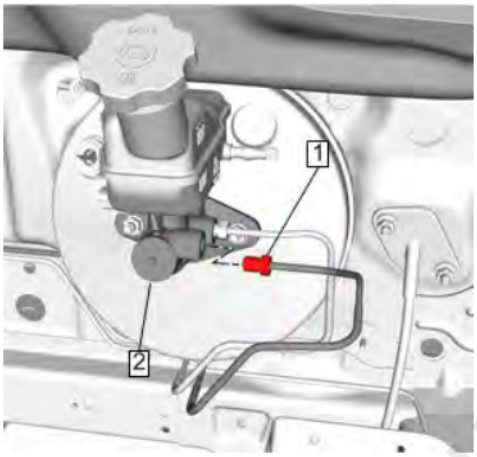
cardiagn.com

4. 

Click here for full size
5. Caution:

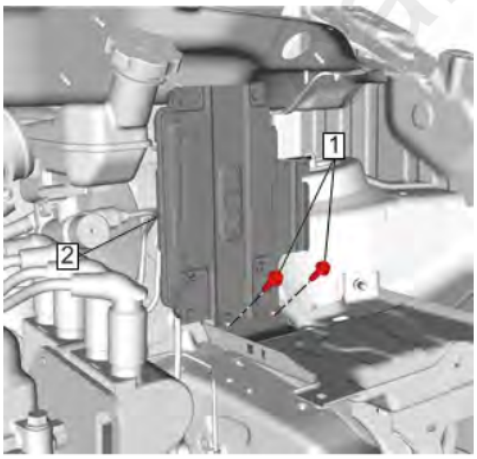
   Refer to Fastener Caution.

6. Brake Pressure Modulator Valve Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Install and tighten 21â€‰N-mâ€‰ (15â€‰lbâ€‰ft)

7. 

Click here for full size

8. Brake Pressure Modulator Valve Rear Brake Pipe Fitting (1) @ Brake Master Cylinder (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)

9. 

Click here for full size

10. Engine Control Module and Bracket (2) >> Reposition
11. Engine Control Module Bracket Bolt (1) @ Battery Tray >> Install and tighten - Engine Control Module Replacement
12. Battery @ Vehicle >> Install - Battery Replacement
13. Bleed the brake system. Hydraulic Brake System Bleeding

ardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Brake Pipe Replacement

Brake pipe is provided as the whole completed component. If the brake pipe is defective, replace with the completed component. For the specified torque of the brake pipe fasteners, refer to Fastener Specifications.

Related Part Information

Part Name	Catalog Name	Part Code
Brake Pipe	PIPE,BRK	0025Z
Brake Pipe	PIPE,BRK	0026A
Brake Pipe	PIPE,BRK	0026B
Brake Pipe	PIPE,BRK(W/FUEL FEED & FUEL RTN HOSE & EVAP EMIS PIPE)	5260A
Brake Pipe	PIPE,BRK (W/FUEL FEED INTER HOSE)	5362A
Brake Pipe	PIPE,BRK(W/FUEL FEED RR HOSE)	5375A

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Front Brake Pipe Replacement - Right Side

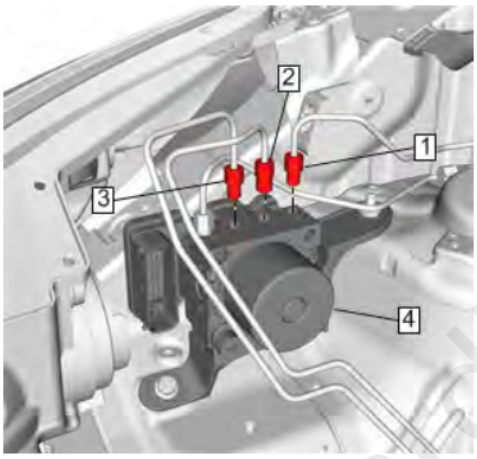
Removal Procedure

Warning:

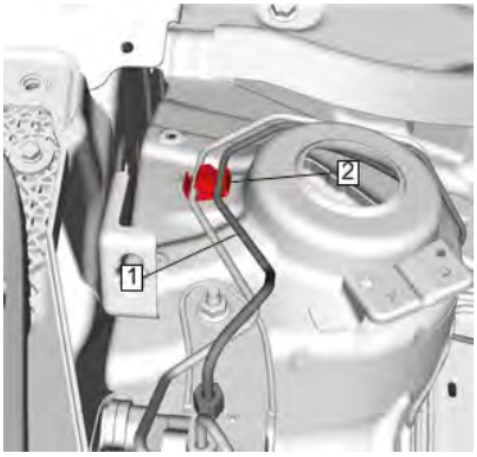
Refer to Brake Fluid Irritant Warning.

Caution:

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

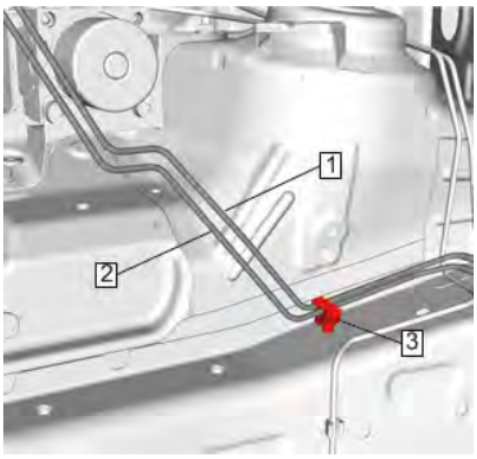
1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Radiator Surge Tank @ Vehicle >> Remove - Radiator Surge Tank Replacement
3. Brake Pressure Modulator Valve Front Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Remove - Brake Pressure Modulator Valve Front Brake Pipe Replacement
4. Brake Pressure Modulator Valve Rear Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Remove - Brake Pressure Modulator Valve Rear Brake Pipe Replacement
5. 

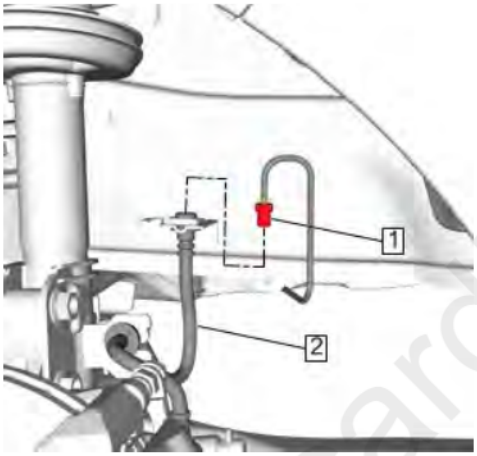
Click here for full size
6. Note:

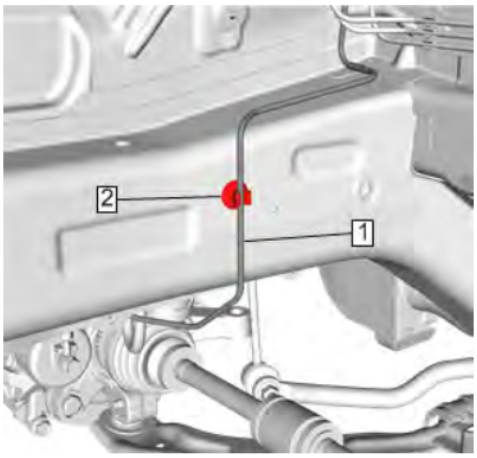
   Cap the brake pressure modulator valve port to prevent brake fluid loss and contamination.
7. Front Brake Pipe Fitting - Right Side (1) @ Brake Pressure Modulator Valve (4) >> Remove
8. Rear Brake Pipe Fitting - Left Side (2) @ Brake Pressure Modulator Valve (4) >> Remove
9. Rear Brake Pipe Fitting - Right Side (3) @ Brake Pressure Modulator Valve (4) >> Remove
10. 

Click here for full size

cardiagn.com

11. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip
12. 

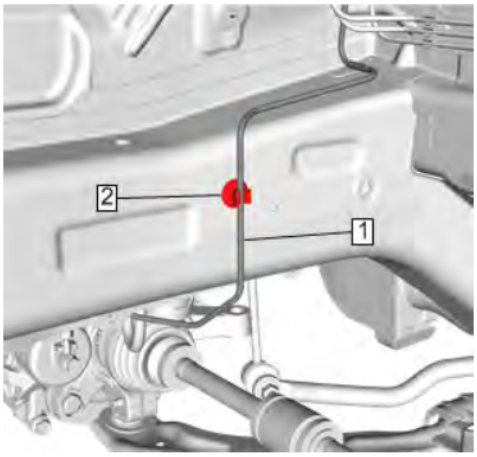
Click here for full size
13. Rear Brake Pipe - Left Side (1) @ Brake Pipe Clip (3) >> Unclip
14. Rear Brake Pipe - Right Side (2) @ Brake Pipe Clip (3) >> Unclip
15. Air Conditioning Evaporator Hose Assembly >> Remove - Air Conditioning Evaporator Hose Replacement
16. Remove the right front tire and wheel assembly. Tire and Wheel Removal and Installation
17. Front Compartment Splash Shield - Right Side >> Remove - Front Compartment Splash Shield Replacement
18. 

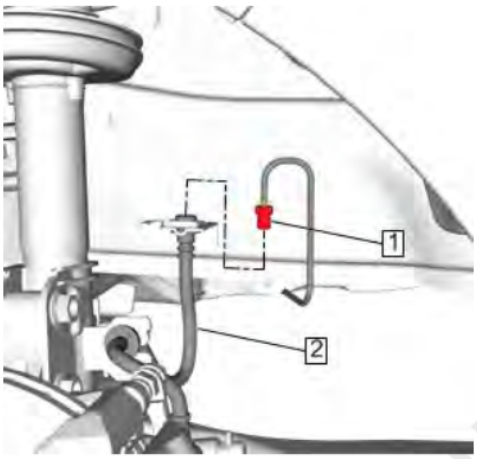
Click here for full size
19. Front Brake Pipe Fitting (1) @ Front Brake Hose (2) >> Remove
20. 

Click here for full size
21. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip
22. Front Brake Pipe (1) @ Vehicle >> Remove

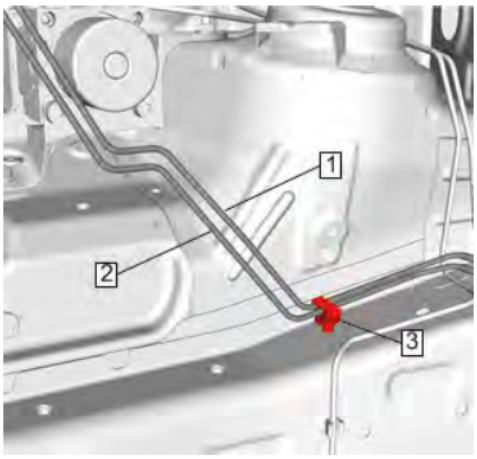
cardiagn.com

Installation Procedure

1. 

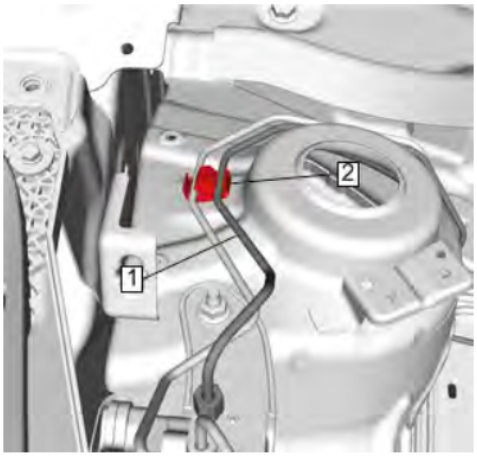
Click here for full size
2. Front Brake Pipe (1) @ Vehicle >> Install
3. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install
4. 

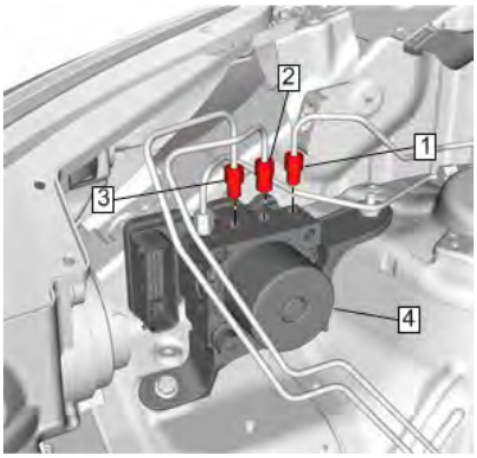
Click here for full size
5. Caution:

   Refer to Fastener Caution.
6. Front Brake Pipe Fitting (1) @ Front Brake Hose (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
7. Front Compartment Splash Shield - Right Side >> Install - Front Compartment Splash Shield Replacement
8. Install the right front tire and wheel assembly. Tire and Wheel Removal and Installation
9. Air Conditioning Evaporator Hose Assembly >> Install - Air Conditioning Evaporator Hose Replacement
10. 

Click here for full size
11. Rear Brake Pipe - Right Side (2) @ Brake Pipe Clip (3) >> Install

cardiagn.com

12. Rear Brake Pipe - Left Side (1) @ Brake Pipe Clip (3) >> Install
13. 

Click here for full size
14. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install
15. 

Click here for full size
16. Rear Brake Pipe Fitting - Right Side (3) @ Brake Pressure Modulator Valve (4) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
17. Rear Brake Pipe Fitting - Left Side (2) @ Brake Pressure Modulator Valve (4) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
18. Front Brake Pipe Fitting - Right Side (1) @ Brake Pressure Modulator Valve (4) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
19. Brake Pressure Modulator Valve Rear Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Install - Brake Pressure Modulator Valve Rear Brake Pipe Replacement
20. Brake Pressure Modulator Valve Front Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Install - Brake Pressure Modulator Valve Front Brake Pipe Replacement
21. Radiator Surge Tank @ Vehicle >> Install - Radiator Surge Tank Replacement
22. Bleed the brake system. Hydraulic Brake System Bleeding
23. Lower the vehicle.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Front Brake Pipe Replacement - Left Side

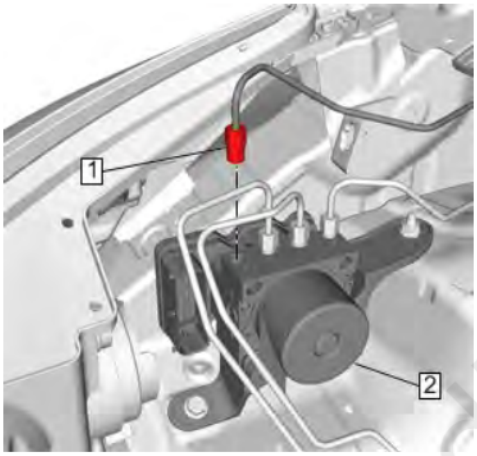
Removal Procedure

Warning:

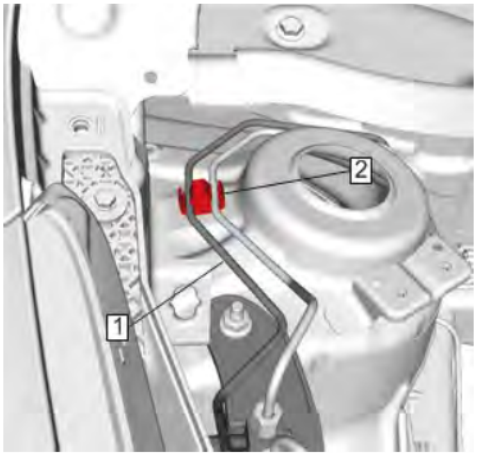
Refer to Brake Fluid Irritant Warning.

Caution:

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

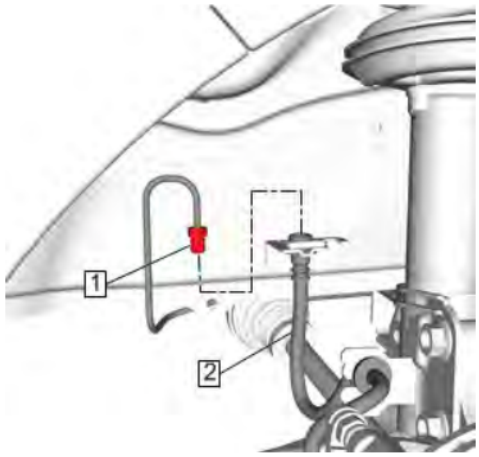
1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Brake Pressure Modulator Valve Front Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Remove - Brake Pressure Modulator Valve Front Brake Pipe Replacement
3. Brake Pressure Modulator Valve Rear Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Remove - Brake Pressure Modulator Valve Rear Brake Pipe Replacement
4. 

