

SECTION : 4A

HYDRAULIC BRAKES

CAUTION : Disconnect the negative battery cable before removing or installing any electrical unit or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in LOCK unless otherwise noted.

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SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	2.0 DOHC Engine	
	Millimeters	Inches
Brake Drums:	200	7.87
Inside Diameter	201	7.91
Maximum Rebore Diameter	0.08	0.0032
Out-of-Round		
Front Brake Rotors:	22.00	0.87
Discard Thickness	0.030	0.001
Lateral Runout	256	10.07
(Installed)	24.00	0.95
Rotor Diameter	0.005	0.0005
Rotor Thickness (New)		
Thickness Variation		

4A – 2 HYDRAULIC BRAKES

Application

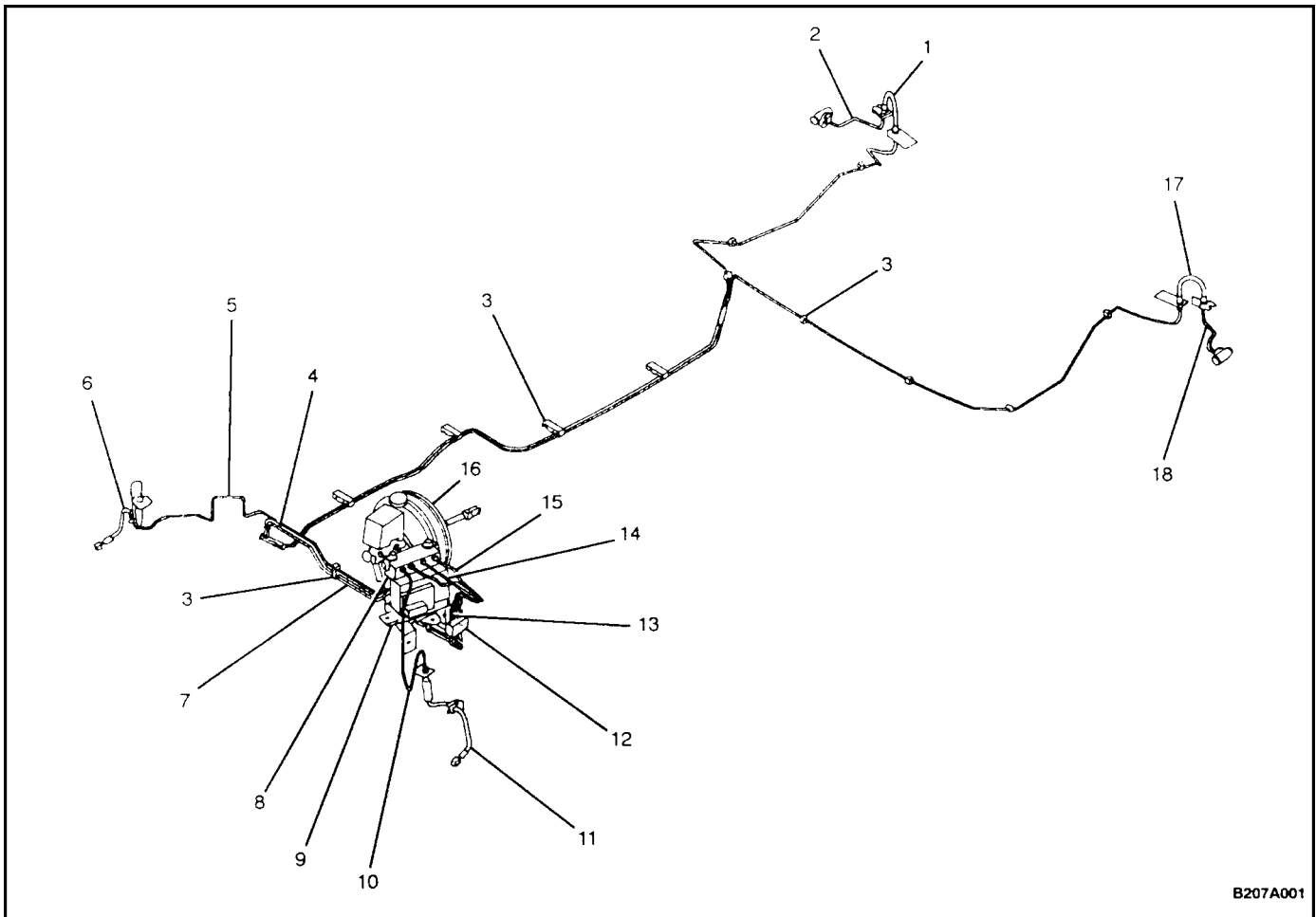
	Millimeters	Inches
Rear Brake Rotors:	8.4	0.33
Discard Thickness	0.03	0.004
Lateral Runout	258.00	10.16
(Installed)	10.40	0.41
Rotor Diameter	0.005	0.0004
Rotor Thickness (New)		
Thickness Variation		
Master Cylinder:	23.81	0.937
Bore Diameter (Nominal)	23.86	0.937
Bore Diameter (Maximum)		
Caliper:	57.00	2.244
Minimum Piston Diameter (Front)	35.00	1.377
Minimum Piston Diameter (Rear)		
Wheel Cylinder Diameter:	–	–
Maximum	–	–
Nominal		

FASTENER TIGHTENING SPECIFICATIONS

Application	N•m	Lb–Ft	Lb–In
Bleeder Screw	8	–	53
Brake Lines	16	12	–
Front Disc Brake Hose–to–Caliper Bolt	40	30	–
Rear Disc Brake Hose–to–Caliper Bolt	32	24	–
Shaft Nut	18	13	–

COMPONENT LOCATOR

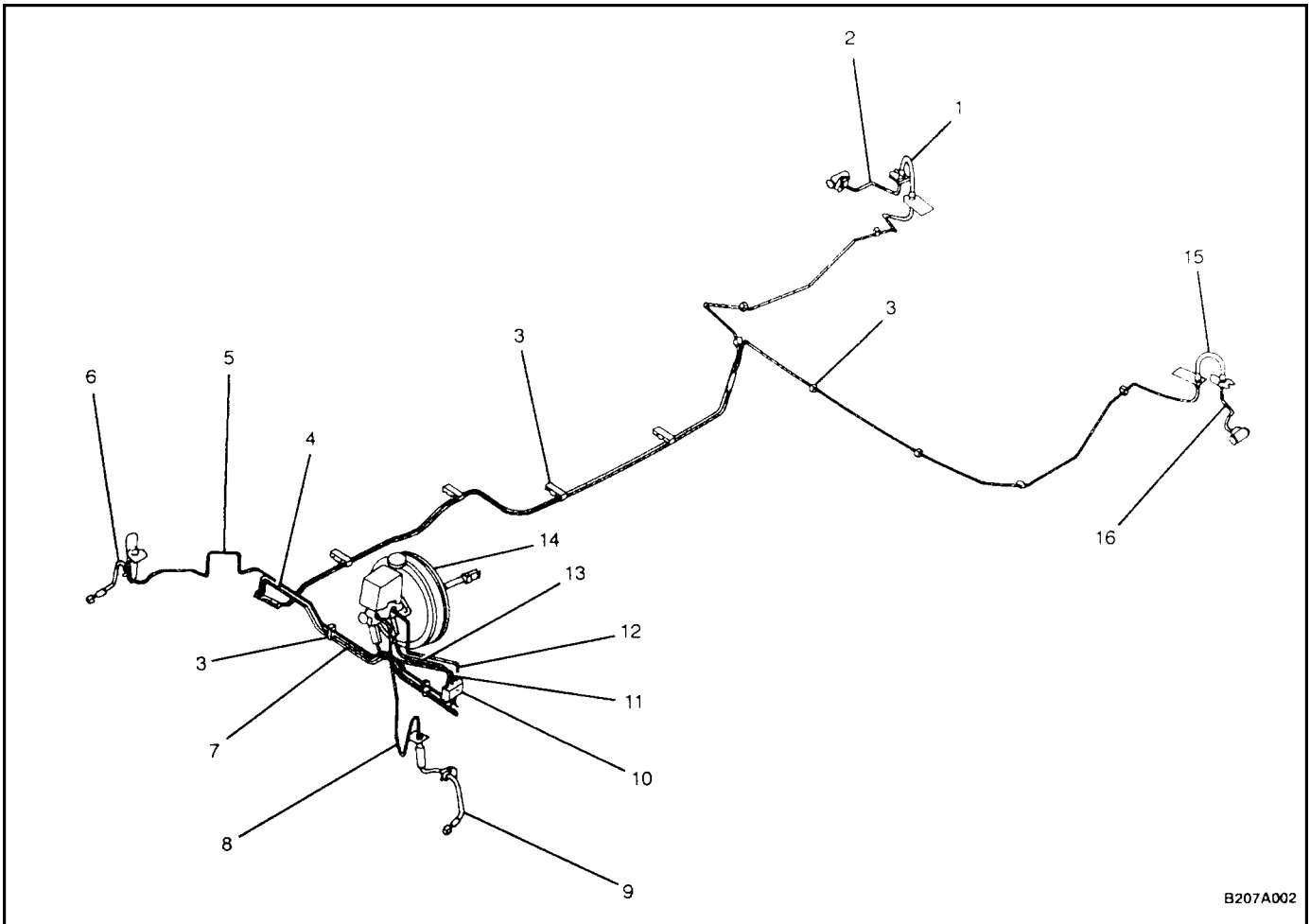
BRAKE SYSTEM (ABS)



