

2003 BRAKES

Disc - Ascender

DESCRIPTION & OPERATION

WARNING: Vehicles are equipped with air bag supplemental restraint system. Before attempting ANY repairs involving steering column, instrument panel or related components, see **SERVICE PRECAUTIONS** and **DISABLING & ACTIVATING AIR BAG SYSTEM** in **AIR BAG RESTRAINT SYSTEMS** article.

BRAKE ASSIST SYSTEM

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 brake pedal to brake booster.
- Vacuum brake booster uses source vacuum to decrease effort required by driver when applying brake system input force. 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 supplies force used by vacuum brake booster to decrease brake pedal effort.
- Vacuum source delivery system enables delivery and retention of source vacuum for vacuum brake booster.

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

HYDRAULIC BRAKE SYSTEM

The hydraulic brake system consists of the following:

- Hydraulic brake master cylinder fluid 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 2 hydraulic circuits, supplying front-rear opposed wheel apply circuits.
- Hydraulic brake pressure balance control system regulates brake fluid pressure delivered to hydraulic brake wheel circuits, in order to control the distribution of braking force. Pressure balance control is achieved through dynamic rear proportioning (DRP), which is a function of the Anti-Lock Brake System (ABS) modulator. For more information on DRP operation, see appropriate ANTI-LOCK article.
- Hydraulic brakelines and flexible brake hoses carry brake fluid to and from hydraulic brake system components.
- Hydraulic brake wheel apply components converts hydraulic input pressure into mechanical output force.

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 brakelines and flexible hoses. The wheel apply components then convert the hydraulic pressure back into mechanical force which presses linings against rotating brake system components.

PARK BRAKE SYSTEM

The park brake system consists of the following:

- Park brake lever assembly receives and transfers park brake system apply input force from driver to park brake cable system. It releases applied park brake system when lever is returned to at-rest (lowered) position.
- Park brake cables transfer input force received from park brake lever, through park brake cable equalizer, to park brake apply lever.
- Park brake cable equalizer evenly distributes input force to both the left and right park brake units. Threaded park brake cable equalizers are also used to remove slack in park brake cables.
- Park brake apply lever multiplies and transfers input force to park brake actuator.
- Park brake actuator uses multiplied input force from apply lever to expand park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor. Threaded park brake actuators are also used to control clearance between the park brake shoe and the friction surface of the drum-in-hat portion of the rear brake rotor.
- Park brake shoe applies mechanical output force from park brake actuator to friction surface of the drum-in-hat portion of the rear brake rotor.

Park brake apply input force is received by the park brake lever assembly being depressed, transferred and evenly distributed, through the park brake cables and the park brake cable equalizer, to the left and right park brake apply levers. The park brake apply levers multiply and transfer the apply input force to the park brake actuators which expand the park brake shoe toward the friction surface of the drum-in-hat portion of the rear brake rotor in order to prevent the rotation of the rear tire and wheel assemblies. The park brake lever assembly releases an applied park brake system when it is returned to the at-rest (lowered) position.

BLEEDING BRAKE SYSTEM

BLEEDING PROCEDURE

While bleeding the hydraulic brake system, observe for the following conditions:

- The presence of air in the system at a bleeder valve location other than at the repair location, except if the brake master cylinder was replaced.
- An unrestricted and even flow of brake fluid per axle during the bleeding procedure.

BRAKELINE BLEEDING SEQUENCE

Application	Sequence
All Models	RR, LR, RF & LF

Proceed to appropriate bleeding procedure below.