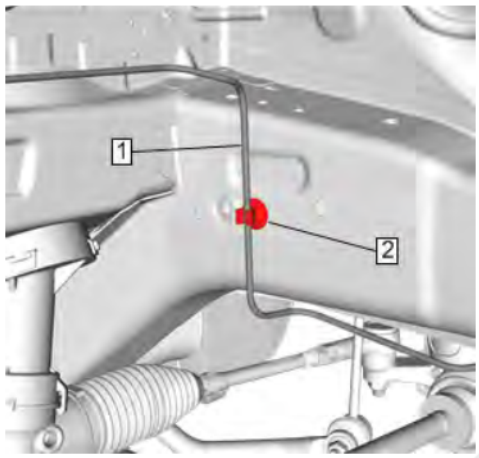
Click here for full size
5. Note:

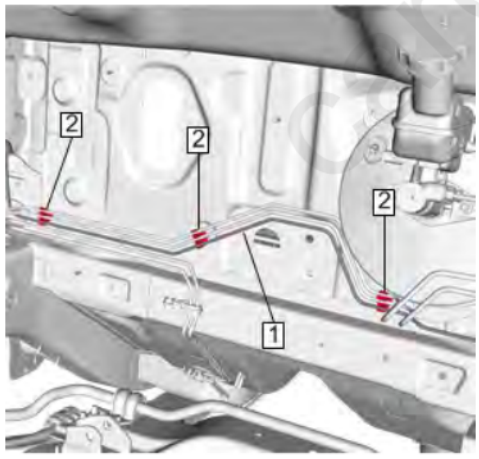
   Cap the brake pressure modulator valve port to prevent brake fluid loss and contamination.
6. Front Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Remove
7. 

Click here for full size
8. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip
9. Air Conditioning Evaporator Hose Assembly >> Remove - Air Conditioning Evaporator Hose Replacement
10. Battery Tray >> Remove - Battery Tray Replacement

cardiagn.com

11. Power brake Booster Vacuum Check Valve and Hose Assembly @ Power Brake Booster >> Remove and position aside - Power Brake Booster Vacuum Check Valve and Hose Replacement
12. 

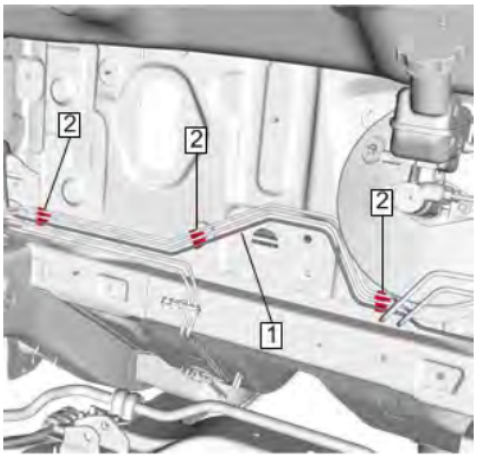
Click here for full size
13. Front Brake Pipe Fitting (1) @ Front Brake Hose (2) >> Remove
14. 

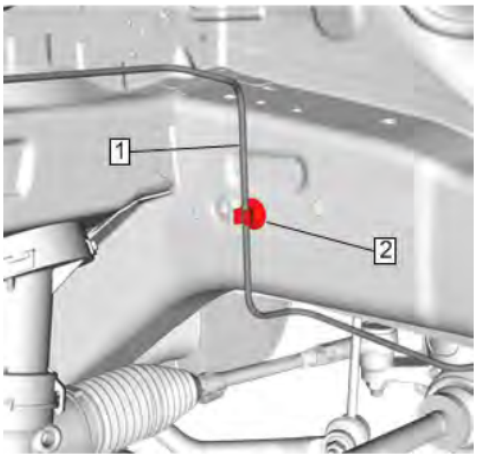
Click here for full size
15. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip
16. 

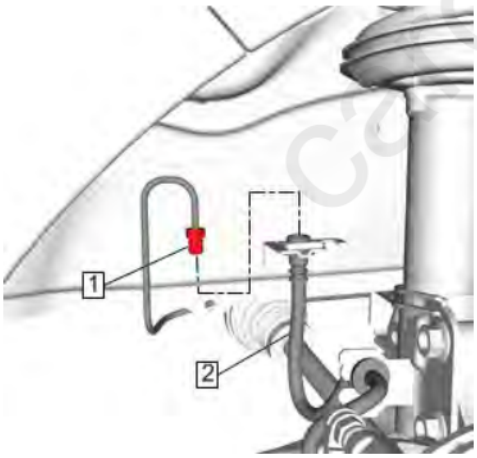
Click here for full size
17. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip [3x]
18. Front Brake Pipe (1) @ Vehicle >> Remove

Installation Procedure

cardiagn.com

1. 

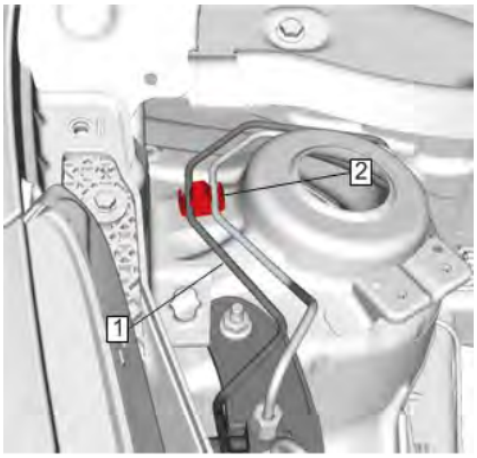
   Click here for full size
2. Front Brake Pipe (1) @ Vehicle >> Install
3. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install [3x]
4. 

   Click here for full size
5. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install
6. 

   Click here for full size
7. Caution:

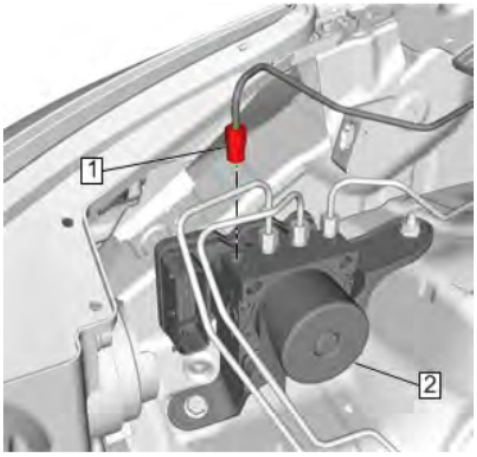
   Refer to Fastener Caution.
8. Front Brake Pipe Fitting (1) @ Front Brake Hose (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
9. Power brake Booster Vacuum Check Valve and Hose Assembly @ Power Brake Booster >> Install - Power Brake Booster Vacuum Check Valve and Hose Replacement
10. Battery Tray >> Install - Battery Tray Replacement
11. Air Conditioning Evaporator Hose Assembly >> Install - Air Conditioning Evaporator Hose Replacement

cardiagn.com

12. 

Click here for full size

13. Front Brake Pipe (1) @ Brake Pipe Clip (2) >> Install

14. 

Click here for full size

15. Front Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)

16. Brake Pressure Modulator Valve Rear Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Install - Brake Pressure Modulator Valve Rear Brake Pipe Replacement

17. Brake Pressure Modulator Valve Front Brake Pipe Fitting @ Brake Pressure Modulator Valve >> Install - Brake Pressure Modulator Valve Front Brake Pipe Replacement

18. Bleed the brake system. Hydraulic Brake System Bleeding

19. Lower the vehicle.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Front Brake Hose Replacement

Removal Procedure

Warning:

Refer to Brake Dust Warning.

Warning:

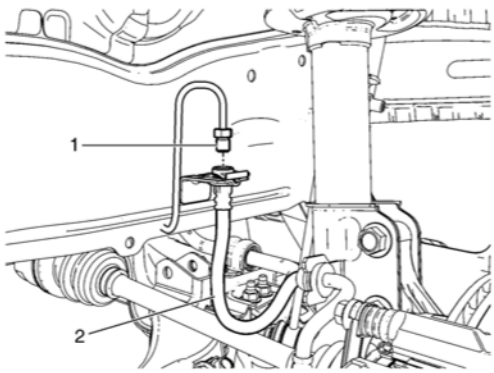
Refer to Brake Fluid Irritant Warning.

Caution:

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

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
3. Clean all dirt and foreign material from the brake hose and the brake pipe fittings.

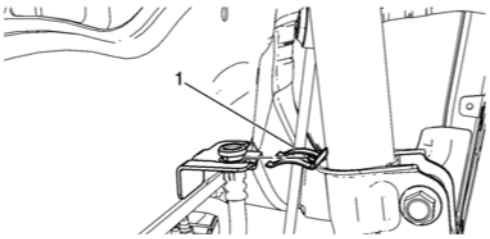
cardiagn.com

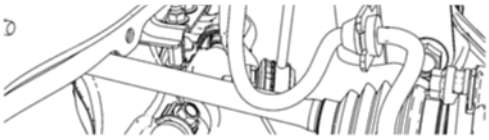


4.
Click here for full size

5. Disconnect the brake pipe fittingâ€‰(1) from the brake hoseâ€‰(2).
6. Cap the brake pipe fitting to prevent brake fluid loss and contamination.

cardiagn.com

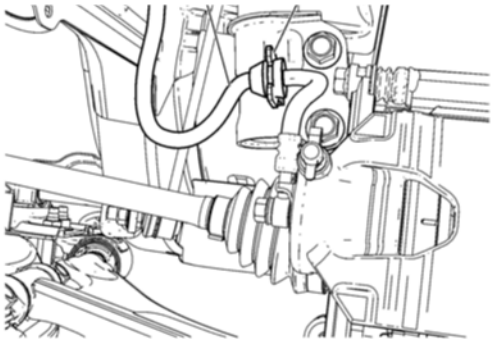




7. Click here for full size
8. Remove the brake hose retaining clipâ€‰(1) from the brake hose mounting bracket on the body frame.
9. Detach the brake hose from the brake hose mounting bracket.

cardiagn.com

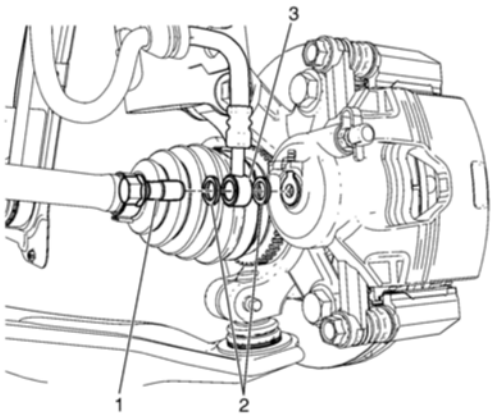




10. Click here for full size

11. Detach the brake hoseâ€‰(1) from the strut mounted brake hose retaining bracketâ€‰(2).

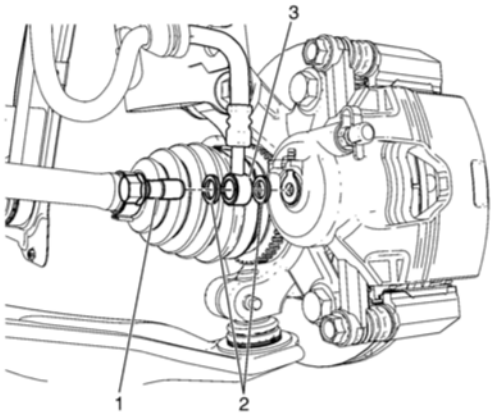
cardiagn.com



12. Click here for full size
13. Remove the brake hose-to-brake caliper banjo retaining boltâ€‰(1).
14. Remove the two copper brake hose sealing washersâ€‰(2) from the brake hoseâ€‰(3).
15. Discard the two copper brake hose sealing washers.
16. Remove the brake hoseâ€‰(3) from the vehicle.

Installation Procedure

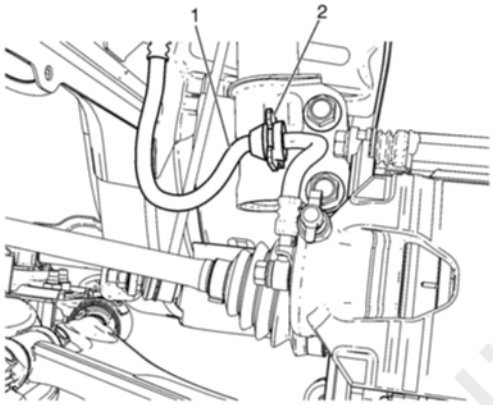
cardiagn.com



cardiagn.com

1. Click here for full size
2. Assemble the brake hose-to-brake caliper banjo retaining boltâ€‰(1) with 2â€‰new copper brake hose sealing washersâ€‰(2) to the brake hoseâ€‰(3).
3. Caution:

   Refer to Fastener Caution.
4. Install the brake hose assembly to the caliper and tighten the banjo retaining bolt to 40â€‰N-m (30â€‰lbâ€‰ft).



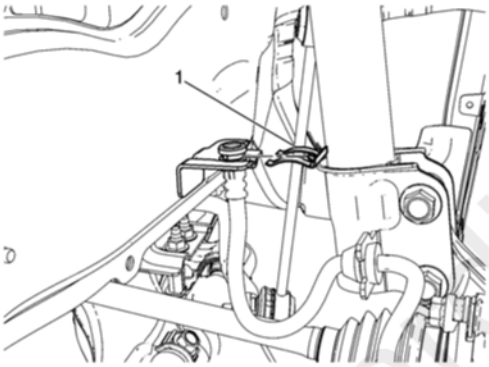
cardiagn.com

5.

Click here for full size

6. Install the brake hoseâ€¦(1) to the strut mounted brake hose retaining bracketâ€¦(2)

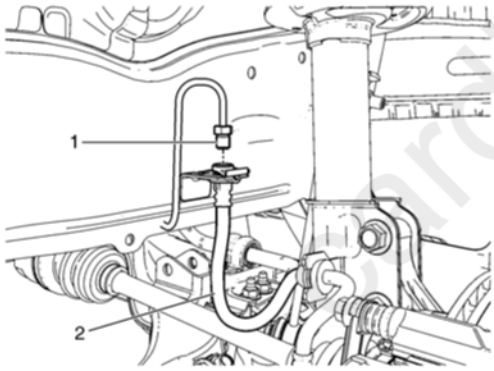
6. Install the brake hose(1) to the strut mounted brake hose retaining bracket(2).



cardiagn.com

7.
Click here for full size

8. Install the brake hose to the brake hose mounting bracket on the body frame.
9. Install the brake hose retaining clipâ€‰(1) to the brake hose mounting bracket.



ardiagn.com

10. Click here for full size

11. Connect the brake pipe fittingâ€‰(1) to the brake hoseâ€‰(2) and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).

12. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.

13. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.

Related Part Information

Part Name	Catalog Name	Part Code
Front Brake Hose	HOSE KIT,FRT BRK	0699Z
Front Brake Hose	HOSE,FRT BRK	0700A
Front Brake Hose	HOSE,FRT BRK (RPR)	0700B
Front Brake Hose	HOSE,FRT BRK	0700C

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Rear Brake Pipe Replacement - Left Side

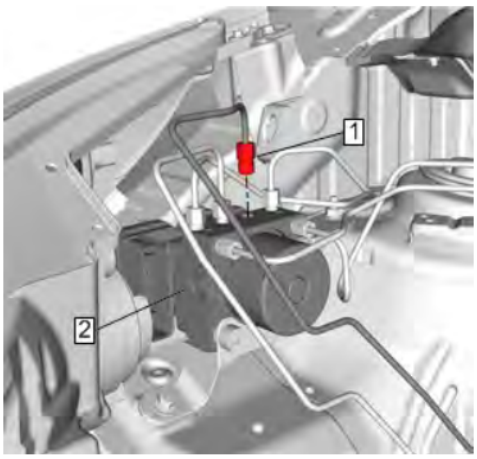
Removal Procedure

Warning:

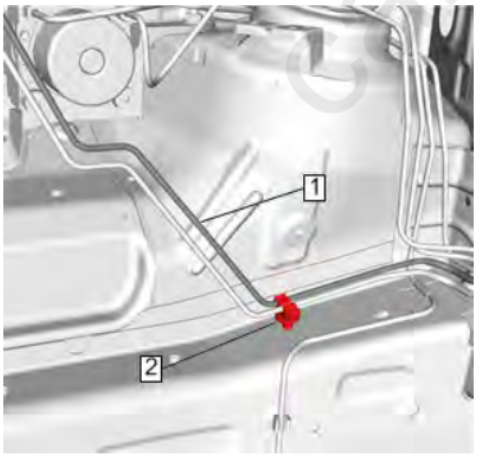
Refer to Brake Fluid Irritant Warning.

Caution:

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

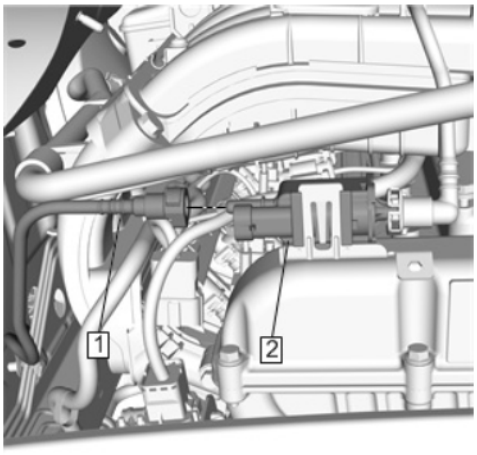
1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Radiator Surge Tank @ Vehicle >> Remove - Radiator Surge Tank Replacement
3. 