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- | | |
|----------------------------|--|
| 1. RH Rear Brake Hose | 10. Front Brake Pipe |
| 2. RH 3rd Rear Brake Pipe | 11. LH Front Brake Hose |
| 3. Clip | 12. Connector |
| 4. 2nd Rear Brake Pipe (A) | 13. 1st Rear Brake Pipe (A) |
| 5. 2nd Front Brake Pipe | 14. 1st Front Brake Pipe |
| 6. RH Front Brake Hose | 15. 1st Rear Brake Pipe (B) |
| 7. 2nd Rear Brake Pipe (B) | 16. LHD Master Cylinder/Booster Assembly |
| 8. ABS Modulator | 17. LH Rear Brake Hose |
| 9. Bracket | 18. LH 3rd Rear Brake Pipe |

BRAKE SYSTEM (NON-ABS)



B207A002

- | | |
|---------------------------|--|
| 1. RH Rear Brake Hose | 9. LH Front Brake Hose |
| 2. RH 3rd Rear Brake Pipe | 10. Connector |
| 3. Clip | 11. 1st Rear Brake Pipe (A) |
| 4. 2nd Rear Brake Pipe | 12. 1st Front Brake Pipe |
| 5. 2nd Front Brake Pipe | 13. 1st Rear Brake Pipe (B) |
| 6. RH Front Brake Hose | 14. LHD Master Cylinder/Booster Assembly |
| 7. 2nd Rear Brake Pipe | 15. LH Rear Brake Hose |
| 8. Front Brake Pipe | 16. LH 3rd Rear Brake Pipe |

DIAGNOSIS

BRAKE SYSTEM TESTING

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy, or covered with loose dirt whereby all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight so roughly that the wheels tend to bounce.

Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the brakes and sliding the tires. Locked brakes and sliding tires do not indicate brake efficiency since heavily braked, but turning, wheels will stop the vehicle in less distance than locked brakes. More tire-to-road friction is present with a heavily-braked, turning tire than with a sliding tire.

Because of the high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

There are three major external conditions that affect brake performance:

- Tires having unequal contact and grip of the road will cause unequal braking. Tires must be equally inflated, and the tread pattern of the right and the left tires must be approximately equal.
- Unequal loading of the vehicle can affect the brake performance since the most heavily loaded wheels require more braking power, and thus more braking effort, than the others.
- Misalignment of the wheels, particularly conditions of excessive camber and caster, will cause the brakes to pull to one side.

To check for brake fluid leaks, hold constant foot pressure on the pedal with the engine running at idle and the shift lever in NEUTRAL. If the pedal gradually falls away with the constant pressure, the hydraulic system may be leaking. Perform a visual check to confirm any suspected leaks.

Check the master cylinder fluid level. While a slight drop in the reservoir level results from normal lining wear, an abnormally low level indicates a leak in the system. The hydraulic system may be leaking either internally or externally. Refer to the procedure below to check the master cylinder. Also, the system may appear to pass this test while still having a slight leak. If the fluid level is normal, check the vacuum booster pushrod length. If an incorrect pushrod length is found, adjust or replace the rod.

Check the master cylinder using the following procedure:

- Check for a cracked master cylinder casting or brake fluid leaking around the master cylinder. Leaks are indicated only if there is at least one drop of fluid. A damp condition is not abnormal.

- Check for a binding pedal linkage and for an incorrect pushrod length. If both of these parts are in satisfactory condition, disassemble the master cylinder and check for an elongated or swollen primary cylinder or piston seals. If swollen seals are found, substandard or contaminated brake fluid should be suspected. If contaminated brake fluid is found, all the components should be disassembled and cleaned, and all the rubber components should be replaced. All of the pipes must also be flushed.

Improper brake fluid, or mineral oil or water in the fluid, may cause the brake fluid to boil or cause deterioration of the rubber components. If the primary piston cups in the master cylinder are swollen, then the rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston seals on the drum brake wheels.

If deterioration of rubber is evident, disassemble all the hydraulic parts and wash the parts with alcohol. Dry these parts with compressed air before reassembly to keep alcohol out of the system. Replace all the rubber parts in the system, including the hoses. Also, when working on the brake mechanisms, check for fluid on the linings. If excessive fluid is found, replace the linings.

If the master cylinder piston seals are in satisfactory condition, check for leaks or excessive heat conditions. If these conditions are not found, drain the fluid, flush the master cylinder with brake fluid, refill the master cylinder, and bleed the system. Refer to "Manual Bleeding the Brakes" or "Pressure Bleeding the Brakes" in this section.

BRAKE HOSE INSPECTION

The hydraulic brake hoses should be inspected at least twice a year. The brake hose assembly should be checked for road hazard damage, cracks, chafing of the outer cover, and for leaks or blisters. Inspect the hoses for proper routing and mounting. A brake hose that rubs on a suspension component will wear and eventually fail. A light and a mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

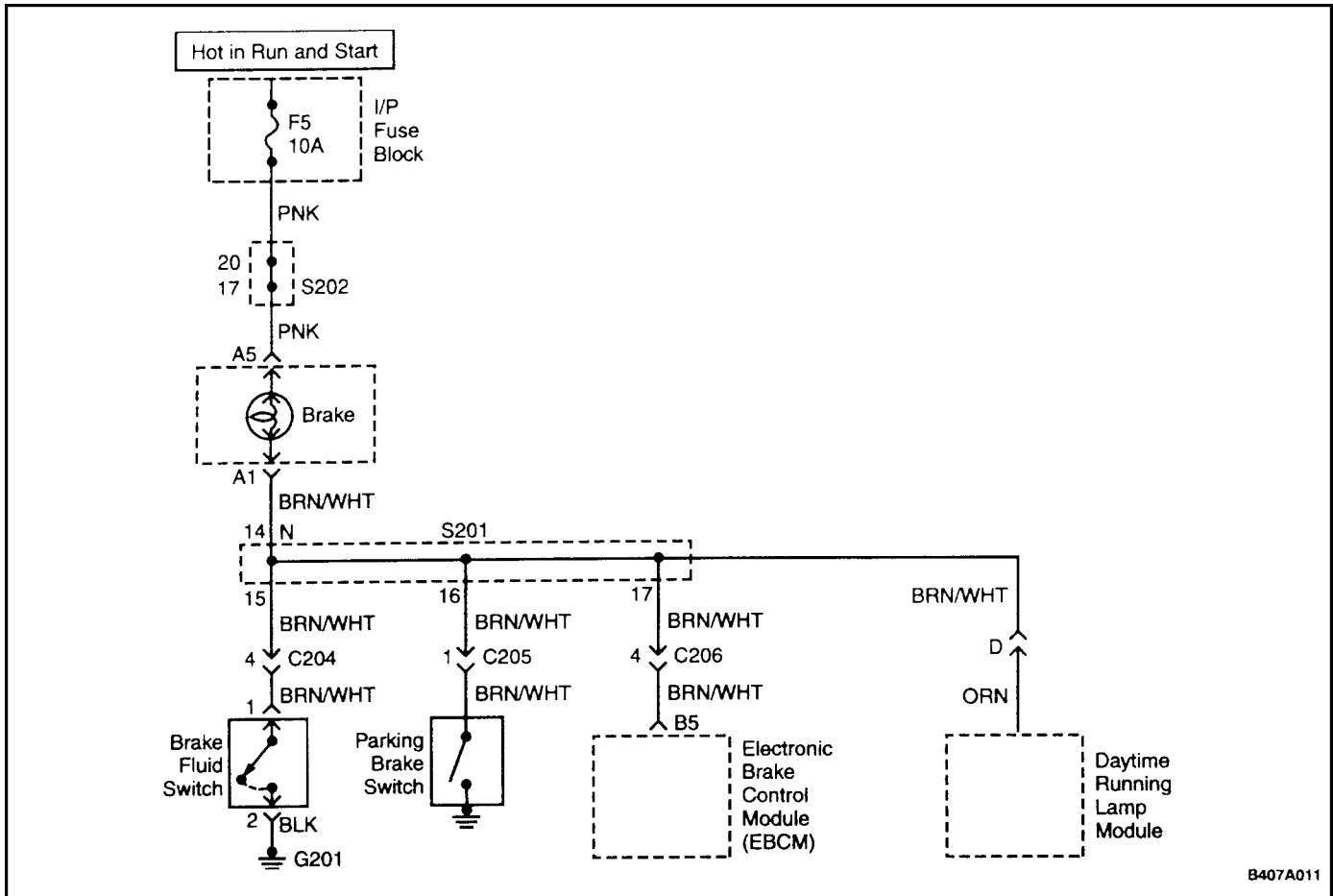
WARNING LAMP OPERATION

This brake system uses a BRAKE warning lamp located in the instrument panel cluster. When the ignition switch is in the START position, the BRAKE warning lamp should glow and go OFF when the ignition switch returns to the RUN position.