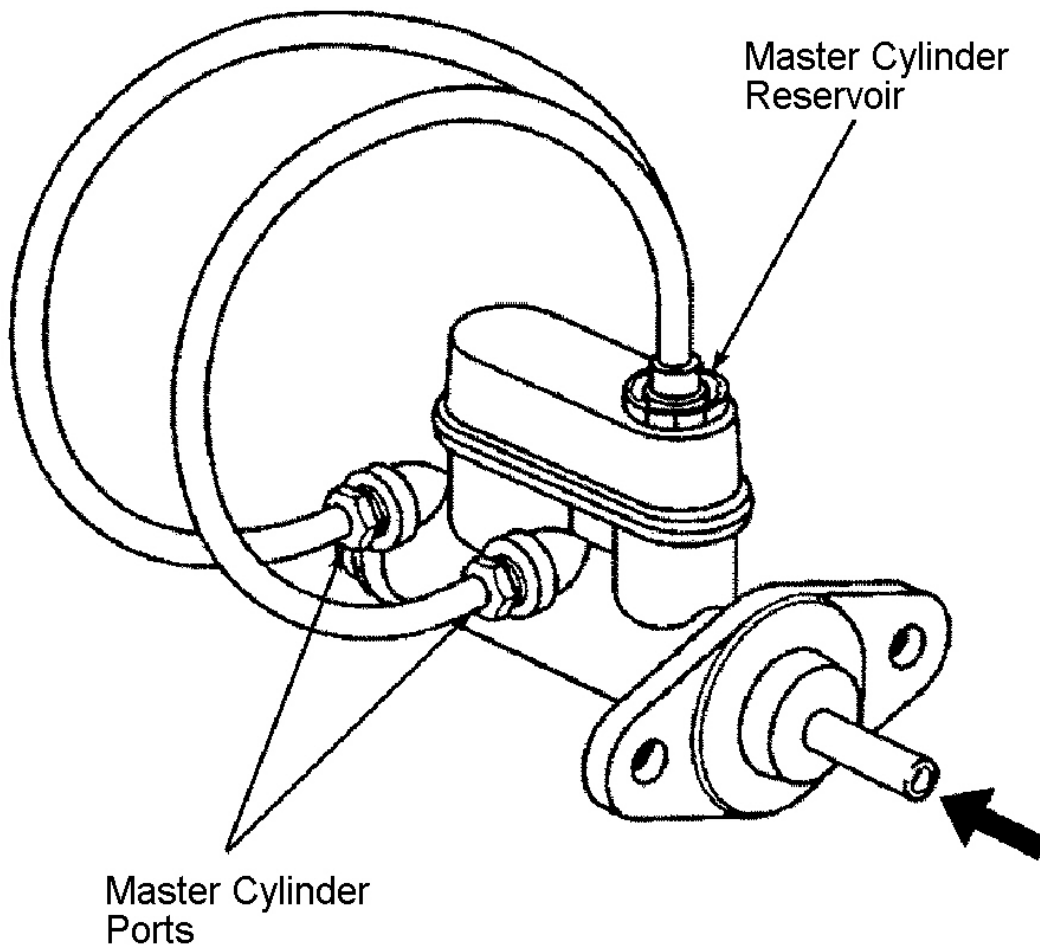
MANUAL BLEEDING

1. Place a clean shop cloth beneath the brake master cylinder to prevent brake fluid spills.
2. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal effort increases significantly, in order to deplete the brake booster power reserve.
3. If you have performed a brake master cylinder bench bleeding on this vehicle, or if you disconnected the brakelines from the master cylinder, you must perform the following steps:
 - A. Ensure that the brake master cylinder reservoir is full to the maximum-fill level. If necessary add Delco Supreme 11(R) P/N 12377967, P/N 992667 or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. If removal of the reservoir cap and diaphragm is necessary, clean the outside of the reservoir on and around the cap prior to removal.
 - B. With the rear brakeline installed securely to the master cylinder, loosen and separate the front brakeline from the front port of the brake master cylinder.
 - C. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder. Reconnect the brakeline to the master cylinder port and tighten securely.
 - D. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal. Loosen the same brakeline to purge air from the open port of the master cylinder. Tighten the brakeline, then have the assistant slowly release the brake pedal.
 - E. Wait 15 seconds, then repeat steps B and C until all air is purged from the same port of the master cylinder.
 - F. With the front brakeline installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brakeline from the master cylinder, then repeat steps B-D . After completing the final master cylinder port bleeding procedure, ensure that both of the brakeline-to-master cylinder fittings are properly tightened.
4. Fill the brake master cylinder reservoir with Delco Supreme 11(R) P/N 12377967, P/N 992667 or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. Ensure that the brake master cylinder reservoir remains at least half-full during this bleeding procedure. Add fluid as needed to maintain the proper level. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm.
5. Install a proper box-end wrench onto the appropriate wheel hydraulic circuit bleeder valve to be serviced. See **BRAKELINE BLEEDING SEQUENCE** table. Install a transparent hose over the end of the bleeder valve.
6. Submerge the open end of the transparent hose into a transparent container partially filled with Delco Supreme 11(R) P/N 12377967, P/N 992667 or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
7. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal. Loosen the bleeder valve to purge air from the wheel hydraulic circuit. Tighten the bleeder valve, then have the assistant slowly release the brake pedal.
8. Wait 15 seconds, then repeat step 7 until all air is purged from the same wheel hydraulic circuit. Tighten bleeder valve securely. See **TORQUE SPECIFICATIONS**.
9. Repeat steps 5-8 for each wheel. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 bleeder valves are properly tightened.

10. Fill the brake master cylinder reservoir to the maximum-fill level with Delco Supreme 11(R), P/N 12377967, P/N 992667, or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
11. Slowly depress and release the brake pedal. Observe the feel of the brake pedal. 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:
 - A. Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK TEST** under TROUBLE SHOOTING.
 - B. Pressure bleed the hydraulic brake system in order to purge any air that may still be trapped in the system. See **PRESSURE BLEEDING**.
12. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated. If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired. If the brake system warning lamp remains illuminated, see appropriate GAUGES & INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT.