Click here for full size
4. Note:

   Cap the brake pressure modulator valve port to prevent brake fluid loss and contamination.
5. Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Remove
6. 

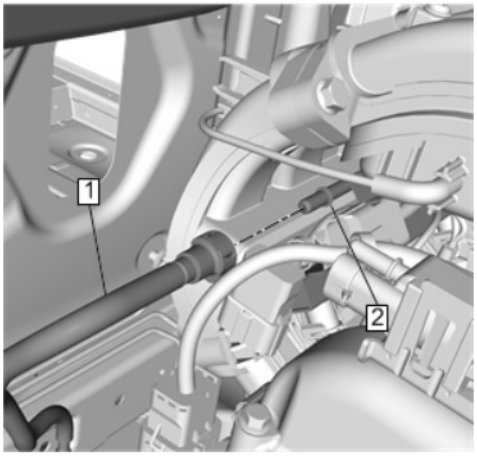
Click here for full size
7. Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip

cardiagn.com

8. 

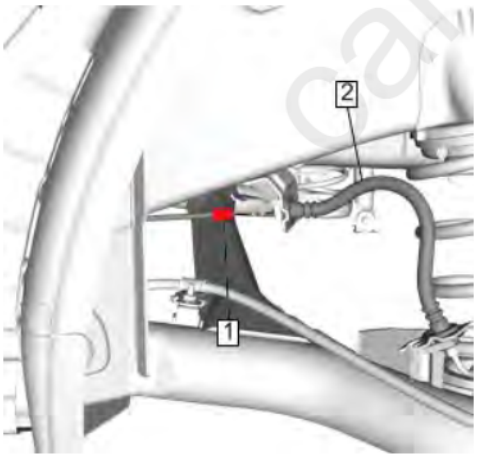
Click here for full size

9. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) >> Disconnect

10. 

Click here for full size

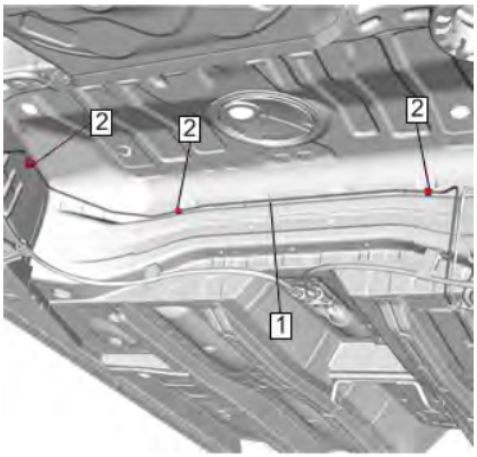
11. Fuel Feed Pipe (1) @ Fuel Rail (2) >> Disconnect
12. Drivetrain and Front Suspension Frame >> Remove - Drivetrain and Front Suspension Frame Replacement
13. Fuel Tank >> Remove - Fuel Tank Replacement

14. 

Click here for full size

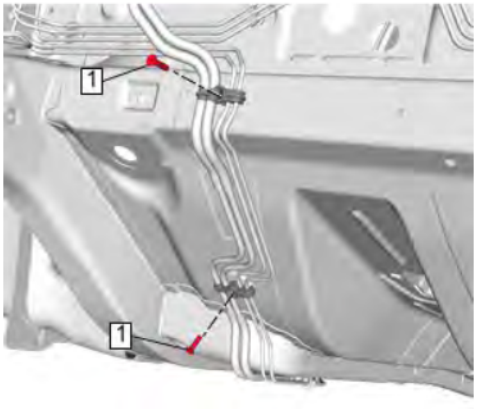
15. Rear Brake Pipe Fitting (1) @ Rear Brake Hose (2) >> Remove

cardiagn.com

16. 

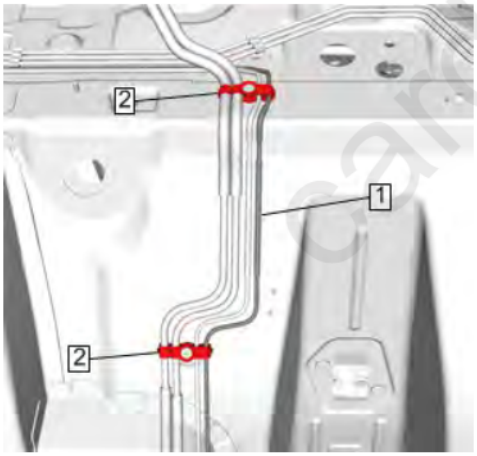
Click here for full size

17. Rear Brake Pipe (1) @ 1 Way Clip (2) >> Unclip [3x]

18. 

Click here for full size

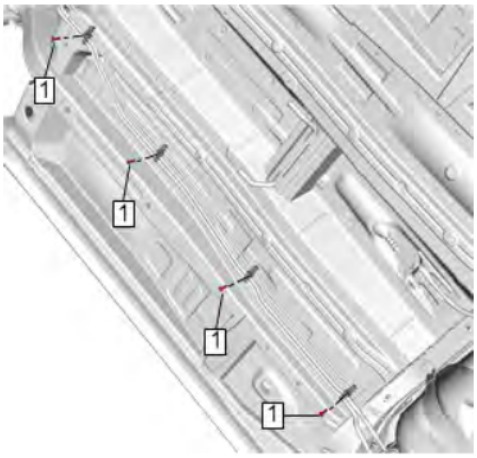
19. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Remove [2x]

20. 

Click here for full size

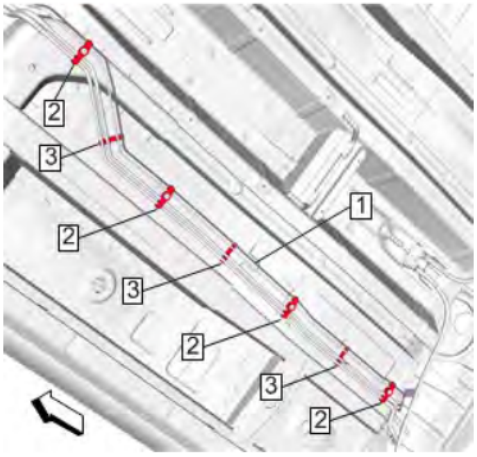
21. Rear Brake Pipe (1) @ Retainer (2) >> Unclip [2x]

cardiagn.com

22. 

Click here for full size

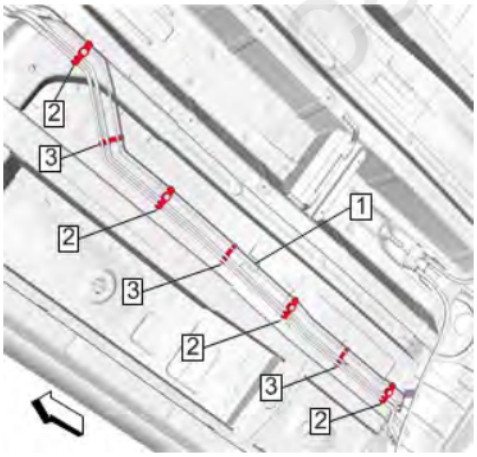
23. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Remove [4x]

24. 

Click here for full size

25. Rear Brake Pipe (1) @ Retainer (2) >> Unclip [4x]
26. Rear Brake Pipe (1) @ Clip (3) >> Unclip [3x]
27. Rear Brake Pipe (3) @ Vehicle >> Remove

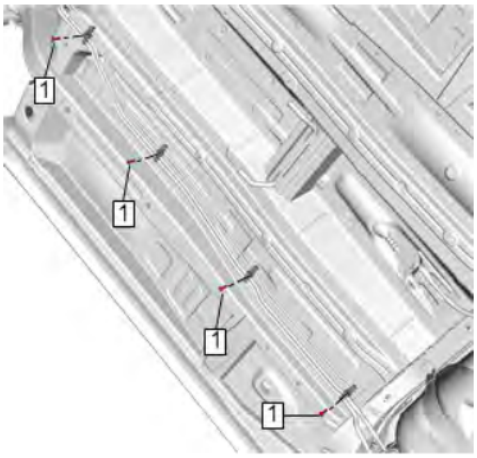
Installation Procedure

1. 

Click here for full size

2. Rear Brake Pipe (3) @ Vehicle >> Install
3. Rear Brake Pipe (1) @ Clip (3) >> Install [3x]
4. Rear Brake Pipe (1) @ Retainer (2) >> Install [4x]

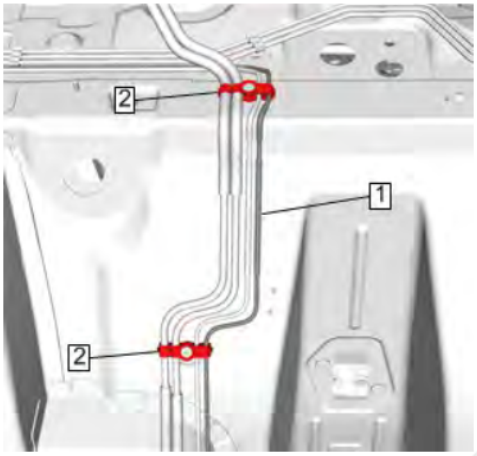
bardiagn.com

5. 

Click here for full size
6. Caution:

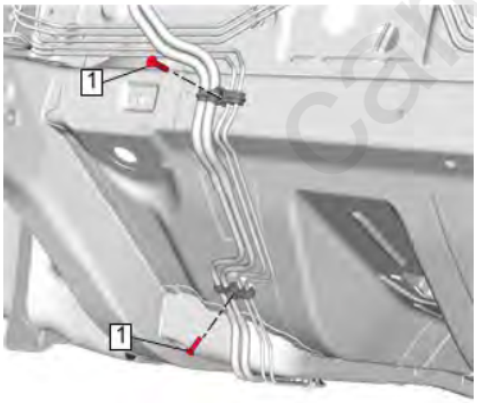
   Refer to Fastener Caution.

7. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Install and tighten [4x]3â€‰N-mâ€‰ (27â€‰lbâ€‰in)

8. 

Click here for full size

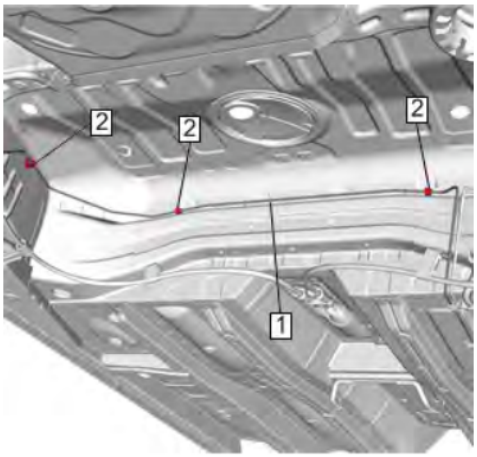
9. Rear Brake Pipe (1) @ Retainer (2) >> Install [2x]

10. 

Click here for full size

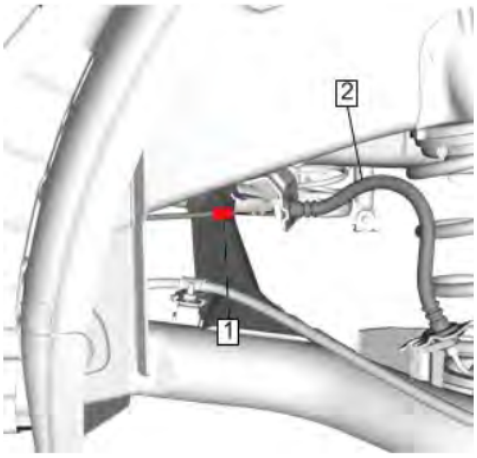
11. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Install and tighten [2x]3â€‰N-mâ€‰ (27â€‰lbâ€‰in)

cardiagn.com

12. 

Click here for full size

13. Rear Brake Pipe (1) @ 1 Way Clip (2) >> Install [3x]

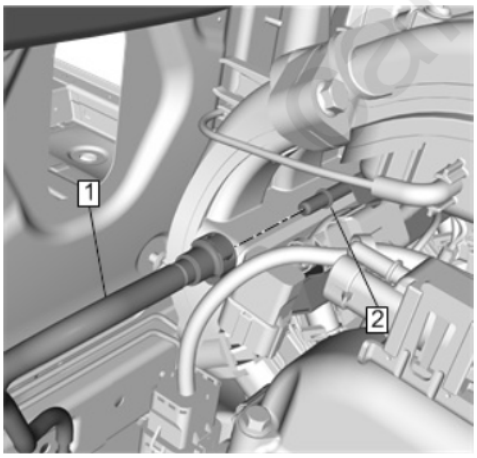
14. 

Click here for full size

15. Rear Brake Pipe Fitting (1) @ Rear Brake Hose (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)

16. Fuel Tank >> Install - Fuel Tank Replacement

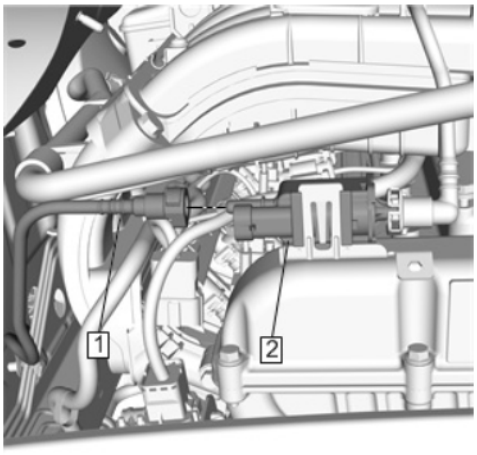
17. Drivetrain and Front Suspension Frame >> Install - Drivetrain and Front Suspension Frame Replacement

18. 

Click here for full size

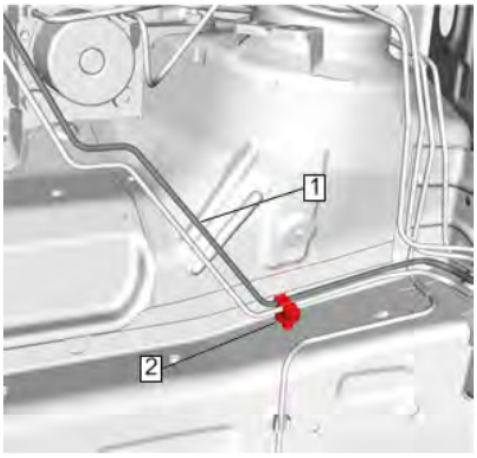
19. Fuel Feed Pipe (1) @ Fuel Rail (2) >> Connect

cardiagn.com

20. 

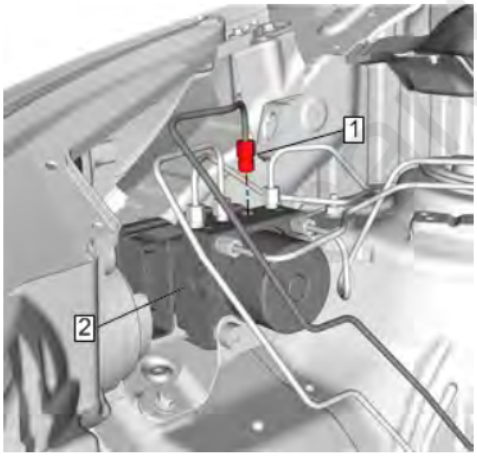
Click here for full size

21. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) >> Connect

22. 

Click here for full size

23. Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Install

24. 

Click here for full size

25. Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
26. Radiator Surge Tank @ Vehicle >> Install - Radiator Surge Tank Replacement
27. Bleed the brake system. Hydraulic Brake System Bleeding
28. Lower the vehicle.

mydiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Rear Brake Pipe Replacement - Right Side

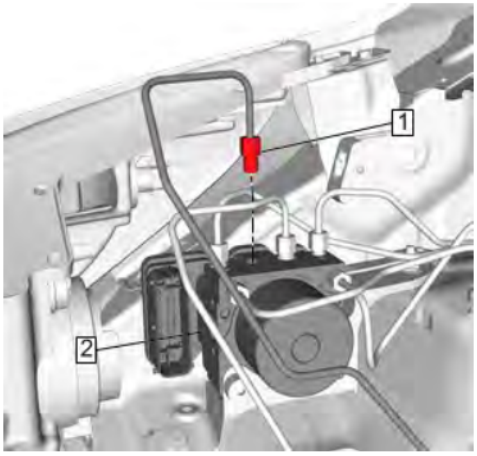
Removal Procedure

Warning:

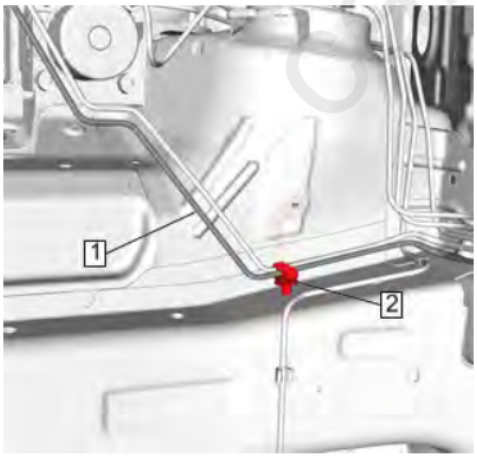
Refer to Brake Fluid Irritant Warning.