The following conditions will activate the BRAKE lamp:

- Parking brake applied. The light should be ON whenever the parking brake is applied and the ignition switch is ON.
- Low fluid level. A low fluid level in the master cylinder will turn the BRAKE lamp ON.
- As a test of the lamp circuit, vehicles with antilock brakes will momentarily illuminate the lamp for about 4 seconds when the ignition

BRAKE LAMP WARNING CIRCUIT DIAGNOSIS



Test Description

The number(s) below refer to step(s) on the diagnostic table.

1. When the ignition is turned ON, the brake warning lamp should initially illuminate and then dim for ABS equipped vehicles. This is done as a bulb check. On vehicles that are not equipped with ABS, the brake warning lamp should only illuminate when either the brake fluid reservoir is low or the parking brake is applied.
7. The brake fluid level switch is a normally open switch. If the brake warning lamp is off after disconnecting the switch, the brake fluid level switch is stuck closed.
9. If the brake warning lamp is still on after disconnecting the parking brake switch, there is a short to ground in the wire to the parking brake switch.
12. If the other checks have been properly performed and the brake warning lamp is off after disconnecting the electronic brake control module (EBCM) J1 connector, the EBCM is faulty.
19. If the brake warning lamp does not operate while performing any of the functions, the fault should be in the ignition feed to the circuit.
24. This step determines if the problem is in the ignition feed to the circuit or in the instrument cluster.
30. The brake warning lamp should illuminate when jumpering the parking brake connector to ground.
32. If the brake warning lamp is on after jumpering the brake fluid level switch terminals, the switch is faulty.

Brake Lamp Warning Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Turn the ignition ON. Is the brake warning lamp always on?		Go to Step 2	Go to Step 18
2	Check the ABS warning lamp. Is the ABS warning lamp also on?		Go to Step 3	Go to Step 4
3	Use a scan tool to check for diagnostic trouble codes (DTCs) and follow the procedures for any DTCs found. Is the lamp still on?		Go to Step 4	System OK
4	Release the parking brake fully. Is the lamp off?		System OK	Go to Step 5
5	Check the brake fluid level. Is the fluid level OK?		Go to Step 7	Go to Step 6
6	1. Fill the brake fluid reservoir with clean DOT 3 equivalent hydraulic fluid. 2. Replace the cap on the fluid reservoir. Is the lamp on?		Go to Step 7	System OK
7	Disconnect the harness connector from the brake fluid level switch. Is the lamp on?		Go to Step 9	Go to Step 8
8	Replace the brake fluid level switch. Is the repair complete?		System OK	
9	1. Connect the brake fluid level switch. 2. Disconnect the parking brake switch. Is the lamp on?		Go to Step 11	Go to Step 10
10	Replace the parking brake switch. Is the repair complete?		System OK	
11	Connect the parking brake switch. Is the vehicle equipped with ABS?		Go to Step 12	Go to Step 14
12	1. Turn the ignition OFF. 2. Disconnect the electronic brake control module (EBCM) connector. 3. Turn the ignition ON. Is the lamp on?		Go to Step 14	Go to Step 13
13	Replace the electronic brake control module (EBCM). Is the repair complete?		System OK	
14	1. Turn the ignition OFF. 2. Connect the EBCM connector. 3. Check for a short to ground in the wiring between the instrument cluster terminal A2 and the brake fluid level switch. Is the problem found?		Go to Step 17	Go to Step 15
15	Check for a short to ground in the wiring between the instrument cluster terminal A2 and the parking brake switch. Is the problem found?		Go to Step 17	Go to Step 16

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Step	Action	Value(s)	Yes	No
16	Check for a short to ground in the wiring between the instrument cluster terminal A2 and the EBCM connector terminal 21. Is the problem found?		Go to <i>Step 17</i>	Go to <i>Step 18</i>
17	Repair the wiring as needed. Is the repair complete?		System OK	
18	Check the brake lamp after doing each of the following functions: <ul style="list-style-type: none"> • Apply the parking brake. • Remove the cap from the brake fluid reservoir. • On vehicles equipped with ABS, command the lamp on using a scan tool. Does the brake warning lamp operate for all of these conditions?		System OK	Go to <i>Step 19</i>
19	When the operations listed in step 18 were performed, the brake warning lamp did not function. Did the brake warning lamp fail to light for all of the operations listed in step 18?		Go to <i>Step 20</i>	Go to <i>Step 27</i>
20	1. Turn the ignition OFF. 2. Inspect the kick panel fuse F5. Is the fuse OK?		Go to <i>Step 22</i>	Go to <i>Step 21</i>
21	Replace the fuse. Is the repair complete?		System OK	
22	Inspect the brake warning lamp bulb. Is the bulb OK?		Go to <i>Step 24</i>	Go to <i>Step 23</i>
23	Replace the bulb. Is the repair complete?		System OK	
24	1. Disconnect the instrument cluster connector. 2. Turn the ignition ON. 3. Measure the voltage at the instrument cluster connector terminal A2. Does the voltage measure within the value specified?	11–14 v	Go to <i>Step 25</i>	Go to <i>Step 26</i>
25	1. Turn the ignition OFF. 2. Repair the open in the instrument cluster. Is the repair complete?		System OK	
26	1. Turn the ignition OFF. 2. Repair the open in the wiring between the instrument cluster connector terminal A2 and the ignition switch. Is the repair complete?		System OK	
27	Apply the parking brake again. Does the parking brake warning lamp operate with the parking brake applied?		Go to <i>Step 28</i>	Go to <i>Step 30</i>
28	Remove the brake fluid reservoir cap. Does the parking brake warning lamp operate with the cap from the brake fluid reservoir removed?		Go to <i>Step 29</i>	Go to <i>Step 32</i>
29	Check for an open between the instrument cluster connector terminal B13 and the EBCM connector terminal 21. Is the problem found?		Go to <i>Step 17</i>	Go to <i>Step 13</i>

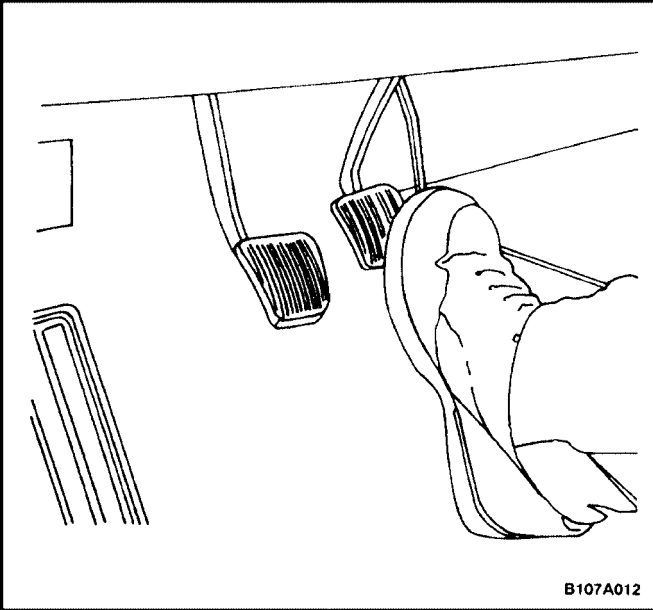
Step	Action	Value(s)	Yes	No
30	<ol style="list-style-type: none"> 1. Turn the ignition ON. 2. Disconnect the parking brake switch. 3. Jumper the parking brake switch connector terminal to ground. Is the lamp on?		Go to <i>Step 10</i>	Go to <i>Step 31</i>
31	<ol style="list-style-type: none"> 1. Turn the ignition OFF. 2. Repair the open in the wire between the instrument cluster connector terminal B13 and the parking brake switch connector terminal. Is the repair complete?		System OK	
32	<ol style="list-style-type: none"> 1. Disconnect the brake fluid level switch. 2. Turn the ignition ON. 3. Jumper the brake fluid level switch connector terminals. Is the lamp on?		Go to <i>Step 8</i>	Go to <i>Step 33</i>
33	<ol style="list-style-type: none"> 1. Turn the ignition OFF. 2. Connect a test light between battery positive and the BRN/WHT wire terminal of the brake fluid level switch. Is the test light on?		Go to <i>Step 34</i>	Go to <i>Step 35</i>
34	Repair the open in the wiring between ground and the brake fluid level switch. Is the repair complete?		System OK	
35	Repair the open in the wiring between the instrument cluster connector terminal B13 and the brake fluid level switch. Is the repair complete?		System OK	

MAINTENANCE AND REPAIR

ON-VEHICLE SERVICE

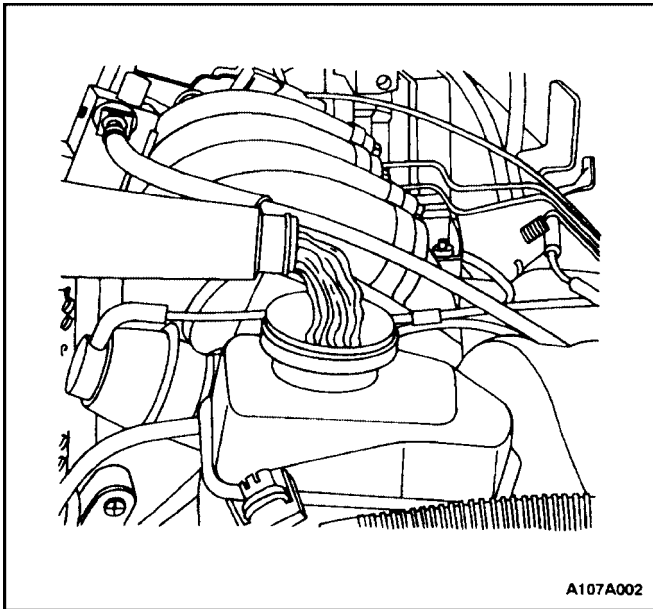
MANUAL BLEEDING THE BRAKES

1. Remove the booster reserve by applying the brakes several times with the engine OFF until all the reserve is depleted.



Important : If the master cylinder is known or suspected to have air in the bore, then it must be bled before any wheel cylinder or caliper is bled.

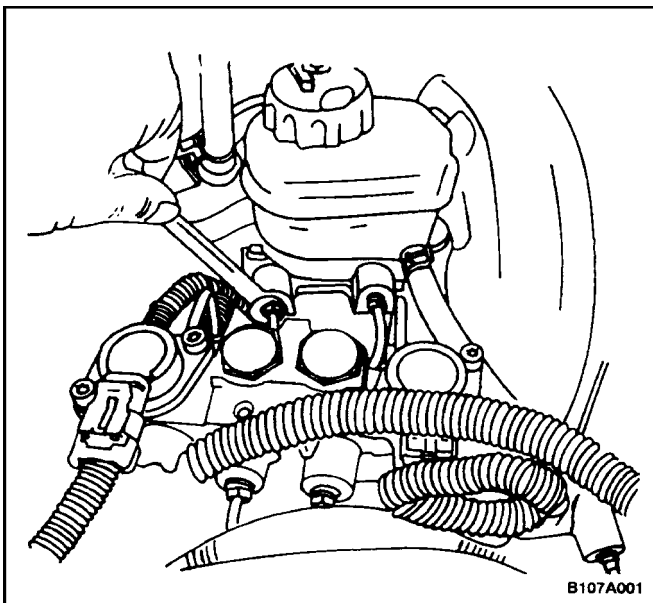
2. Fill the master cylinder reservoir with brake fluid. Keep the master cylinder at least one-half full of fluid during the bleeding operation.

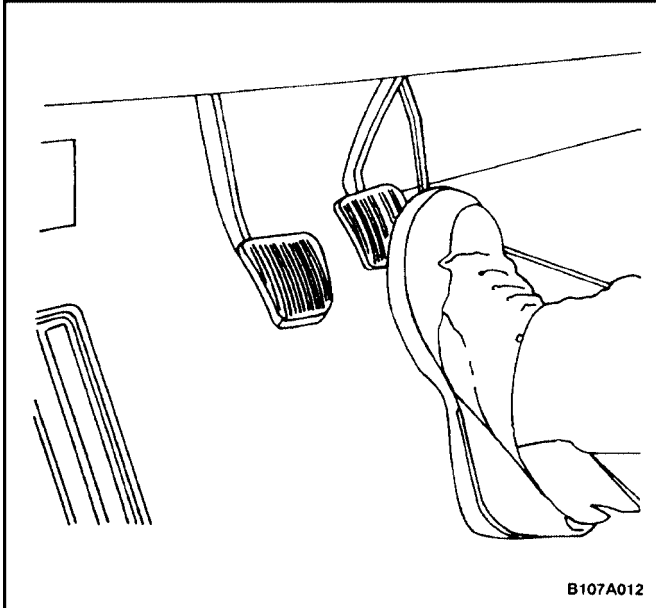


3. Disconnect the front brake line(s) at the master cylinder.
4. Allow the brake fluid to fill the master cylinder until it begins to flow from the front pipe connector port.
5. Connect the front brake line(s) to the master cylinder.

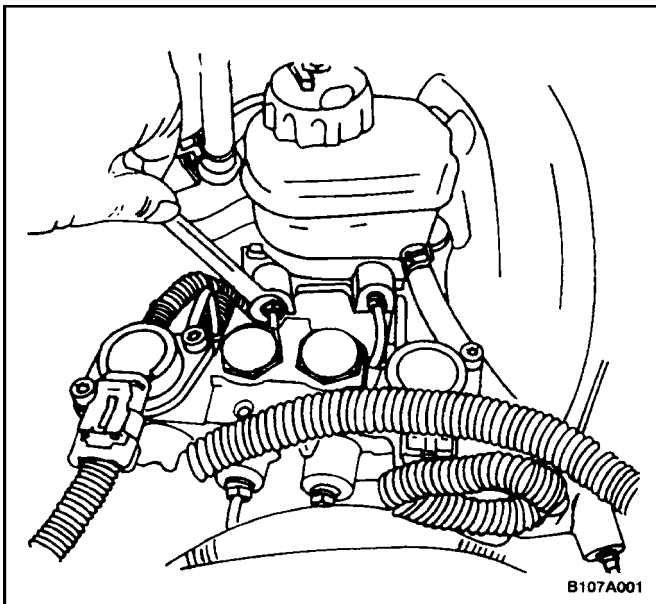
Tighten

Tighten the brake lines to 16 N•m (12 lb–ft).

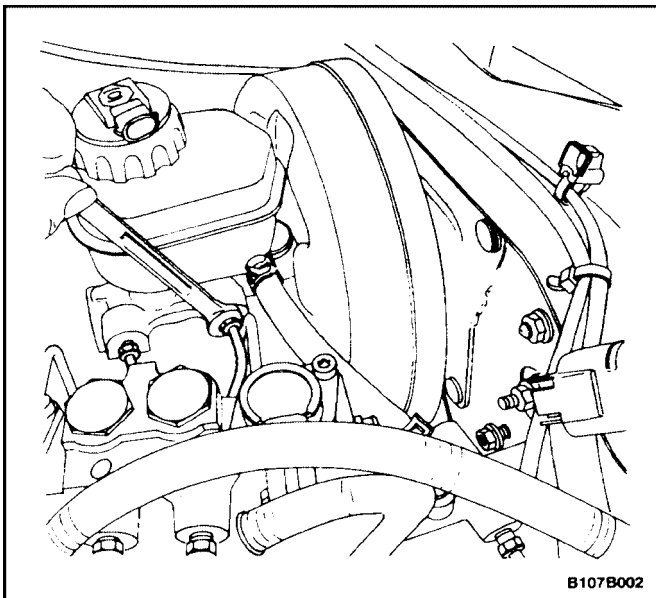




6. Slowly push and hold the brake pedal one time.

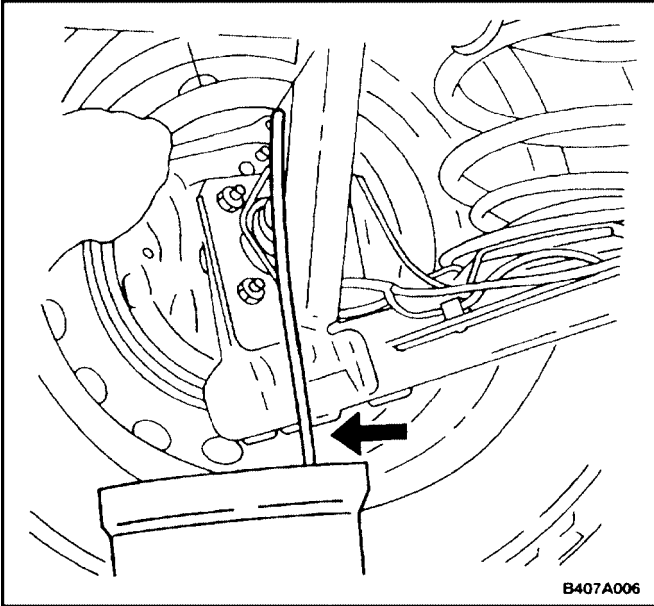


7. Loosen the front brake line at the master cylinder to purge air from the cylinder.
8. Tighten the brake line (as in step 5), and then release the brake pedal slowly. Wait 15 seconds before proceeding to the next step.
9. Repeat the sequence, including the 15-second wait, until all the air is removed from the master cylinder bore.