Caution:

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

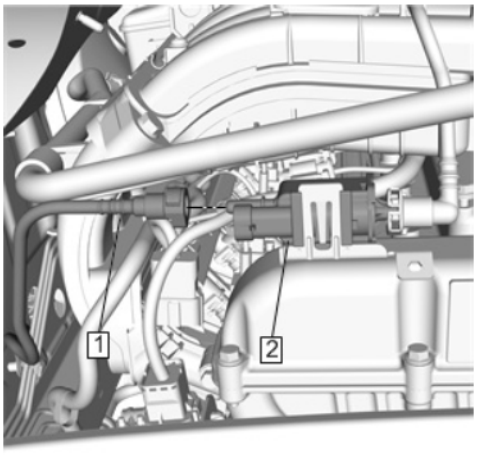
1. Raise and support the vehicle. Lifting and Jacking the Vehicle
2. Radiator Surge Tank @ Vehicle >> Remove - Radiator Surge Tank Replacement
3. 

Click here for full size
4. Note:

   Cap the brake pressure modulator valve port to prevent brake fluid loss and contamination.
5. Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Remove
6. 

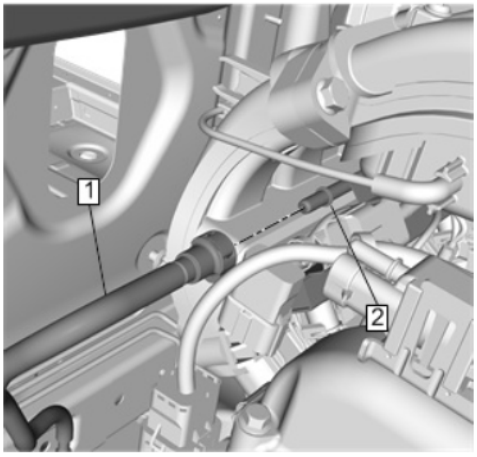
Click here for full size
7. Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Unclip

cardiagn.com

8. 

Click here for full size

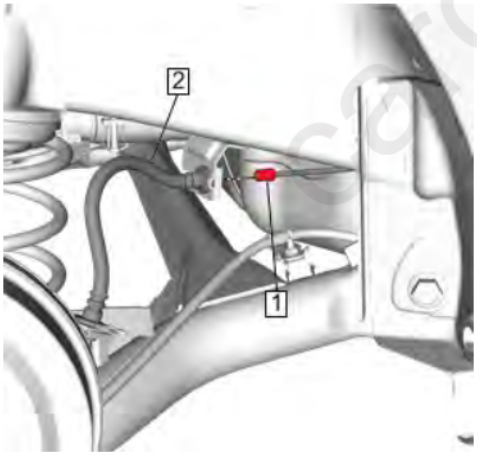
9. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) >> Disconnect

10. 

Click here for full size

11. Fuel Feed Pipe (1) @ Fuel Rail (2) >> Disconnect

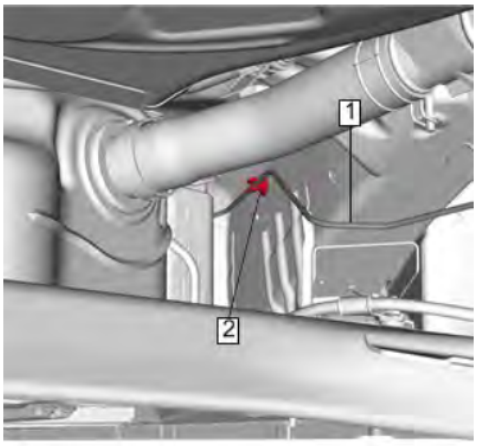
12. Drivetrain and Front Suspension Frame >> Remove - Drivetrain and Front Suspension Frame Replacement

13. 

Click here for full size

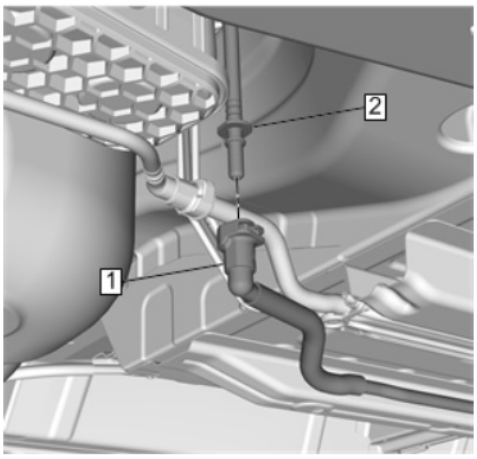
14. Rear Brake Pipe Fitting (1) @ Rear Brake Hose (2) >> Remove

cardiagn.com

15. 

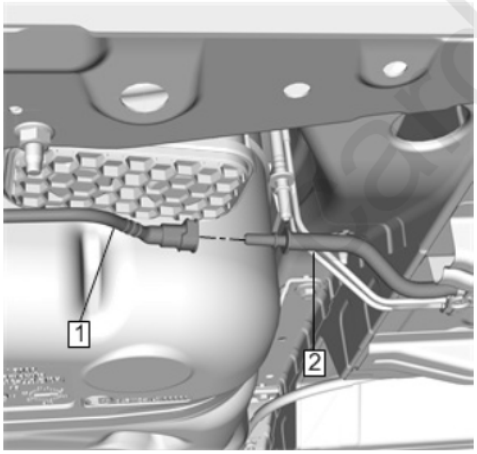
Click here for full size

16. Rear Brake Pipe (1) @ 1 Way Clip (2) >> Unclip

17. 

Click here for full size

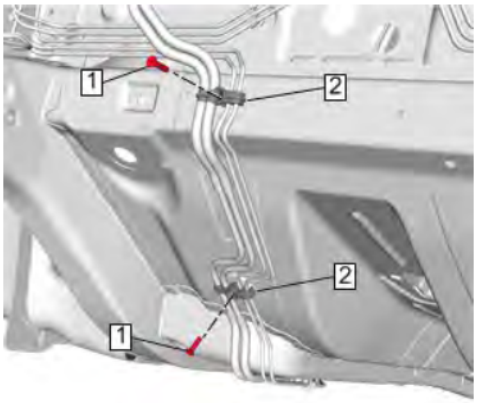
18. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Pipe (2) >> Disconnect

19. 

Click here for full size

20. Fuel Feed Pipe - Fuel Tank (1) @ Fuel Feed Pipe (2) >> Disconnect

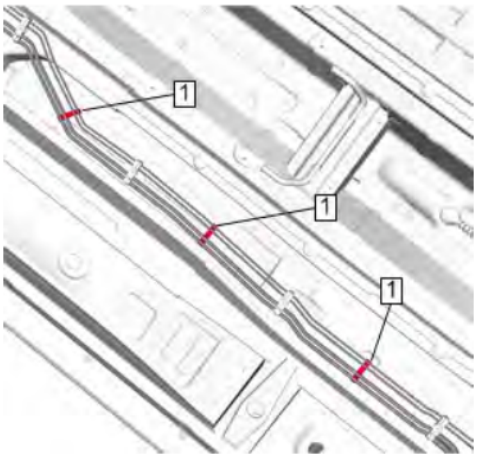
adiagn.com



21. Click here for full size

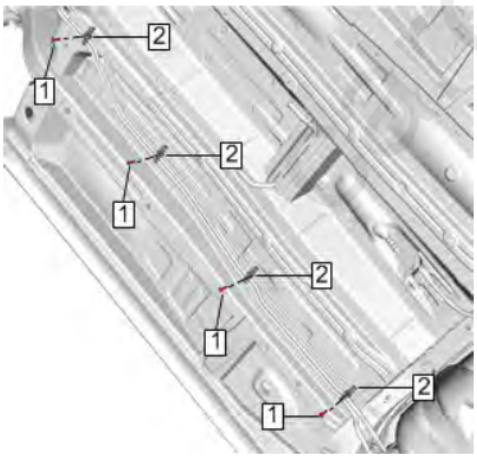
22. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Remove [2x]

23. Retainer (2) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Remove [2x]



24. Click here for full size

25. Clip (1) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Remove [3x]

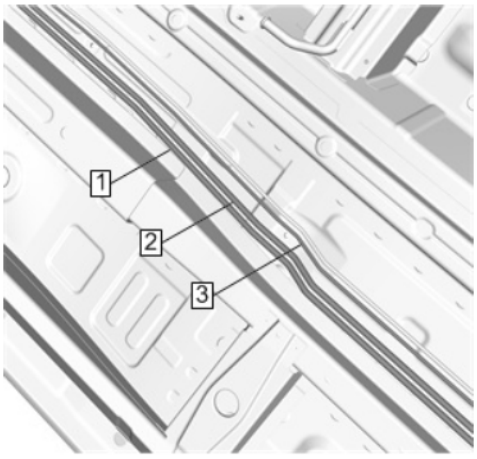


26. Click here for full size

27. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Remove [4x]

28. Retainer (2) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Remove [4x]

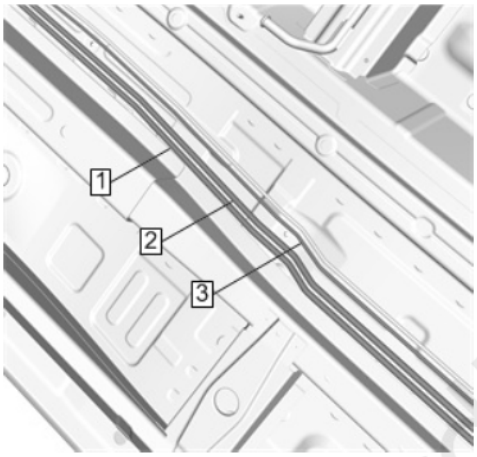
diagn.com

29. 

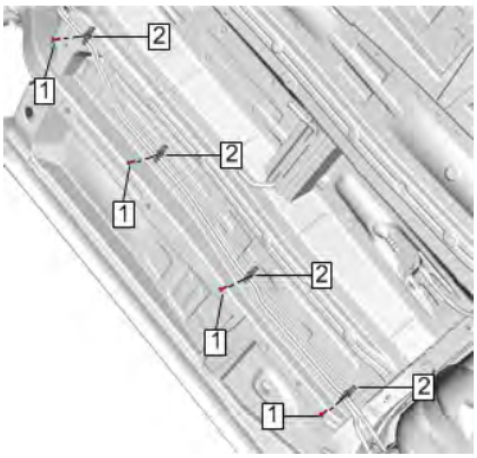
Click here for full size

30. Evaporative Emission Pipe (1) @ Vehicle >> Remove
31. Fuel Feed Pipe (2) @ Vehicle >> Remove
32. Rear Brake Pipe (3) @ Vehicle >> Remove

Installation Procedure

1. 

Click here for full size

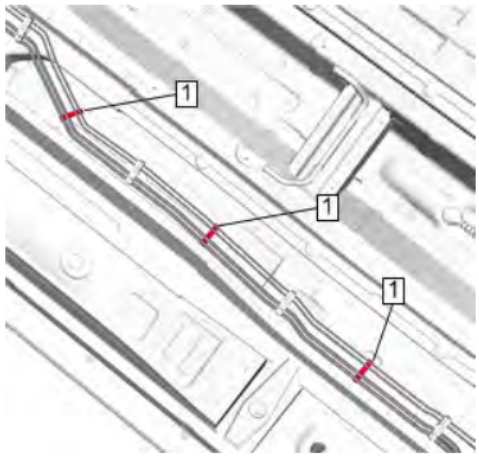
2. Rear Brake Pipe (3) @ Vehicle >> Install
3. Fuel Feed Pipe (2) @ Vehicle >> Install
4. Evaporative Emission Pipe (1) @ Vehicle >> Install
5. 

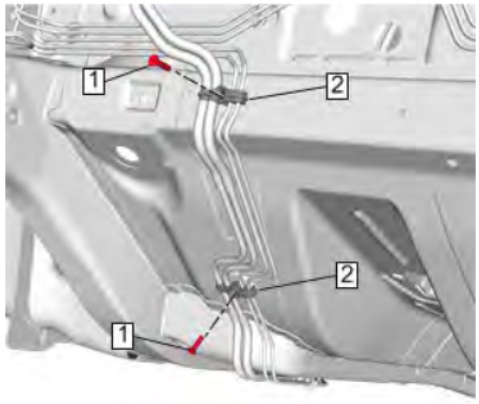
Click here for full size

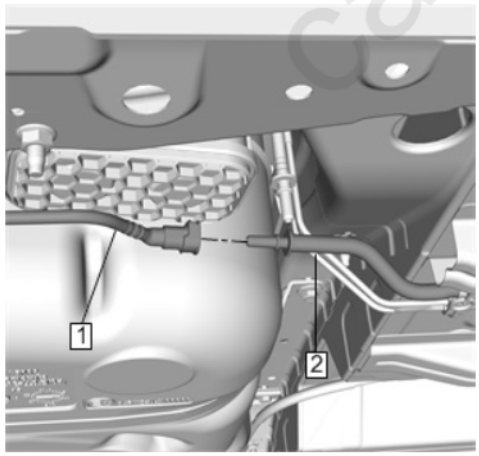
6. Retainer (2) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Install [4x]
7. Caution:

cardiagn.com

Refer to Fastener Caution.

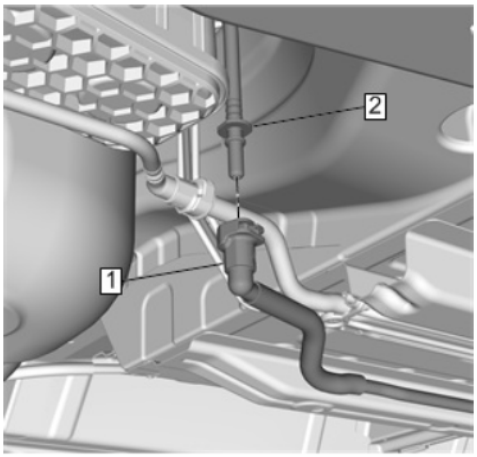
8. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Install and tighten [4x]3â€‰N-mâ€‰ (27â€‰lbâ€‰in)
9. 

Click here for full size
10. Clip (1) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Install [3x]
11. 

Click here for full size
12. Retainer (2) @ Brake, Fuel Feed and Evaporative Emission Pipe >> Install [2x]
13. Brake Pipe Retainer Bolt (1) @ Body Lower Structure >> Install and tighten [2x]3â€‰N-mâ€‰ (27â€‰lbâ€‰in)
14. 

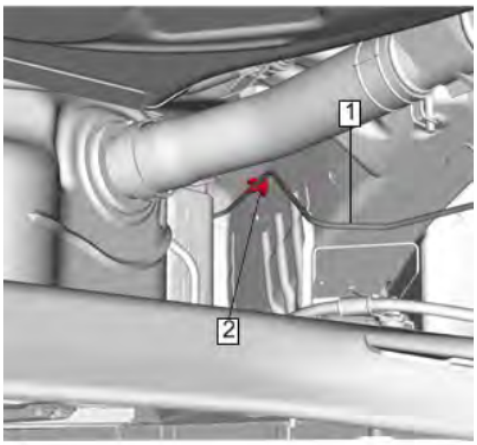
Click here for full size
15. Fuel Feed Pipe - Fuel Tank (1) @ Fuel Feed Pipe (2) >> Connect

cardiagn.com

16. 

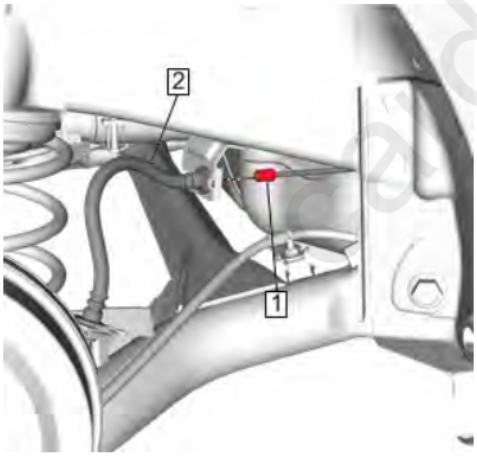
Click here for full size

17. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Pipe (2) >> Connect

18. 

Click here for full size

19. Rear Brake Pipe (1) @ 1 Way Clip (2) >> Install

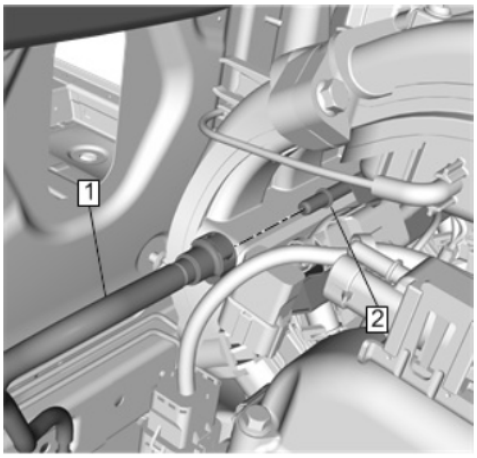
20. 