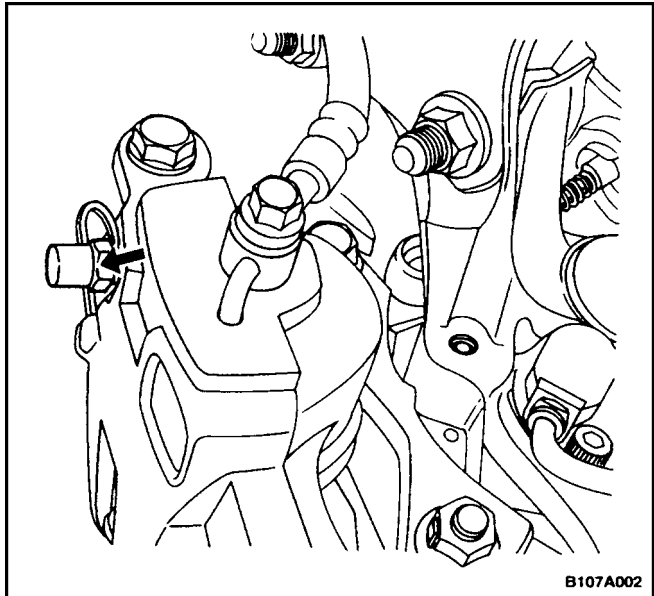


Notice : Care must be taken to prevent brake fluid from contacting any painted surface to prevent damage to the paint finish.

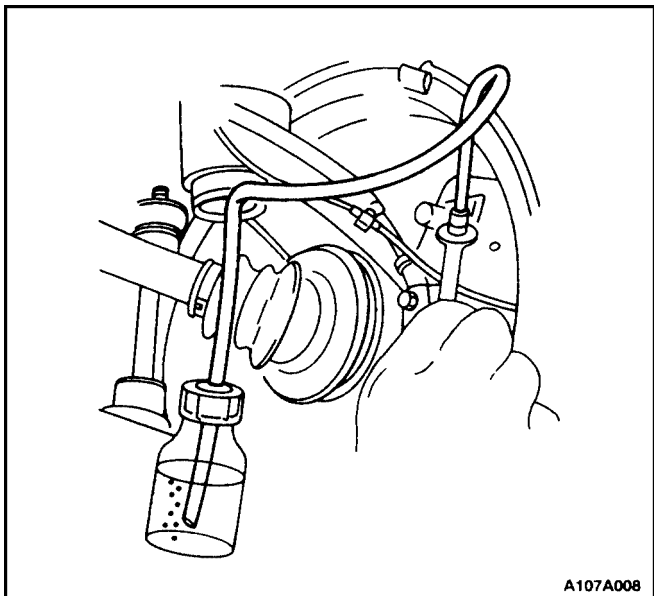
10. After all the air has been removed at the forward connection(s), bleed the master cylinder at the rear (cowl) connection(s) in the same manner as with the front connections.



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Important : For vehicles equipped with a non-antilock braking system, the bleeding sequence is as follows: right rear, left rear, left front and right front. For ABS vehicles, refer to *Section 4F, Antilock Brake System* for the correct sequence and bleeding procedure.

11. Attach a transparent tube over the valve. Allow the tube to hang submerged in brake fluid in a transparent container.

- 12. Slowly push and hold the brake pedal one time.
- 13. Remove the bleeder valve dust cover and loosen the bleeder screw to purge the air from the cylinder.
- 14. Slowly release the brake pedal. Wait 15 seconds before proceeding with the next step.

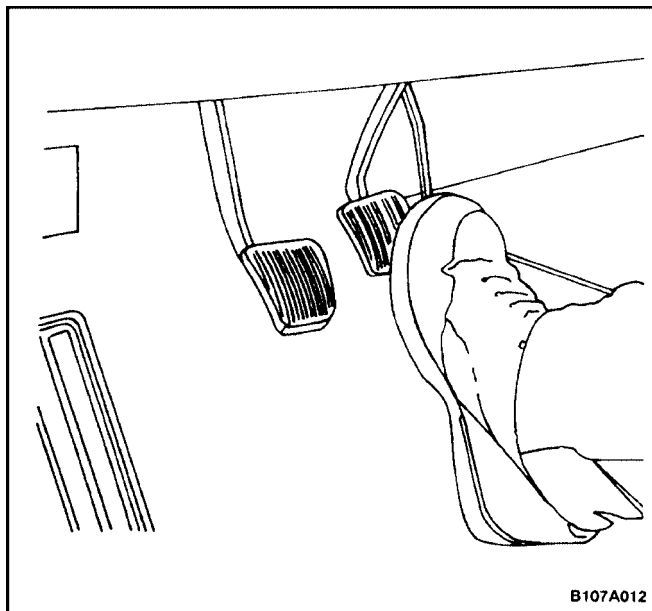
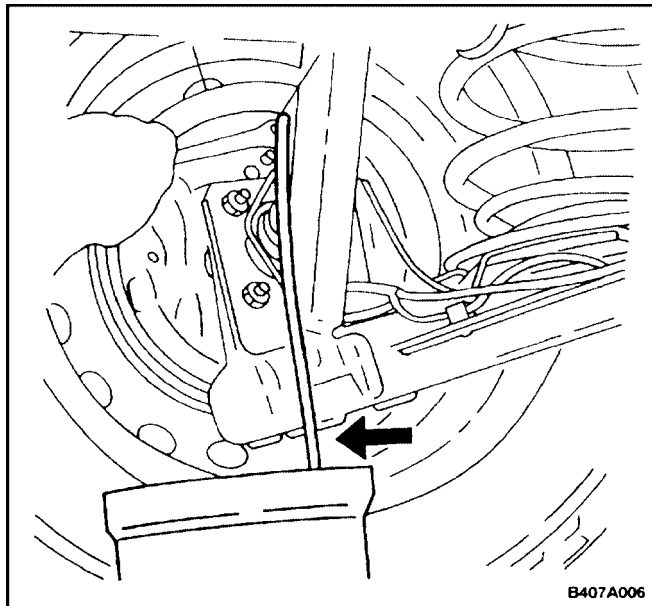
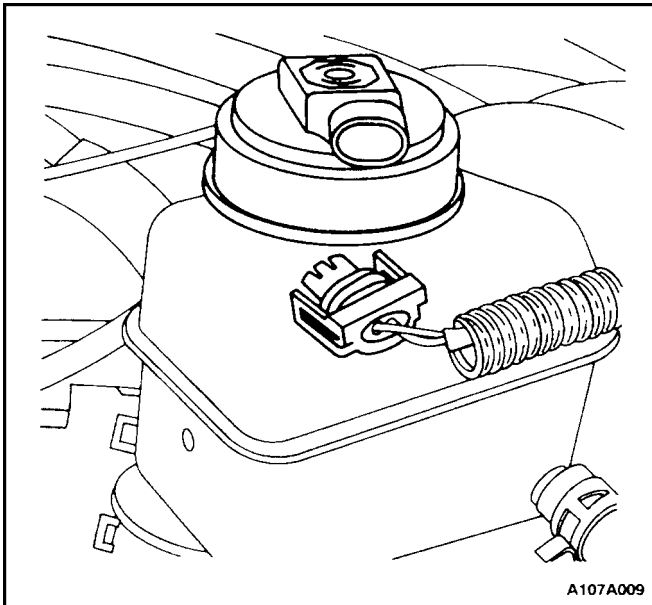
Important : Rapid pumping of the brake pedal pushes the master cylinder secondary piston down the bore in a manner that makes it difficult to bleed the system.