Click here for full size

21. Rear Brake Pipe Fitting (1) @ Rear Brake Hose (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)

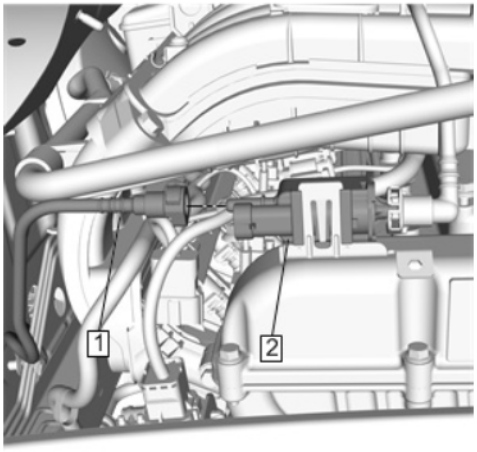
22. Drivetrain and Front Suspension Frame >> Remove - Drivetrain and Front Suspension Frame Replacement

mydiagn.com

23. 

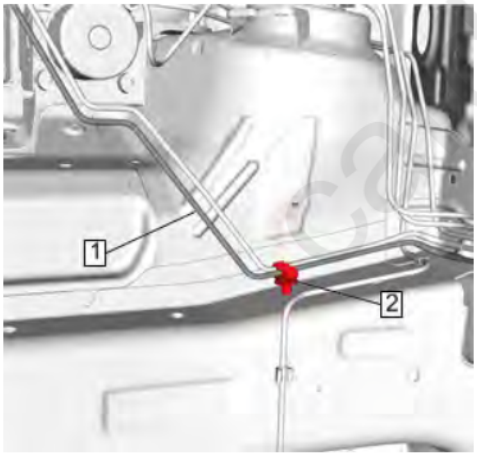
Click here for full size

24. Fuel Feed Pipe (1) @ Fuel Rail (2) >> Connect

25. 

Click here for full size

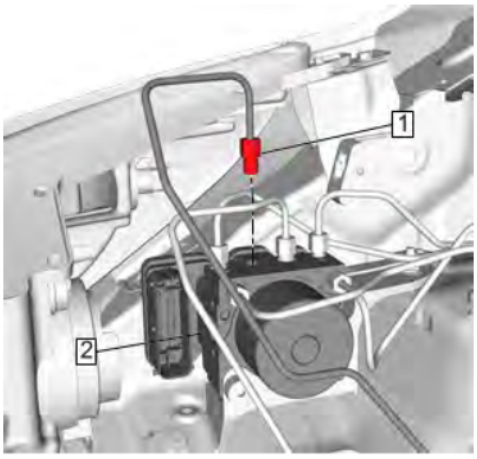
26. Evaporative Emission Pipe (1) @ Evaporative Emission Canister Purge Solenoid Valve (2) >> Connect

27. 

Click here for full size

28. Rear Brake Pipe (1) @ Brake Pipe Clip (2) >> Install

carDiagn.com

29. 

Click here for full size

30. Rear Brake Pipe Fitting (1) @ Brake Pressure Modulator Valve (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
31. Radiator Surge Tank @ Vehicle >> Install - Radiator Surge Tank Replacement
32. Bleed the brake system. Hydraulic Brake System Bleeding
33. Lower the vehicle.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Rear Brake Rear Pipe Replacement

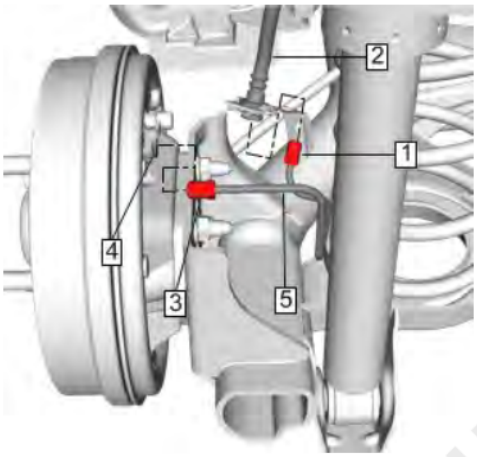
Removal Procedure

Warning:

Refer to Brake Fluid Irritant Warning.

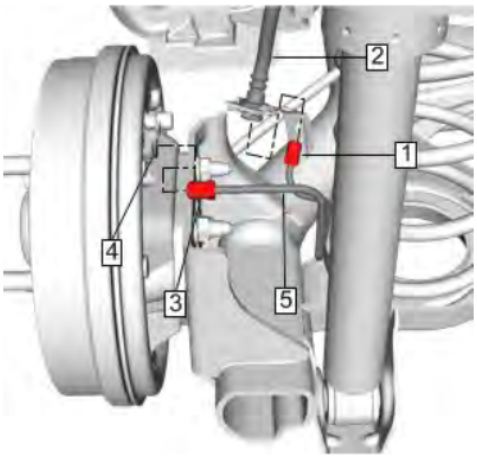
Caution:

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

1. Raise and support the vehicle. Vehicle Lifting and Jacking Caution
2. Remove the rear tire and wheel assembly. Tire and Wheel Removal and Installation
3. Clean all dirt and foreign material from the brake hose ends and the brake pipe fitting.
4. 

Click here for full size
5. Rear Brake Rear Pipe Fitting (1) @ Rear Brake Hose (2) >> Remove
6. Cap the brake pipe fitting to prevent brake fluid loss and contamination.
7. Rear Brake Rear Pipe Fitting (3) @ Rear Brake Cylinder (4) >> Remove
8. Rear Brake Rear Pipe (5) @ Vehicle >> Remove

Installation Procedure

1. 

Click here for full size
2. Rear Brake Rear Pipe (5) @ Vehicle >> Install

cardiagn.com

3. Caution:

   Refer to Fastener Caution.

4. Rear Brake Rear Pipe Fitting (3) @ Rear Brake Cylinder (4) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
5. Rear Brake Rear Pipe Fitting (1) @ Rear Brake Hose (2) >> Install and tighten 18â€‰N-mâ€‰ (13â€‰lbâ€‰ft)
6. Bleed the brake system. Hydraulic Brake System Bleeding
7. Install the rear tire and wheel assembly. Tire and Wheel Removal and Installation
8. Lower the vehicle.

Related Part Information

Part Name	Catalog Name	Part Code
Rear Brake Rear Pipe	PIPE,RR BRK RR	1618B
Rear Brake Rear Pipe	PIPE,RR BRK RR	1850A
Rear Brake Rear Pipe	PIPE,RR BRK RR (RPR)	X0032

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Rear Brake Hose Replacement

Removal Procedure

Warning**:**

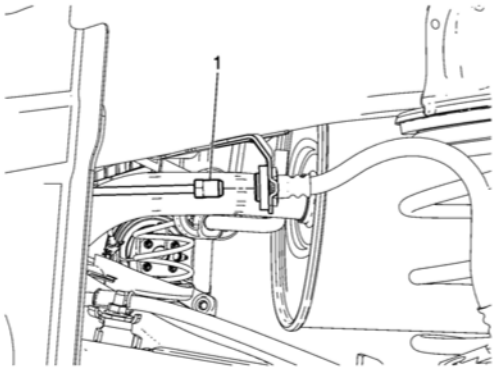
Refer to Brake Fluid Irritant Warning.

Caution**:**

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

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
3. Clean all dirt and foreign material from the brake hose ends and brake pipe fittings.

cardiagn.com

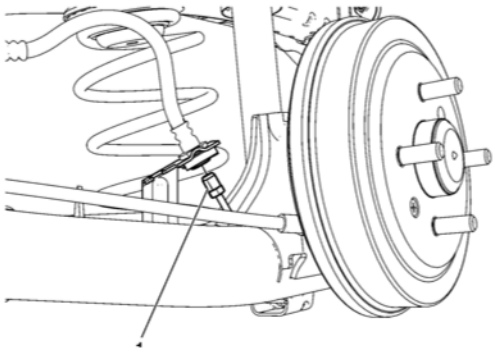


4. Click here for full size

5. Disconnect the brake pipe fittingâ€‰(1) from the brake hose at the rear brake pipe side.

6. Cap or plug the brake pipe fitting end to prevent brake fluid loss and contamination.

cardiagn.com



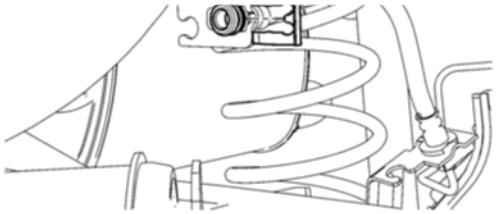
7. Click here for full size

8. Disconnect the brake pipe fittingâ€‰(1) from the brake hose at the wheel cylinder side.

9. Cap or plug the brake pipe fitting end to prevent brake fluid loss and contamination.

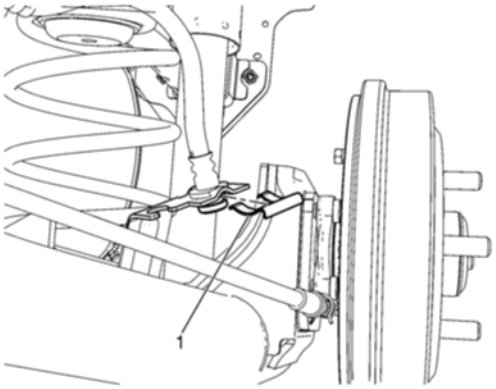
cardiagn.com





10. Click here for full size
11. Remove the brake hose retaining clipâ€‰(1) from the brake hose mounting bracket on the body frame.
12. Detach the brake hose from the brake hose mounting bracket.

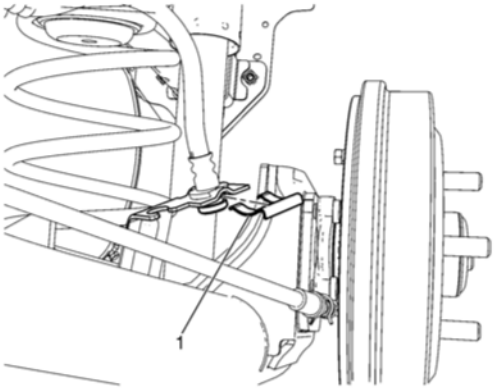
cardiagn.com



13. Click here for full size
14. Remove the brake hose retaining clipâ€‰(1) from the brake hose mounting bracket on the rear axle.
15. Remove the brake hose from the brake hose mounting bracket.

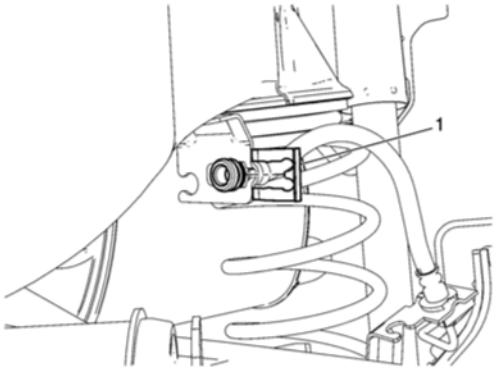
Installation Procedure

cardiagn.com



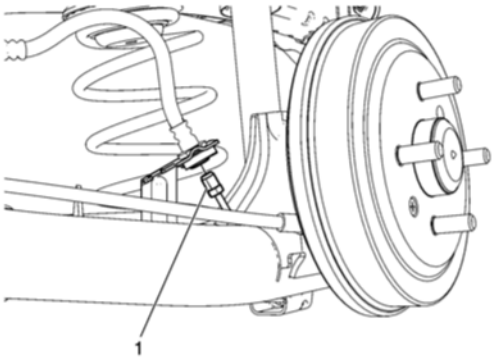
cardiagn.com

1. Click here for full size
2. Install the brake hose to the brake hose mounting bracket on the rear axle.
3. Install the brake hose retaining clipâ€‰(1) onto the hose fitting at the brake hose mounting bracket.



cardiagn.com

4. Click here for full size
5. Install the brake hose to the brake hose mounting bracket on the body frame.
6. Install the brake hose retaining clipâ€‰(1) onto the hose fitting at the brake hose mounting bracket.

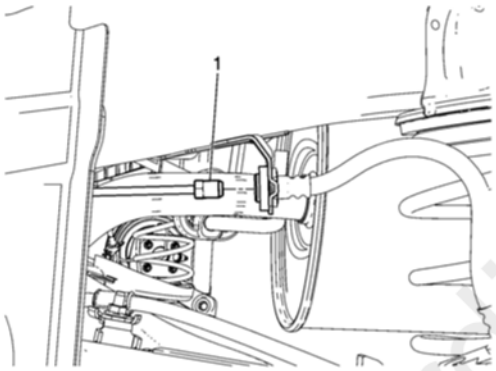


cardiagn.com

7. Click here for full size
8. Caution:

   Refer to Fastener Caution.

9. Connect the brake pipe fittingâ€‰(1) to the brake hose at the wheel cylinder side and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).



cardiagn.com

Click here for full size

11. Connect the brake pipe fittingâ€‰(1) to the brake hose at the rear brake pipe side and tighten to 18â€‰N-m (13â€‰lbâ€‰ft).
12. Bleed the hydraulic brake system. Refer to Hydraulic Brake System Bleeding.
13. Install the tire and wheel assembly. Refer to Tire and Wheel Removal and Installation.
14. Lower the vehicle.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Hydraulic Brake System Bleeding (Pressure)

Special Tools

- *CH-29532* Diaphragm Type Brake Pressure Bleeder
- *CH-50253* Brake Pressure Bleeder Adapter

Warning**:**

Refer to Brake Fluid Irritant Warning.

Caution**:**

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

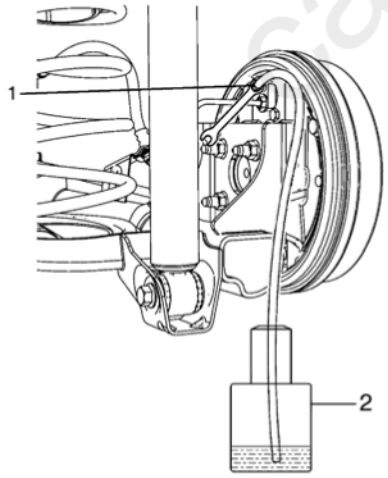
1. Place a clean shop cloth beneath the brake master cylinder reservoir to catch brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3â€“5 times, or until the brake pedal effort increases significantly, to deplete the brake booster power reservoir.
3. If you have performed a master cylinder bench bleeding on this vehicle, or if you have disconnected the brake pipes from the proportioning valve assembly or the brake modulator assembly, you must perform the following steps to bleed air at the ports of the hydraulic components.
4.
    1. Fill the master cylinder reservoir to the maximum-full level with the approved brake fluid from a clean, sealed brake fluid container.
    2. If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.
    3. With the brake pipes installed securely to the master cylinder, proportioning valve assembly, or the brake pressure modulator valve assembly, loosen and separate one of the brake pipes from the port of the component.
    4. Note**:**

       For the proportioning valve assembly or the brake pressure modulator valve assembly, perform these steps in the sequence of system flow; begin with the fluid feed pipes on the master cylinder.
    5. Allow a small amount of brake fluid to gravity bleed from the open port of the component.
    6. Connect the brake pipe fitting to the component and tighten securely.
    7. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
    8. Loosen the same brake pipe fitting to purge air from the open port of the component.
    9. Tighten the brake pipe fitting, then have the assistant slowly release the brake pedal.
    10. Wait 15â€‰seconds, then repeat steps 3.3â€“3.7 until all air is purged from the same port of each component.
    11. With the brake pipe fitting installed securely to the master cylinder, proportioning valve assembly, or brake pressure modulator assembly after all air has been purged from the first port of the component that was bled, loosen and separate the next brake pipe from the component and repeat steps 3.3â€“3.8 until each of the ports on the component has been bled.
    12. After completing the final component port bleeding procedure, ensure that each of the brake pipe fittings is properly tightened.
5. Fill the brake master cylinder reservoir to the maximum-fill level with the approved brake fluid from a clean, sealed brake fluid container. Ensure the master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to remain the proper level.
6. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
7. Set up the brake pressure bleeder following the manufacturer's instructions.
8. Open the brake pressure bleeder fluid valve to allow pressurized brake fluid to enter the brake system.

cardiagn.com

9. Wait approximately 30 seconds, and then inspect the entire hydraulic brake system in order to ensure that there are no existing external brake fluid leaks.

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



cardiagn.com

11. Click here for full size

12. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valveâ€‰(1).

13. Install a transparent hose over the end of the wheel hydraulic circuit bleeder valveâ€‰(1).

14. Submerge the open end of the transparent hose into a transparent containerâ€‰(2) partially filled with the approved brake fluid from a clean, sealed brake fluid container.

15. 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.