- 15. Repeat the sequence, including the 15-second wait, until all the air is removed. It may be necessary to repeat the sequence 10 or more times to remove all the air.
- 16. Tighten the bleeder screw.

Tighten

Tighten the bleeder screw to 8 N•m (71 lb-in).

- 17. Proceed to bleed the front brakes following the appropriate sequence, beginning with step 12.
- 18. Check the brake pedal for sponginess. Repeat the entire bleeding procedure to correct this condition.



PRESSURE BLEEDING THE BRAKES

Notice : Pressure bleeding equipment must be of the diaphragm type. It must have a rubber diaphragm between the air supply and the brake fluid to prevent moisture, oil, and other contaminants from entering the hydraulic system. Contamination could lead to deterioration of the braking components and loss of braking action.

1. Disconnect the master cylinder electrical connector.
2. Remove the master cylinder reservoir cap.

3. Connect the bleeder with the adapter to the master cylinder reservoir.
4. For vehicles with the antilock braking system (ABS), locate and remove the hydraulic modulator bleeder valves. Refer to *Section 4F, Antilock Brake System*
5. Charge the bleeder ball to 140 to 172 kPa (20 to 25 psi).
6. Connect the line to the adapter. Open the line valve.
7. Raise and suitably support the vehicle.

Important : The bleeding sequence is as follows: right rear, left front, left rear and right front.

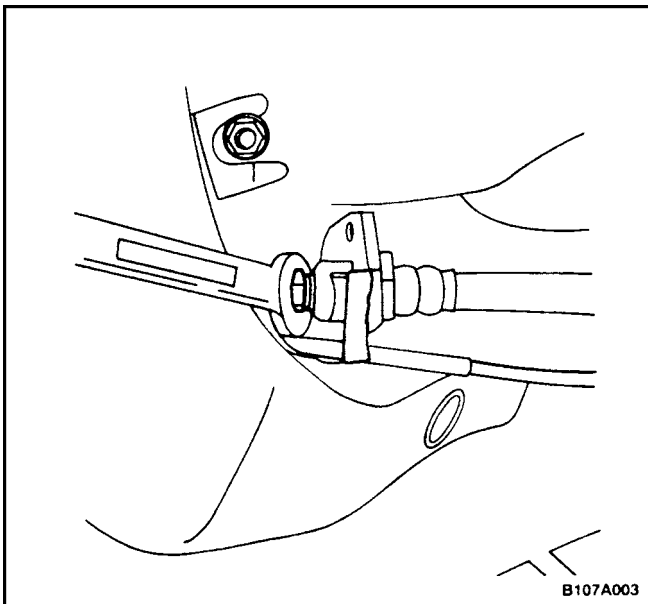
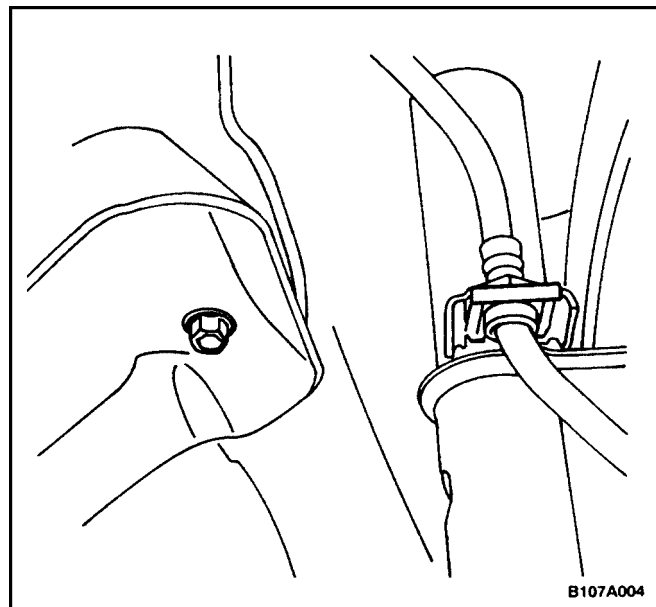
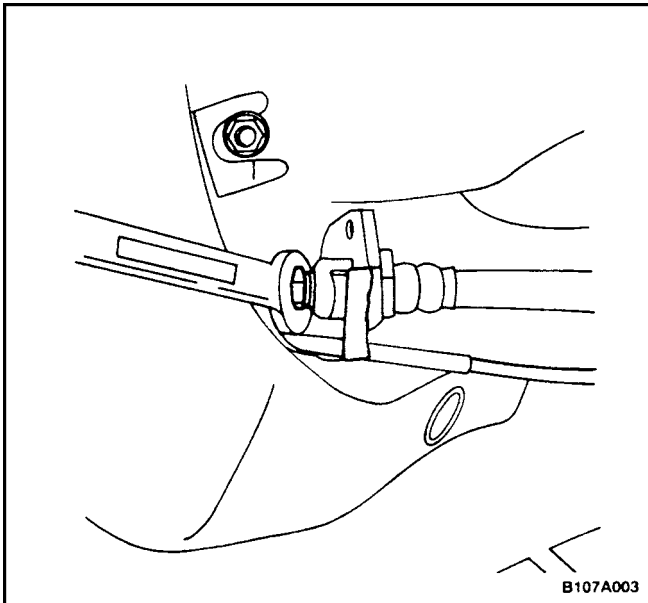
8. Attach the bleeder hose to the bleeder valve. Submerge the opposite end of the hose in a clean container partially filled with brake fluid.
9. A107A006 Open the bleeder valve one-half to three-fourths turn and allow the fluid to flow until no air is seen in the fluid.

Notice : After the bleeding operation, the brake reservoir may be pressurized. While disconnecting the bleeder hose or the unthreaded adapter cap, cover the cap and the connection with a shop towel to protect painted surfaces from contact with the brake fluid.

10. Inspect the brake pedal for sponginess. Repeat the entire bleeding procedure to correct this condition.
11. Tighten the bleeder valve and replace the dust covers.

Tighten

Tighten the bleeder valve to 8 N•m (71 lb-in).



BRAKE HOSE REAR

Removal Procedure

1. Raise and suitably support the vehicle.
2. Disconnect the brake line from the disc brake hose at the wheel housing bracket on each side of the vehicle.
3. Remove the brake hose retainer.
4. Remove the rear disc brake hose retainer and the brake hose from the bracket on the steering knuckle shaft.
5. Remove the rear disc brake hose from the caliper.

Installation Procedure

1. Install the rear disc brake hose to the caliper.

Tighten

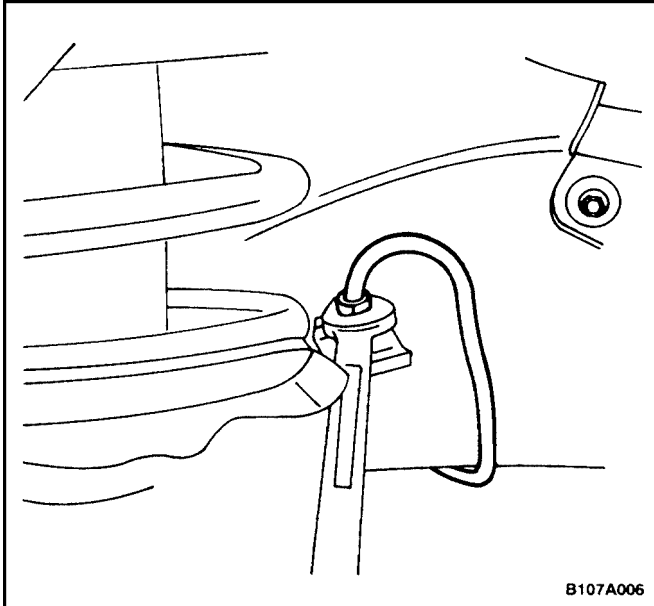
Tighten the rear disc brake hose-to-caliper bolt to 32 N•m (24 lb-ft).

2. Install the rear disc brake hose and retainer on the bracket on the steering knuckle shaft
3. Install the rear disc brake line to the brake hose on the wheel housing bracket.

Tighten

Tighten the brake line to 16 N•m (12 lb-ft).

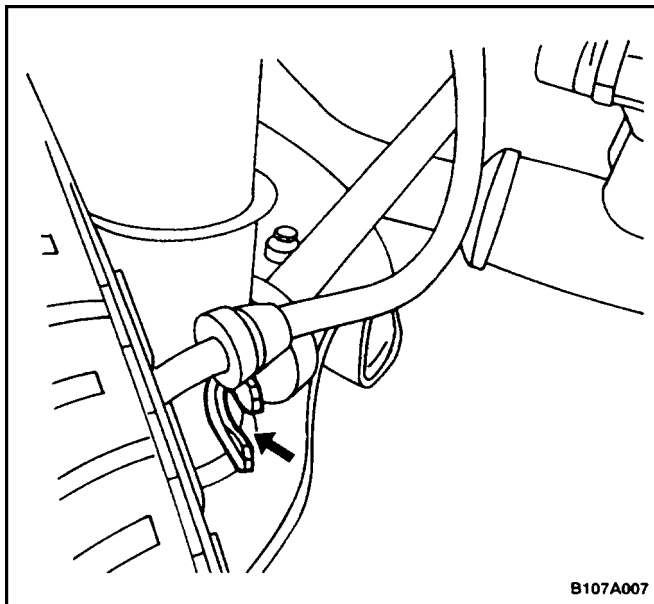
4. Lower the vehicle.
5. Bleed the brake system. Refer to "Manual Bleeding the Brakes" in this section, or *Section 4F, Antilock Brakes*, if applicable.
6. Check the brake system for leaks.



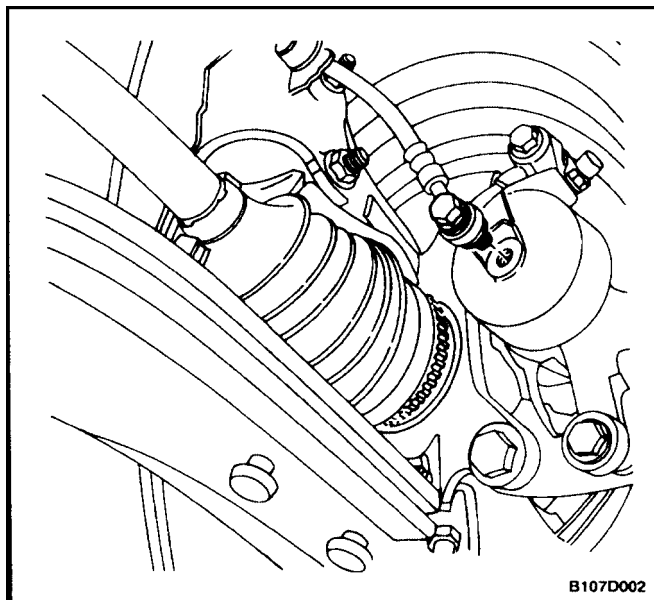
BRAKE HOSE FRONT

Removal Procedure

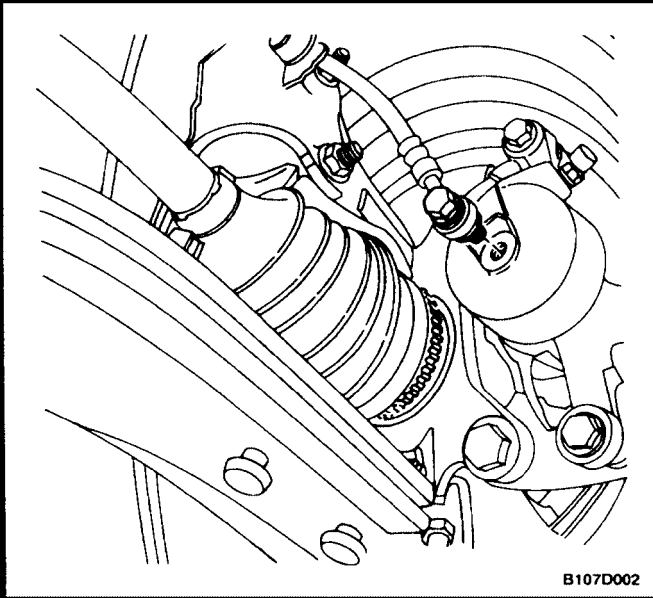
1. Raise and suitably support the vehicle.
2. Disconnect the brake line from the brake hose support bracket on the wheel housing on each side of the vehicle.
3. Remove the retainer.



4. Disconnect the brake hose from the "C" bracket on the steering knuckle shaft.



5. Remove the bolt from the brake caliper.
6. Remove the seal rings and the disc brake hose.

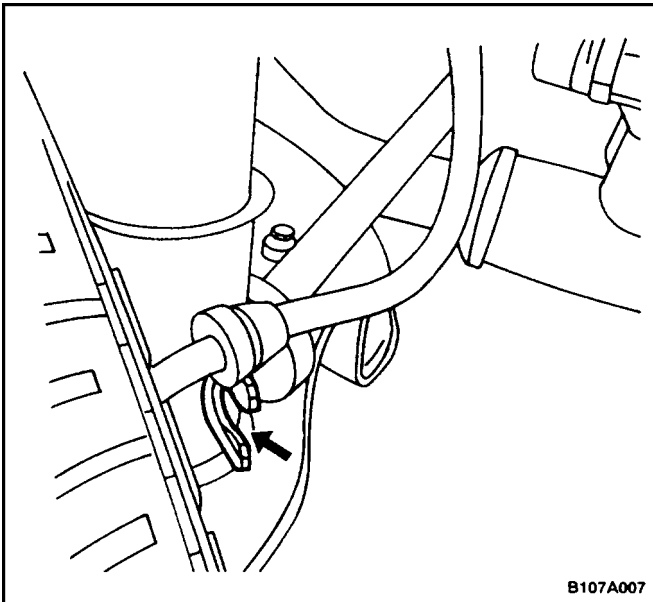


Installation Procedure

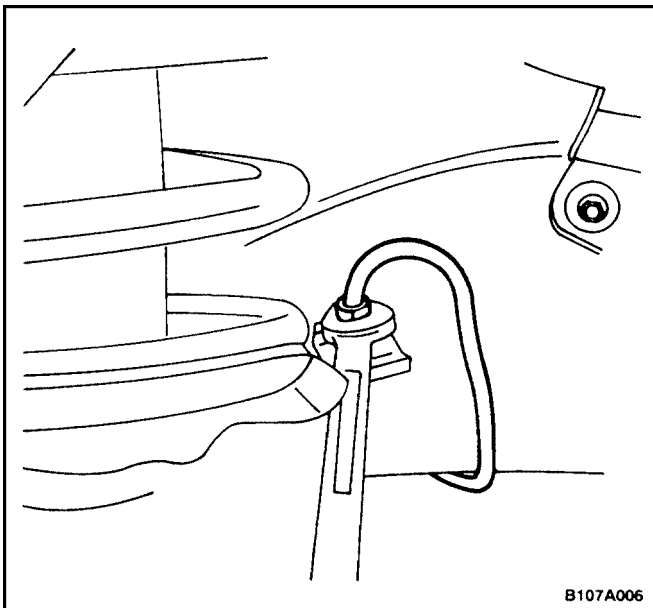
1. Install the new disc brake hose to the caliper with new seal rings and the bolt.

Tighten

Tighten the front disc brake hose-to-caliper bolt to 40 N•m (30 lb–ft).



2. Slide the brake hose on the steering knuckle shaft "C" bracket.

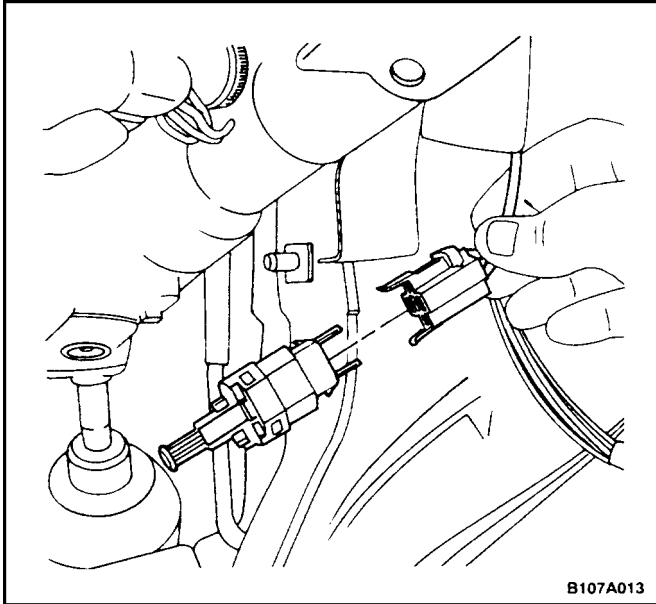


3. Connect the brake line to the brake hose on the wheel housing bracket on each side of the vehicle.

Tighten

Tighten the brake line to 16 N•m (12 lb–ft).