16. Tighten the wheel circuit bleeder valve securely.

17. Install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.

18. Install a transparent hose over the end of the wheel hydraulic circuit bleeder valve, then repeat steps 10â€“12.

19. Install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.

20. Install a transparent hose over the end of the wheel hydraulic circuit bleeder valve, then repeat steps 10â€“12.

21. Install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.

22. Install a transparent hose over the end of the wheel hydraulic circuit bleeder valve, then repeat steps 10â€“12.

23. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves is properly tightened.

24. Close the brake pressure bleeder fluid valve.

25. Remove the brake pressure bleeder from the brake master cylinder reservoir.

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

27. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.

28. 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 step:

29.

cardiagn.com

1. Inspect the brake system for external leaks. Refer to Brake System External Leak Inspection.
2. If equipped with antilock brakes, using a scan toll, perform the antilock brake system automated bleeding procedure to remove any air that may have been trapped in the brake pressure modulator valve (BPMV). Refer to Antilock Brake System Automated Bleed

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

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Hydraulic Brake System Bleeding (Manual)

Warning**:**

Refer to Brake Fluid Irritant Warning.

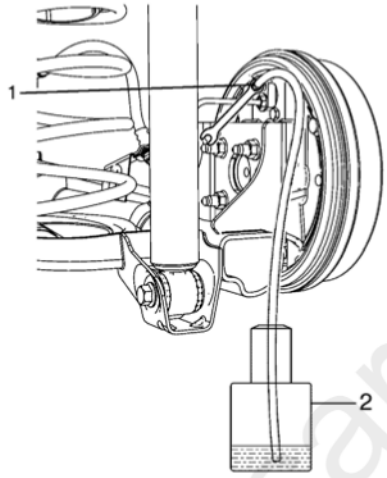
Caution**:**

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

1. Place a clean shop cloth beneath the brake master cylinder to catch brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3â€“5 times, or until the brake pedal effort increases significantly, to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you have disconnected the brake pipes from the proportioning valve assembly or the brake pressure modulator assembly, you MUST perform the following steps to bleed air at the ports of the hydraulic component.
4.
    1. Fill the master cylinder reservoir to the maximum-full level with the approved brake fluid from a clean, sealed brake fluid container.
    2. If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.
    3. With the brake pipes installed securely to the master cylinder, proportioning valve assembly, or brake pressure modulator valve assembly, loosen and separate one of the brake pipes from the port of the component.
    4. Note**:**

       For the proportioning valve assembly or the brake pressure modulator valve assembly, perform these steps in the sequence of system flow; begin with the fluid feed pipes on the master cylinder.
    5. Allow a small amount of brake fluid to gravity bleed from the open port of the component.
    6. Connect the brake pipe fitting to the component and tighten securely.
    7. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal.
    8. Loosen the same brake pipe fitting to purge air from the open port of the component.
    9. Tighten the brake pipe fitting, then have the assistant slowly release the brake pedal.
    10. Wait 15â€‰seconds, then repeat steps 3.3â€“3.7 until all air is purged from the same port of each component.
    11. With the brake pipe fitting installed securely to the master cylinder, proportioning valve assembly, or brake pressure modulator valve assembly after all air has been purged from the first port of the component that was bled, loosen and separate the next brake pipe from the component and repeat steps 3.3â€“3.8 until each of the ports on the component has been bled.
    12. After completing the final component port bleeding procedure, ensure that each of the brake pipe fittings is properly tightened.
5. Fill the master cylinder reservoir to the maximum-full level with the approved brake fluid from a clean, sealed brake fluid container. Ensure the master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to maintain the proper level.
6. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.

cardiagn.com



cardiagn.com

7. Click here for full size

8. Install a proper box-end wrench onto the RIGHT REAR wheel hydraulic circuit bleeder valveâ€‰(1).
9. Install a transparent hose over the end of the wheel hydraulic circuit bleeder valveâ€‰(1).
10. Submerge the open end of the transparent hose into a transparent container partially filled with the approved brake fluid from a clean, sealed brake fluid container.
11. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the 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 15â€‰seconds, then repeat steps 8â€“10 until all air is purged from the wheel hydraulic circuit.
15. Tighten the wheel circuit bleeder valve securely.
16. Install a proper box-end wrench onto the LEFT FRONT wheel hydraulic circuit bleeder valve.
17. Install a transparent hose over the end of the bleeder valve, then repeat steps 7â€“12.
18. Install a proper box-end wrench onto the LEFT REAR wheel hydraulic circuit bleeder valve.
19. Install a transparent hose over the end of the bleeder valve, then repeat steps 7â€“12.
20. Install a proper box-end wrench onto the RIGHT FRONT wheel hydraulic circuit bleeder valve.
21. Install a transparent hose over the end of the bleeder valve, then repeat steps 7â€“12.
22. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 wheel hydraulic circuit bleeder valves is properly tightened.
23. Fill the brake master cylinder reservoir to the maximum-full level with the approved brake fluid from a clean, sealed brake fluid container.
24. Slowly depress and release the brake pedal. Observe the brake pedal feel.
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:
26.
    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.
27. Turn the ignition ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated.
28. Note:

    DO NOT allow the vehicle to be driven until it is diagnosed and repaired.
29. If the brake system warning lamp remains illuminated, refer to Symptoms - Hydraulic Brakes.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Hydraulic Brake System Flushing

Warning**:**

Refer to Brake Fluid Irritant Warning.

Caution**:**

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

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

cardiagn.com

8.

- Brake 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. Refer to Brake Master Cylinder Reservoir Replacement.
- Front Brake Hose Replacement
- Rear Brake Hose Replacement
- Front Brake Caliper Replacement
- Rear Brake Cylinder Replacement
- Brake Pressure Modulator Valve Replacement

6. 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 which may have allowed the moisture or particles to enter the hydraulic system.
7. Fill the brake master cylinder reservoir to the maximum-fill level with the approved brake fluid from a clean, sealed brake fluid container.
8. 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. Refer to Hydraulic Brake System Bleeding.

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Power Vacuum Brake Booster Replacement

Removal Procedure

Warning**:**

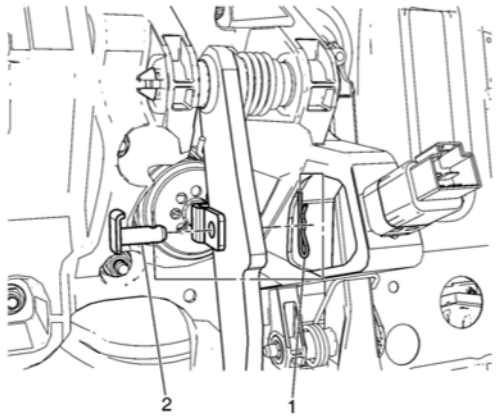
Refer to Brake Fluid Irritant Warning.

Caution**:**

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

1. Apply and release the brake pedal several times until it becomes firm to deplete the brake booster vacuum reserve.
2. Remove the master cylinder. Refer to Brake Master Cylinder Replacement.
3. Remove the power vacuum brake booster check valve and hose assembly from the brake booster grommet.
4. Remove the steering column opening filler. Refer to Steering Column Opening Filler Replacement.

cardiagn.com

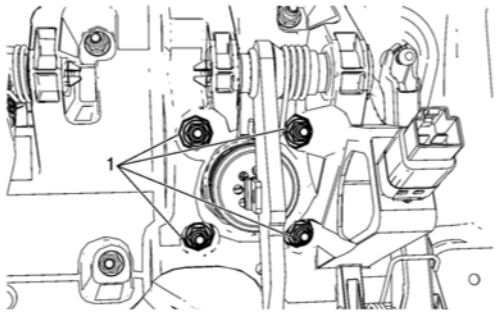


5. Click here for full size

6. Remove the retaining clipâ€‰(1) and pinâ€‰(2) from brake pedal.

7. Separate the brake booster pushrod from the brake pedal.

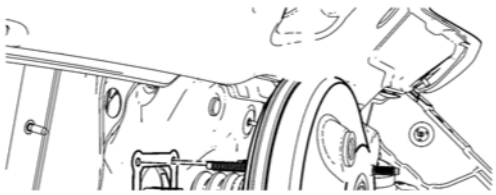
cardiagn.com



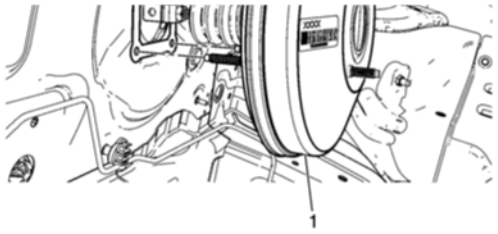


8. Click here for full size

9. Remove the brake booster to accelerator, brake and clutch (ABC) pedal module retaining nutsâ€‰(1) from the ABC pedal module.



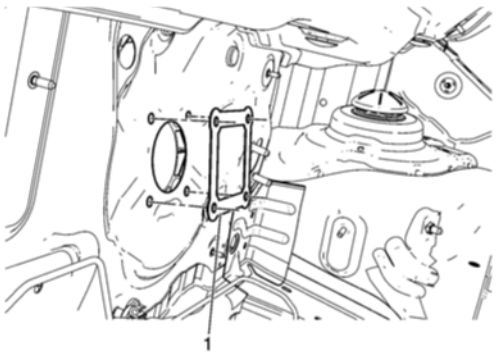
cardiagn.com



10. Click here for full size

11. Remove the power vacuum brake boosterâ€‰(1).

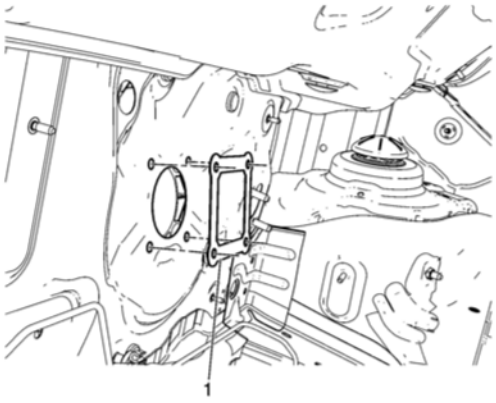
cardiagn.com



12. Click here for full size
13. Remove the power vacuum brake booster gasketâ€‰(1).
14. Inspect the power vacuum brake booster gasket for damage and replace if necessary.

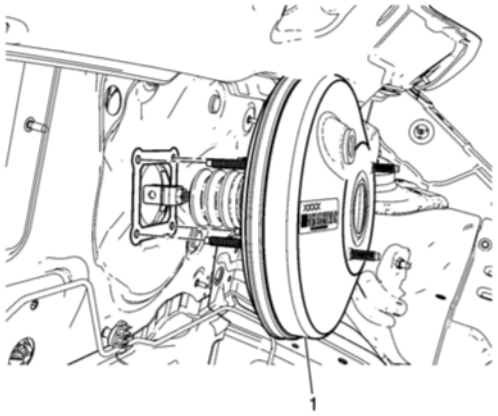
Installation Procedure

cardiagn.com



cardiagn.com

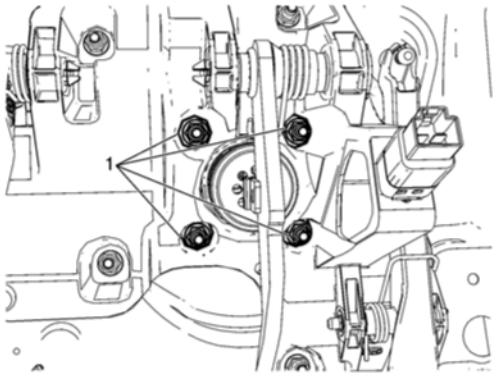
1. Click here for full size
2. Install the power vacuum brake booster gasketâ€‰(1).



cardiagn.com

3. Click here for full size

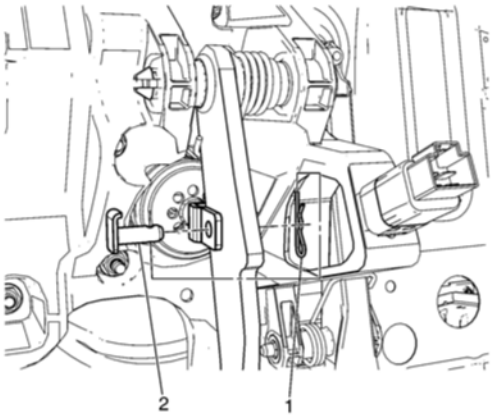
4. Install the power vacuum brake boosterâ€‰(1).



cardiagn.com

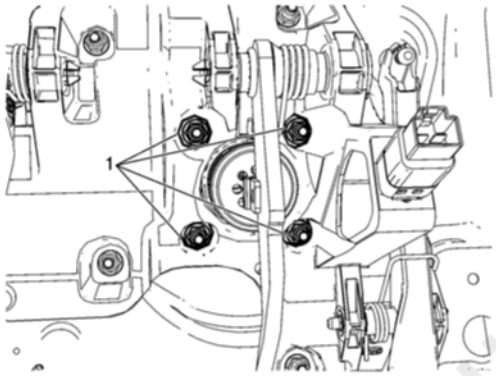
5. Click here for full size

6. Loosely install the brake booster to ABC pedal module retaining nutsâ€‰(1).



cardiagn.com

7. Click here for full size
8. Connect the brake booster pushrod to the brake pedal.
9. Install the pushrod pinâ€‰(2) to the brake pedal and insert the retaining clipâ€‰(1) to the pinâ€‰(2).



cardiagn.com

10. Click here for full size
11. Caution:

Refer to Fastener Caution.

12. Completely tighten the brake booster to ABC pedal module retaining nutsâ€‰(1) and tighten to 22â€‰N-m (16â€‰lbâ€‰ft).
13. Install the steering column opening filler. Refer to Steering Column Opening Filler Replacement.
14. Install the power vacuum brake booster check valve and hose assembly to the brake booster grommet.
15. Install the master cylinder. Refer to Brake Master Cylinder Replacement.

Related Part Information

Part Name	Catalog Name	Part Code
Power Brake Booster	BOOSTER PKG,P/B	0049Y
Power Brake Booster	BOOSTER,P/B	0050A
Power Brake Booster	BOOSTER KIT,P/B(VAC)	0050B
Power Brake Booster	BOOSTER,P/B(VAC)	0050D
Power Brake Booster	BOOSTER,P/B (VAC)	0050F
Power Brake Booster	BOOSTER,P/B	0050H
Power Brake Booster	BOOSTER,P/B (W/ VAC SEN)	0052A

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Power Vacuum Brake Booster Replacement (PMC)

Removal Procedure

Warning**:**

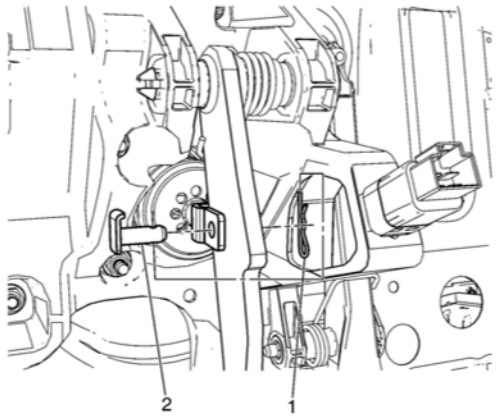
Refer to Brake Fluid Irritant Warning.

Caution**:**

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

1. Apply and release the brake pedal several times until it becomes firm to deplete the brake booster vacuum reserve.
2. Remove the master cylinder. Refer to Brake Master Cylinder Replacement.
3. Remove the power vacuum brake booster check valve and hose assembly from the brake booster grommet.
4. Remove the steering column opening filler. Refer to Steering Column Opening Filler Replacement.

cardiagn.com

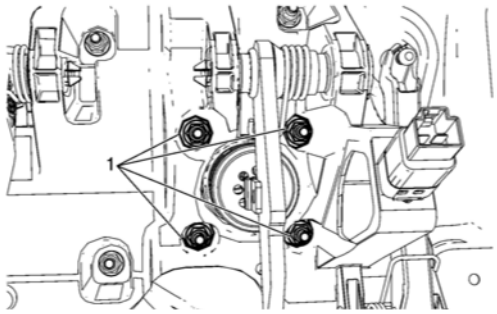


5. Click here for full size

6. Remove the retaining clipâ€‰(1) and pinâ€‰(2) from brake pedal.

7. Separate the brake booster pushrod from the brake pedal.

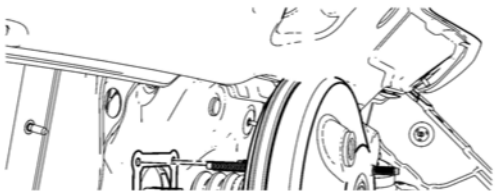
cardiagn.com



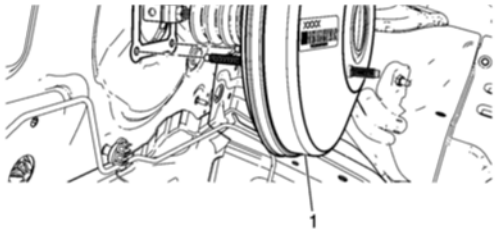


8. Click here for full size

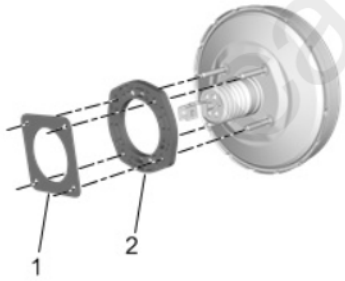
9. Remove the brake booster to accelerator, brake and clutch (ABC) pedal module retaining nutsâ€‰(1) from the ABC pedal module.



cardiagn.com



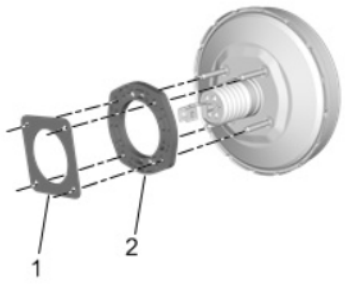
10. Click here for full size
11. Remove the power vacuum brake boosterâ€‰(1) from the vehicle.



12. Click here for full size
13. Remove the brake master cylinder spacer gasket (1) and brake master cylinder spacer (2) from the power vacuum brake booster.
14. Inspect the brake master cylinder spacer gasket for damage and replace if necessary.

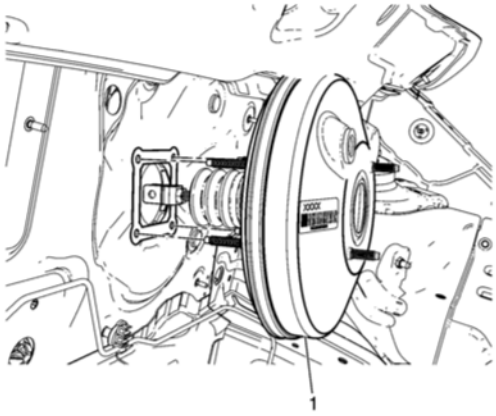
Installation Procedure

cardiagn.com



1. Click here for full size
2. Install the brake master cylinder spacer gasket (1) and brake master cylinder spacer (2) to the power vacuum brake booster.

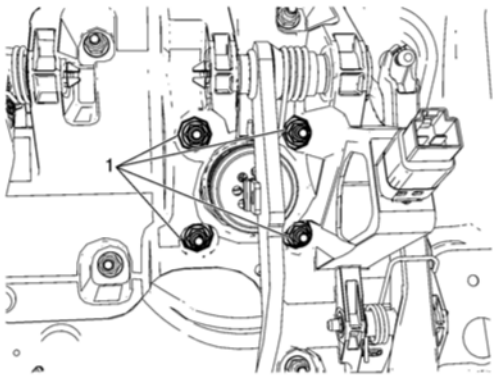
cardiagn.com



3.
Click here for full size

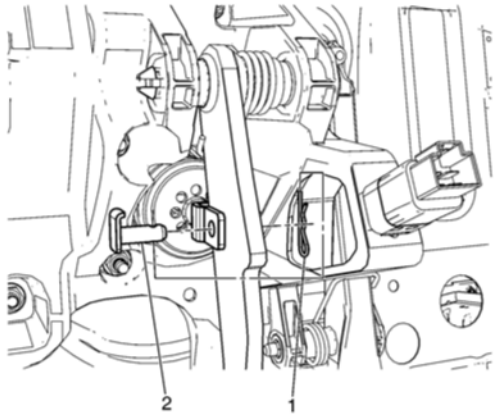
4. Install the power vacuum brake boosterâ€‰(1) to the vehicle.

cardiagn.com



5.
Click here for full size

6. Loosely install the brake booster to ABC pedal module retaining nutsâ€‰(1).

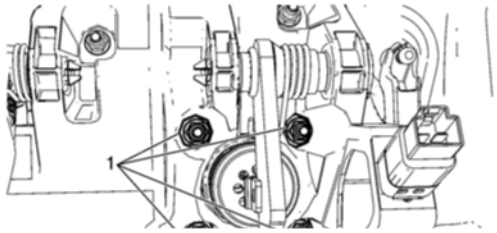


cardiagn.com

7. Click here for full size

8. Connect the brake booster pushrod to the brake pedal.

9. Install the pushrod pinâ€‰(2) to the brake pedal and insert the retaining clipâ€‰(1) to the pinâ€‰(2).



cardiagn.com



10. Click here for full size
11. Caution:

    Refer to Fastener Caution.

12. Completely tighten the brake booster to ABC pedal module retaining nutsâ€‰(1) and tighten to 22â€‰N-m (16â€‰lbâ€‰ft).
13. Install the steering column opening filler. Refer to Steering Column Opening Filler Replacement.
14. Install the power vacuum brake booster check valve and hose assembly to the brake booster grommet.
15. Install the master cylinder. Refer to Brake Master Cylinder Replacement.

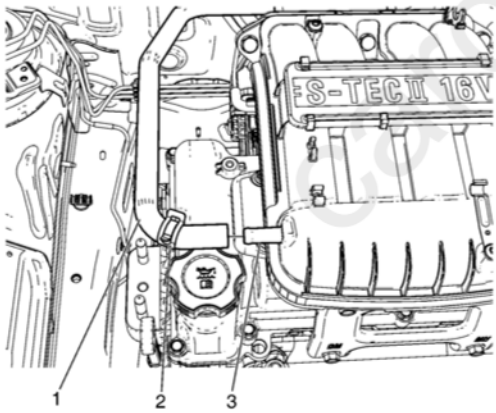
cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Power Brake Booster Vacuum Check Valve and Hose Replacement

Removal Procedure

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



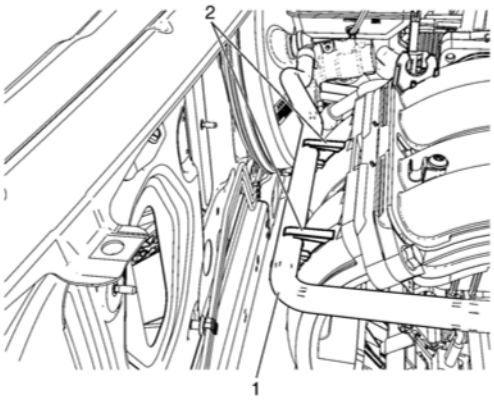
cardiagn.com

2.
Click here for full size

3. Compress the vacuum hose retaining clampâ€‰(2) at the intake manifold vacuum portâ€‰(3) and slide 50â€‰mm (2â€‰in) along the vacuum hoseâ€‰(1).

4. Disconnect the vacuum hoseâ€‰(1) from the intake manifold vacuum portâ€‰(3).

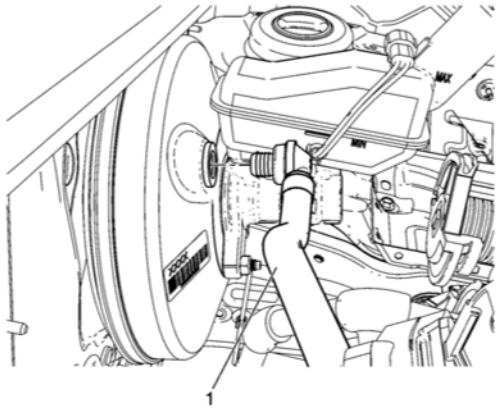
cardiagn.com



5.
Click here for full size

6. Detach the vacuum hoseâ€‰(1) from the intake manifold mounted vacuum hose retaining bracketsâ€‰(2).

cardiagn.com

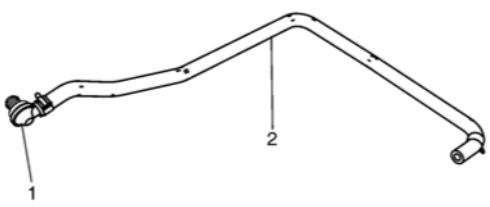


7.

Click here for full size

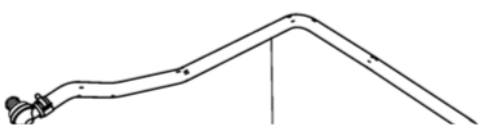
8. Remove the vacuum hose and the vacuum brake booster check valveâ€‰(1) from the vacuum brake booster.

cardiagn.com



9. Click here for full size
10. Remove the vacuum brake booster check valveâ€‰(1) from the vacuum hoseâ€‰(2), if necessary.

Installation Procedure



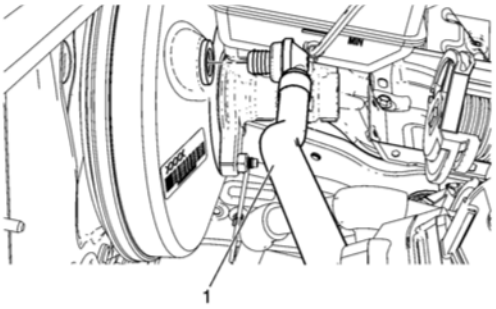
cardiagn.com



1. Click here for full size
2. Install the vacuum brake booster check valveâ€‰(1) to the vacuum hoseâ€‰(2).

cardiagn.com

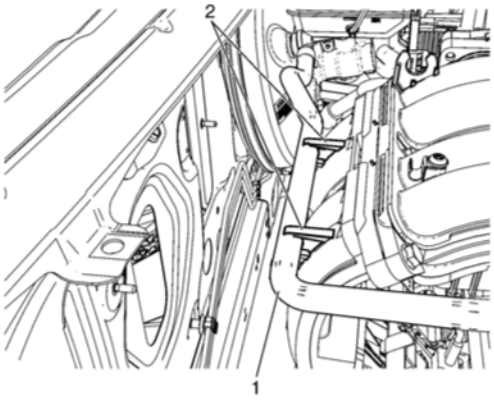




3. Click here for full size

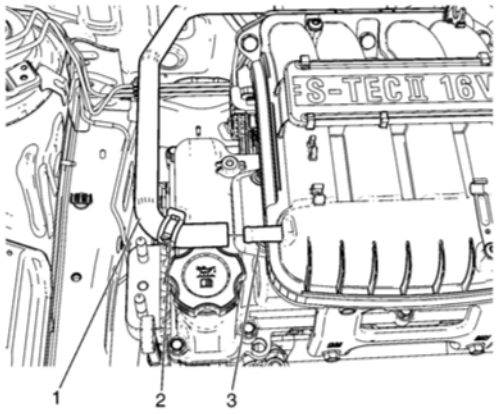
4. Install the vacuum hose and the vacuum brake booster check valveâ€‰(1) to the vacuum brake booster.

cardiagn.com



5. Click here for full size
6. Attach the vacuum hoseâ€‰(1) to the intake manifold mounted vacuum hose retaining bracketsâ€‰(2).

cardiagn.com



cardiagn.com

7. Click here for full size

8. Connect the vacuum hoseâ€‰(1) to the intake manifold vacuum portâ€‰(3).

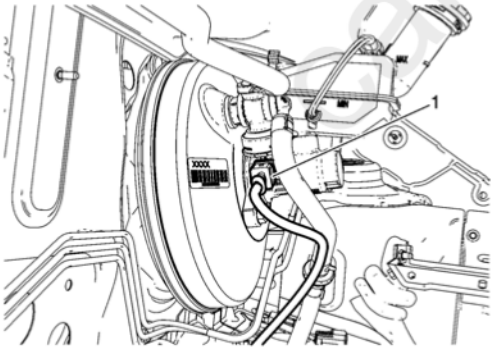
9. Compress the vacuum hose retaining clampâ€‰(2) and slide along the vacuum hoseâ€‰(1) to the correct location, to secure the vacuum hoseâ€‰(1) to the intake manifold vacuum portâ€‰(3).

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Power Brake Booster Vacuum Hose Replacement

Removal Procedure

1. With the engine OFF, apply and release the brake pedal several times to deplete the power vacuum brake booster vacuum reserve.
2. Remove the battery. Refer to Battery Replacement.



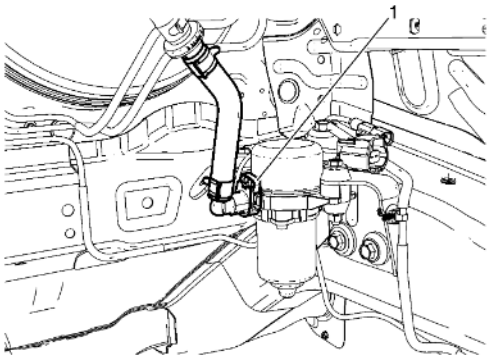
ardiagn.com

3.
Click here for full size

4. Remove the ECM bracket boltsâ€‰(1), and then position the ECM and ECM bracket aside. Refer to Engine Control Module Replacement.

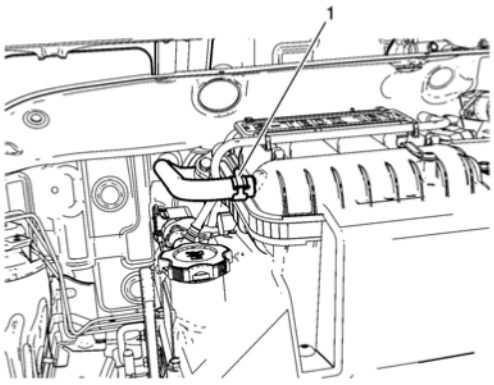
5. Disconnect the power brake booster vacuum switch electrical connectorâ€‰(1).

cardiagn.com



6.
Click here for full size

7. Disconnect the power brake booster vacuum hose quick connectâ€‰(1) from the power brake booster pump.



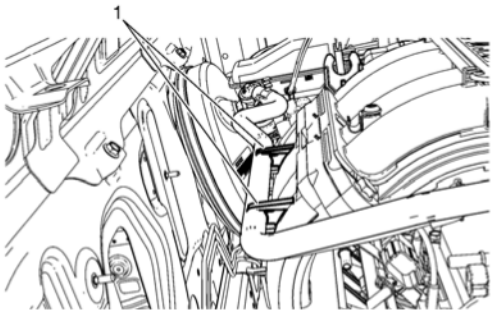
cardiagn.com

8.

Click here for full size

9. Disconnect the power brake booster vacuum hose quick connectâ€‰(1) from the intake manifold fitting.

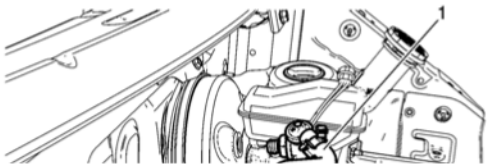
cardiagn.com



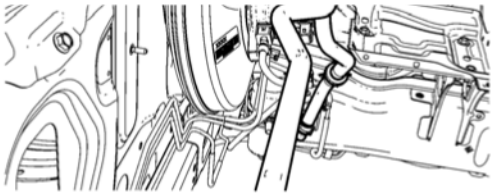


10. Click here for full size

11. Disconnect the power brake booster vacuum hose from the bracketsâ€‰(1) on the intake manifold.

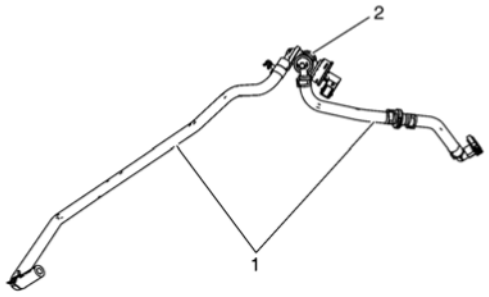


cardiagn.com



12. Click here for full size
13. Disconnect the power brake booster vacuum hose and vacuum switch assemblyâ€‰(1) from the power vacuum brake booster grommet.
14. Remove the power brake booster vacuum hose and vacuum switch assemblyâ€‰(1).

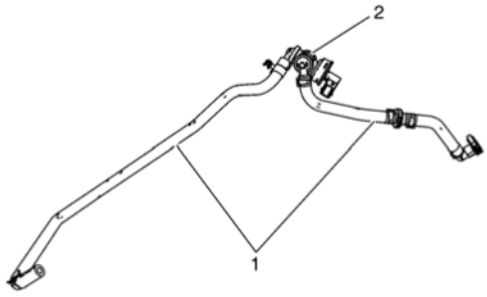
cardiagn.com



15. Click here for full size
16. Remove the power brake booster vacuum hosesâ€‰(1) from the vacuum switchâ€‰(2), if necessary.

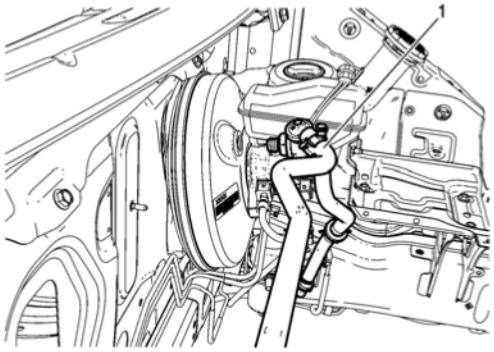
Installation Procedure

cardiagn.com



cardiagn.com

1. Click here for full size
2. Install the power brake booster vacuum hosesâ€‰(1) to the vacuum switchâ€‰(2), if necessary.



cardiagn.com

3. Click here for full size

4. Install the power brake booster vacuum hoses and vacuum switch assemblyâ€‰(1).

5. Note:

   A small amount of denatured alcohol may be used to lubricate the power vacuum brake booster grommet.