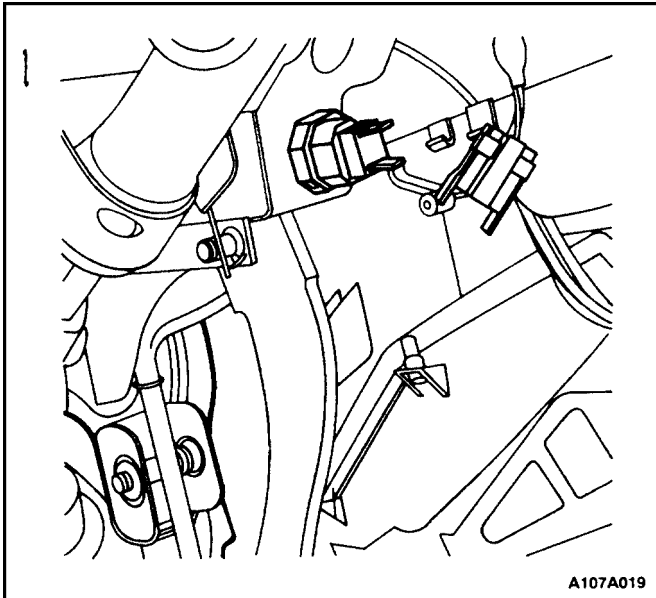
4. Lower the vehicle.
5. Bleed the brake system. Refer to "Manual Bleeding the Brakes" in this section.
6. Check the brake system for leaks.



STOPLAMP SWITCH

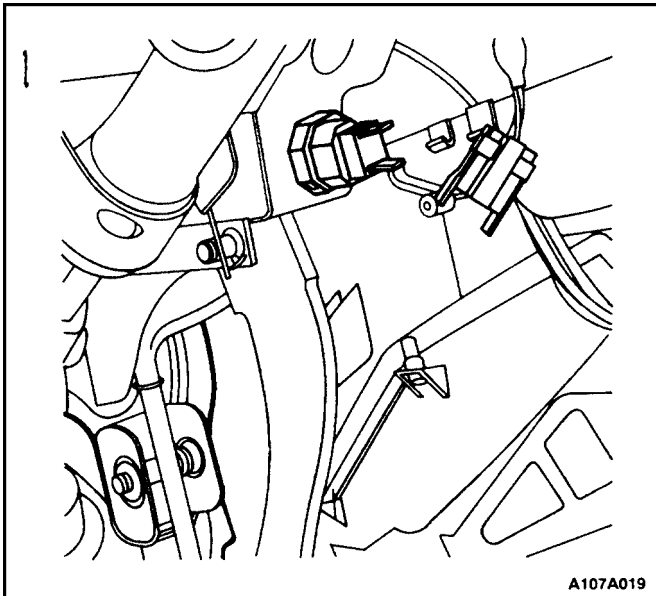
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the connector from the stoplamp switch.
3. Rotate the switch and remove it from the brake pedal bracket.



Installation Procedure

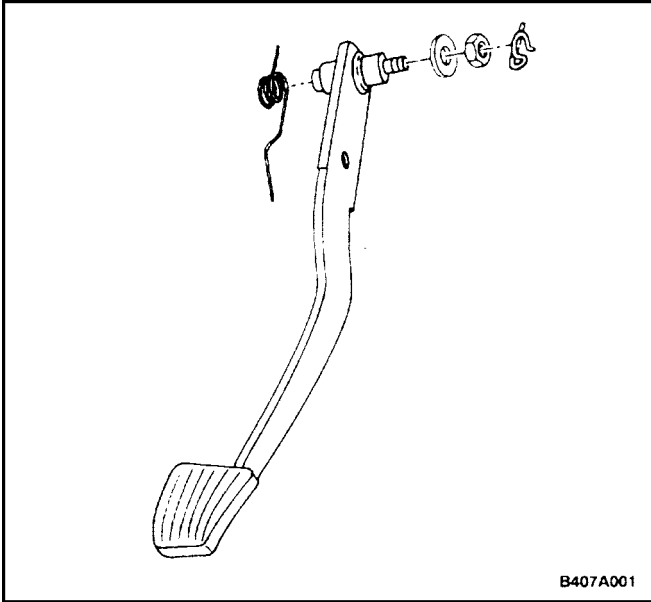
1. Insert the stoplamp switch into the brake pedal bracket and rotate the switch to lock it.
2. Connect the electrical connector to the stoplamp switch.
3. Press the brake pedal and pull the switch plunger to its maximum setting to adjust the switch.
4. Release the plunger and pull up on the pedal.
5. Connect the negative battery cable.



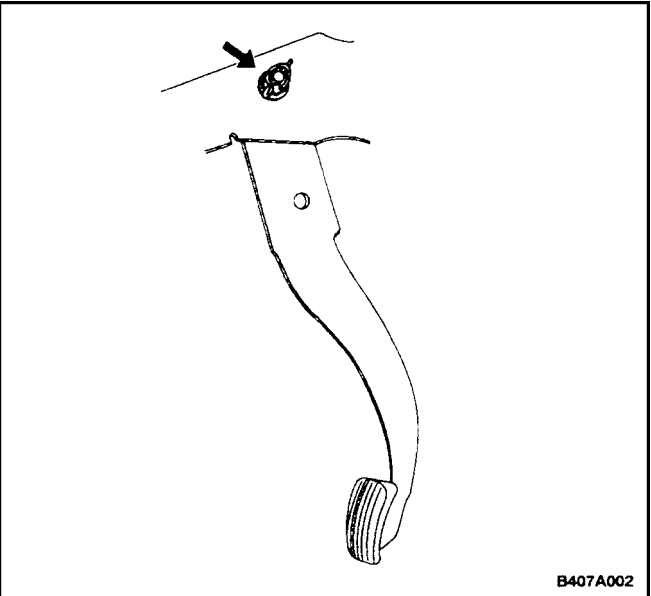
BRAKE PEDAL

Removal Procedure

1. Remove the stoplamp switch.



2. Notice how the brake pedal return spring is installed so that it can be reinstalled the same way. Move the end of the brake return spring away from the clevis retainer on the brake pedal.
3. Remove the clip, the retainer, and the clevis pin from the brake pedal.
4. Remove the retaining clip from the brake pedal shaft, and remove the nut and the washer from the shaft.
5. Remove the pedal shaft and the brake pedal.



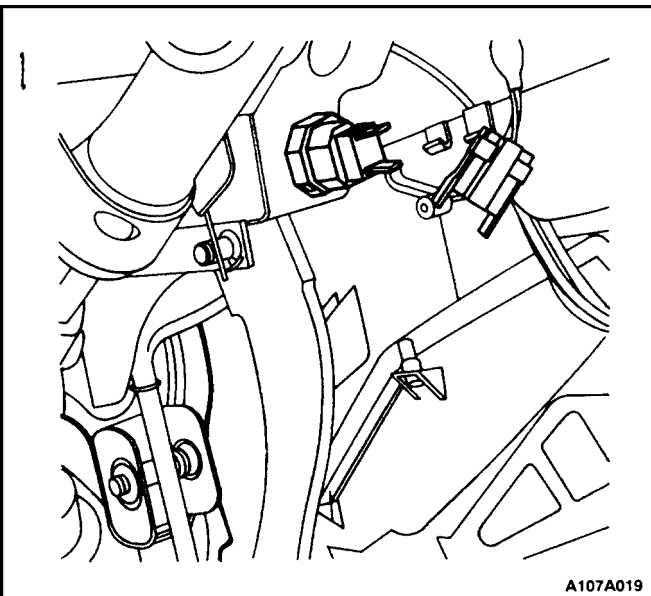
Installation Procedure

1. Coat the pedal shaft with grease.
2. Place the brake pedal and the return spring in the brake pedal bracket, and install the shaft, the washer, and the nut.

Tighten

Tighten the shaft nut to 18 N•m (13 lb–ft).

3. Install the retaining clip into the hole in the pedal shaft.
4. Align the clevis with the holes in the brake pedal, and install the clevis pin, the clevis retainer, and the clip.



5. Install the stoplamp switch.

GENERAL DESCRIPTION AND SYSTEM OPERATION

HYDRAULIC FLUID

Brake fluid should meet the DOT–3 specification. Use DOT–4 fluid for heavy duty applications such as trailer towing or mountain driving. Use only clean fluid from a sealed container. Fluid exposed to air will absorb moisture from the air. Water in the brake fluid will cause the fluid to boil, and the rubber components to deteriorate.

Thoroughly clean the master cylinder reservoir cap before removing it. Do not let any dirt or foreign material fall into the fluid reservoir.

There is a fluid level switch in the master cylinder reservoir. When the fluid level is low, the BRAKE lamp in the instrument cluster will turn on. The correct brake fluid level is marked on the driver's side of the master cylinder reservoir. If the fluid level is below the MIN indicator mark, check the hydraulic brake system for leaks and then refill the reservoir to the MAX indicator mark.