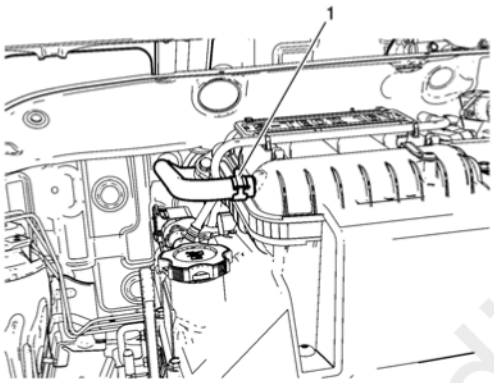
6. Connect the power brake booster vacuum hoses and switch assemblyâ€‰(1) to the power vacuum brake booster grommet.



cardiagn.com

7. Click here for full size

8. Connect the power brake booster vacuum hose to the bracketsâ€‰(1) on the intake manifold.

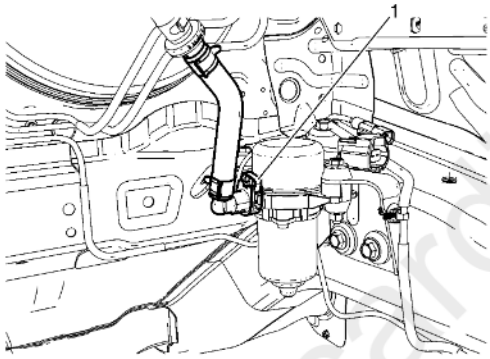


cardiagn.com

9.

Click here for full size

10. Connect the power brake booster vacuum pipe quick connectâ€‰(1) to the intake manifold fitting.

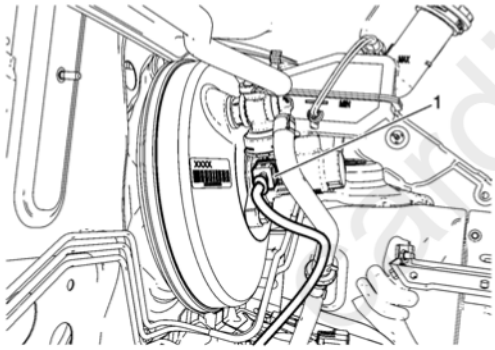


cardiagn.com

11.

Click here for full size

12. Connect the power brake booster vacuum hose quick connectâ€‰(1) to the power brake booster pump.



ardiagn.com

13. Click here for full size

14. Connect the power brake booster vacuum switch electrical connectorâ€‰(1).

15. Install the ECM and ECM bracket. Refer to Engine Control Module Replacement.

16. Install the battery. Refer to Battery Replacement.

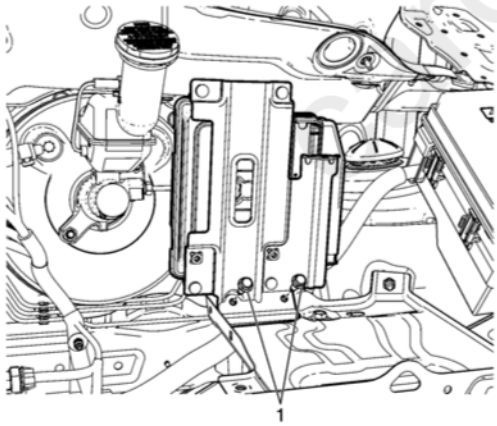
cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. REPAIR INSTRUCTIONS
4.

Power Brake Booster Pump Replacement

Removal Procedure

1. With the engine OFF, apply and release the brake pedal several times to deplete the power vacuum brake booster vacuum reserve.
2. Remove the battery. Refer to Battery Replacement.

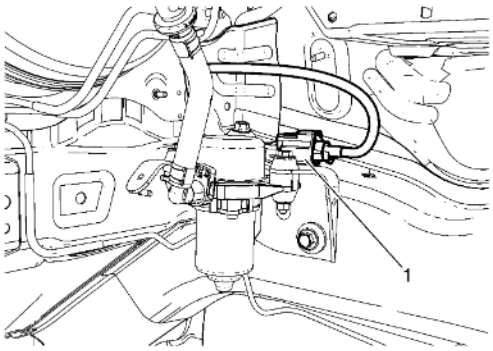


.com

3.
Click here for full size

4. Remove the ECM bracket bolts (1), and then position the ECM and ECM bracket aside. Refer to Engine Control Module Replacement.
5. Remove the battery tray. Refer to Battery Tray Replacement.

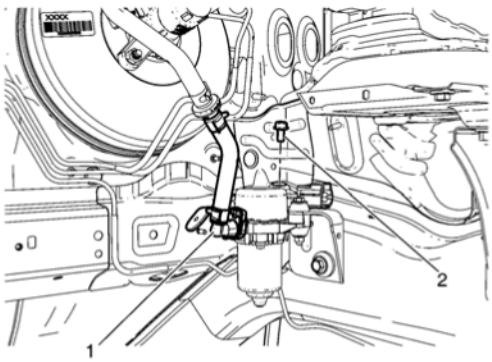
cardiagn.com



6.
Click here for full size

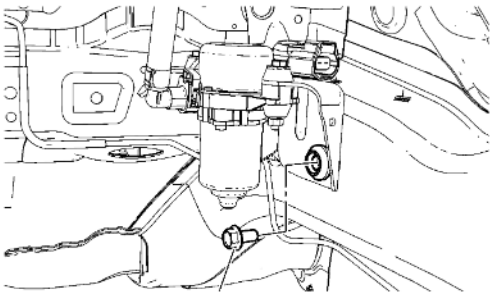
7. Disconnect the power brake booster pump electrical connector (1).

cardiagn.com



8. Click here for full size
9. Remove the power brake booster vacuum hose quick connector (1).
10. Remove the power brake booster pump bracket bolt (2).

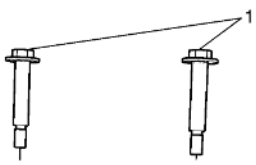
cardiagn.com

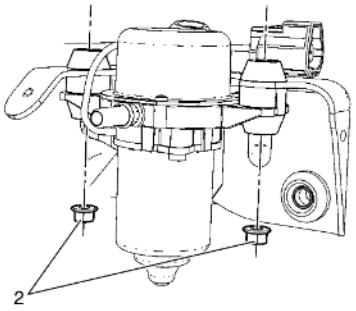




11. Click here for full size
12. Remove the power brake booster pump bracket bolt (1).
13. Remove the power brake booster pump and bracket assembly from the vehicle.

cardiagn.com

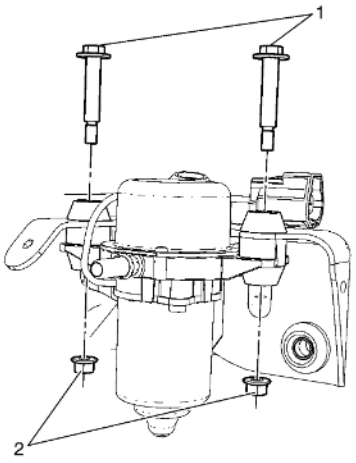




14. Click here for full size
15. Remove the power brake booster pump to bracket bolts (1) and nuts (2).
16. Remove the power brake booster pump from the bracket.

Installation Procedure

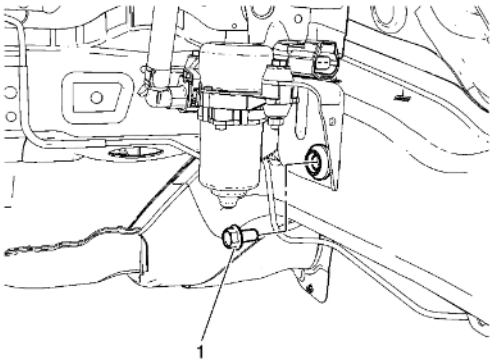
cardiagn.com



cardiagn.com

1. Click here for full size
2. Install the power brake booster pump to the bracket.
3. Caution:

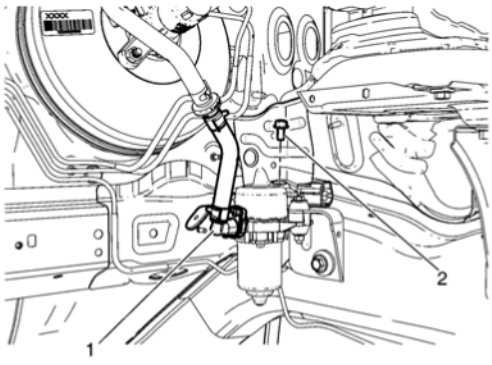
   Refer to Fastener Caution.
4. Install the power brake booster pump to bracket bolt (1) and nut (2) and tighten to 7â€‰N-m (62â€‰lbâ€‰in).
5. Install the power brake booster pump and bracket assembly to the vehicle.



cardiagn.com

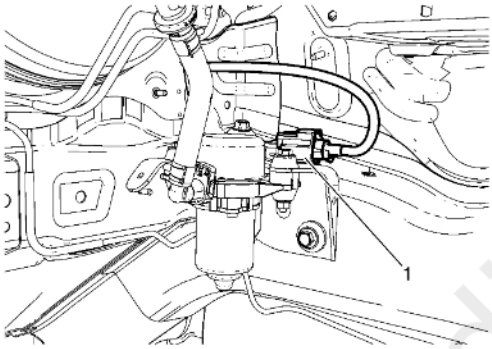
6. Click here for full size

7. Install the power brake booster pump bracket bolts (1) and tighten to 20â€‰N-m (15â€‰lbâ€‰ft).



cardiagn.com

8. Click here for full size
9. Install the power brake booster pump bracket bolt (2) and tighten to 20â€‰N-m (15â€‰lbâ€‰ft).
10. Remove the power brake booster vacuum hose quick connector (1).



cardiagn.com

Click here for full size

12. Connect the power brake booster pump electrical connector (1).
13. Install the battery tray. Refer to Battery Tray Replacement.
14. Install the ECM and ECM bracket. Refer to Engine Control Module Replacement.
15. Install the battery. Refer to Battery Replacement.

Related Part Information

Part Name	Catalog Name	Part Code
Power Brake Booster Pump	PUMP,P/B BOOS	2900A
Power Brake Booster Pump	PUMP KIT,P/B BOOS	2900B
Power Brake Booster Pump	PUMP,P/B BOOS (MECH)	2901A
Power Brake Booster Pump	PUMP,P/B BOOS (ELEC)	2902A

cardiagn.com

Specifications

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIFICATIONS
4.

Fastener Specifications

Single Use Non-Threaded Fasteners/Components

Application
Note: All fasteners/components listed in this table MUST BE DISCARDED and replaced with NEW after removal.
Front Brake Hose Washer

Reusable Threaded Fastener Tightening Specifications

Application	Specification
	Metric (English)
Note: All fasteners listed in this table can be reused after removal.	
ABC Pedal Module to Dash Panel Retaining Nuts	22â€‰N-mâ€‰(16â€‰lbâ€‰ft)
Brake Master Cylinder Brake Pipe Fittings	18â€‰N-mâ€‰(13â€‰lbâ€‰ft)
Brake Master Cylinder Nut	13â€‰N-mâ€‰(115â€‰lbâ€‰in)
Brake Master Cylinder Nut - PMC	14.8â€‰N-mâ€‰(11â€‰lbâ€‰ft)
Brake Master Cylinder Reservoir Bolt	4.2â€‰N-mâ€‰(37â€‰lbâ€‰in)
Brake Proportion Valve	35â€‰N-mâ€‰(26â€‰lbâ€‰ft)
Brake Proportion Valve Brake Pipe Fitting	18â€‰N-mâ€‰(13â€‰lbâ€‰ft)
Brake Proportion Valve Retaining Nut	9â€‰N-mâ€‰(80â€‰lbâ€‰in)
Front Brake Hose to Brake Caliper Banjo Retaining Bolt	40â€‰N-mâ€‰(30â€‰lbâ€‰ft)
Front Brake Hose to Front Brake Pipe Fitting	18â€‰N-mâ€‰(13â€‰lbâ€‰ft)
Power Brake Booster Pump Bolt/Nut	7â€‰N-mâ€‰(62â€‰lbâ€‰in)
Power Brake Booster Pump Bracket Bolts	20â€‰N-mâ€‰(15â€‰lbâ€‰ft)
Rear Brake Hose to Rear Brake Pipe Fitting	18â€‰N-mâ€‰(13â€‰lbâ€‰ft)
Rear Brake Hose to Wheel Cylinder Pipe Fitting	18â€‰N-mâ€‰(13â€‰lbâ€‰ft)
Vacuum Brake Booster to ABC Pedal Module Retaining Nuts	22â€‰N-mâ€‰(16â€‰lbâ€‰ft)

carmanuals.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIFICATIONS
4.

Approximate Fluid Capacities

Application	Specification	
	Metric	US English
Hydraulic Brake System	0.50â€‰L	1.06â€‰pt

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIFICATIONS
4.

Brake Component Specifications

Application	Specification	
	Metric	English
Brake Caliper Bleeder Valveâ€“ Front	8.5â€‰N-m	75â€‰lbâ€‰in
Drum Brake Wheel Cylinder Bleeder Valveâ€“ Rear	8.5â€‰N-m	75â€‰lbâ€‰in

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIFICATIONS
4.

Brake System Specifications

Component	Application	Specification
Brake Fluid	Type	DOT 4 +
	Capacity	0.5â€‰L (0.528â€‰qts)
Brake Booster	Make	KDAC
	Type	Single Vacuum Suspended
	Size	231.00â€‰mm (9.094â€‰in)
Master Cylinder	Type	Fore/Aft Split
	Bore Size	22.22â€‰mm (0.875â€‰in)
	Nominal Stroke	32.00â€‰mm (1.260â€‰in)
Brake Pedal Travel	Maximum Specification with â€‰445â€‰Nâ€‰(100â€‰lbs) of force applied to the pedal with the ignition OFF and the booster power reserve depleted.	40â€“60â€‰mm (1.6â€“2.4â€‰in)

cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIFICATIONS
4.

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number
Hydraulic Brake System	DOTâ€‰4â€‰+ Brake Fluid	Refer to Electronic Parts Catalog

cardiagn.com

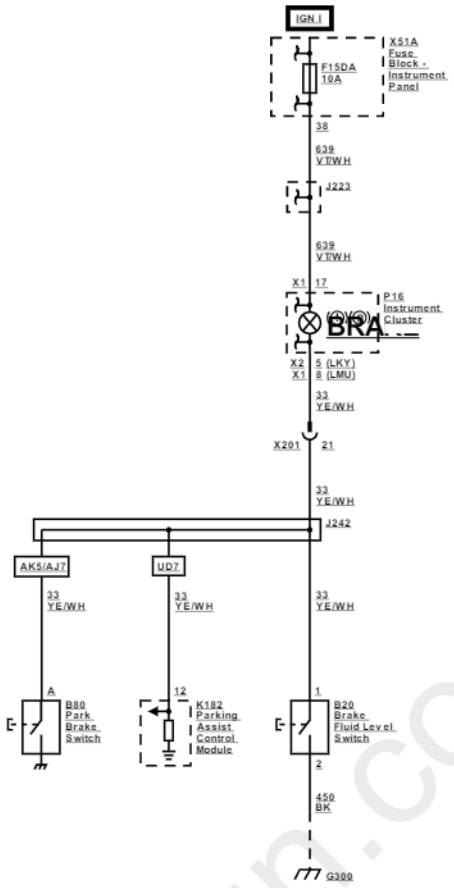
Schematic and Routing Diagrams

cardiagn.com

Hydraulic Brake Schematics

cardiagn.com

Hydraulic Brakes



Click here for full size

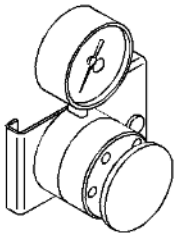
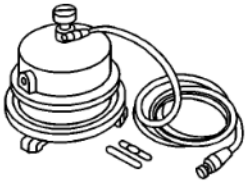
cardiagn.com

Special Tools and Equipment

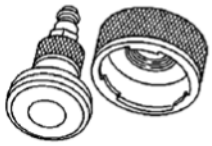
cardiagn.com

1. **BRAKES**
2. HYDRAULIC BRAKES
3. SPECIAL TOOLS AND EQUIPMENT
4.

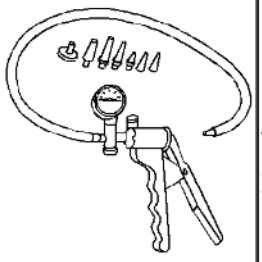
Special Tools

Illustration	Tool Number/ Description
 Click here for full size	CH-28662 J-28662 Brake Pedal Effort Gauge
 Click here for full size	CH-29532 J-29532 Diaphragm Pressure Bleeder

cardiagn.com

Illustration	Tool Number/ Description
 Click here for full size	CH-50253 Brake Pressure Bleeder Adapter

cardiagn.com

Illustration	Tool Number/ Description
 Click here for full size	J-23738-A Hand Vacuum Pump

cardiagn.com