MASTER CYLINDER BENCH BLEEDING

1. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible.
2. Remove the master cylinder reservoir cap and diaphragm.
3. Install suitable fittings to the master cylinder ports that match the type of flare seat required and also provide for hose attachment. Install transparent hoses to the fittings installed to the master cylinder ports, then route the hoses into the master cylinder reservoir. See **Fig. 1**.
4. Fill the master cylinder reservoir to at least the half-way point with Delco Supreme 11(R), P/N 12377967, P/N 992667, or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
5. Ensure that the ends of the transparent hoses running into the master cylinder reservoir are fully submerged in the brake fluid.
6. Using a smooth, round-ended tool, depress and release the primary piston as far as it will travel, a depth of about 1" (25 mm), several times. Observe the flow of fluid coming from the ports. As air is bled from the primary and secondary pistons, the effort required to depress the primary piston will increase and the amount of travel will decrease.
7. Continue to depress and release the primary piston until fluid flows freely from the ports with no evidence of air bubbles. Remove the transparent hoses from the master cylinder reservoir.
8. Install the master cylinder reservoir cap and diaphragm.
9. 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.
10. Remove the master cylinder from the vise.



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Fig. 1: Installing Hoses To Master Cylinder Ports & Reservoir
Courtesy of ISUZU MOTOR CO.

PRESSURE BLEEDING

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

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- B. With the rear brakeline installed securely to the master cylinder, loosen and separate the front brakeline from the front port of the brake master cylinder.
 - C. Allow a small amount of brake fluid to gravity bleed from the open port of the master cylinder. Reconnect the brakeline to the master cylinder port and tighten securely.
 - D. Have an assistant slowly depress the brake pedal fully and maintain steady pressure on the pedal. Loosen the same brakeline to purge air from the open port of the master cylinder. Tighten the brakeline, then have the assistant slowly release the brake pedal.
 - E. Wait 15 seconds, then repeat steps B-C until all air is purged from the same port of the master cylinder.
 - F. With the front brakeline installed securely to the master cylinder, after all air has been purged from the front port of the master cylinder, loosen and separate the rear brakeline from the master cylinder, then repeat steps B-D . After completing the final master cylinder port bleeding procedure, ensure that both of the brakeline-to-master cylinder fittings are properly tightened.
3. Fill the brake master cylinder reservoir to the maximum-fill level with DOT-3 brake fluid from a clean, sealed brake fluid container. Clean the outside of the reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Install the brake pressure bleeder adapter (J-35589-A) to the brake master cylinder reservoir.
 4. Check the brake fluid level in the diaphragm type brake pressure bleeder (J-29532), DOT-3 brake fluid from a clean, sealed brake fluid container as necessary to bring the level to approximately the half-full point.
 5. Connect J-29532, or equivalent, to J-35589-A. Charge J-29532, or equivalent, air tank to 25-30 psi (1.75-2.04 kg/cm²). Open J-29532, or equivalent, fluid tank valve to allow pressurized brake fluid to enter the brake system.
 6. Wait approximately 30 seconds, then inspect the entire hydraulic brake system in order to ensure that there are no existing external brake fluid leaks. Any brake fluid leaks identified require repair prior to completing this procedure.
 7. Install a proper box-end wrench onto the appropriate wheel hydraulic circuit bleeder valve to be serviced. See **BRAKELINE BLEEDING SEQUENCE** table. Install a transparent hose over the end of the bleeder valve.
 8. Submerge the open end of the transparent hose into a transparent container partially filled with Delco Supreme 11(R), P/N 12377967, P/N 992667, or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container. 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. See **TORQUE SPECIFICATIONS**.
 9. Repeat steps 7 and 8 for each wheel. After completing the final wheel hydraulic circuit bleeding procedure, ensure that each of the 4 bleeder valves are properly tightened.
 10. Close J-29532, or equivalent, fluid tank valve, then disconnect J-29532, or equivalent, from J-35589-A. Remove J-35589-A from the brake master cylinder reservoir.
 11. Fill the brake master cylinder reservoir to the maximum-fill level with DOT-3 brake fluid from a clean, sealed brake fluid container. Slowly depress and release the brake pedal. Observe the feel of the brake pedal.
 12. If the brake pedal feels spongy perform the following steps:
 - A. Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK TEST**

under TROUBLE SHOOTING.

- B. Using a scan tool, perform the anti-lock brake system automated bleeding procedure to remove any air that may have been trapped in the brake pressure modulator valve (BPMV). Refer to ABS automated bleed procedure in appropriate ANTI-LOCK article.
13. Turn the ignition key ON, with the engine OFF. Check to see if the brake system warning lamp remains illuminated. If the brake system warning lamp remains illuminated, DO NOT allow the vehicle to be driven until it is diagnosed and repaired. If the brake system warning lamp remains illuminated, see appropriate GAUGES & INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT.

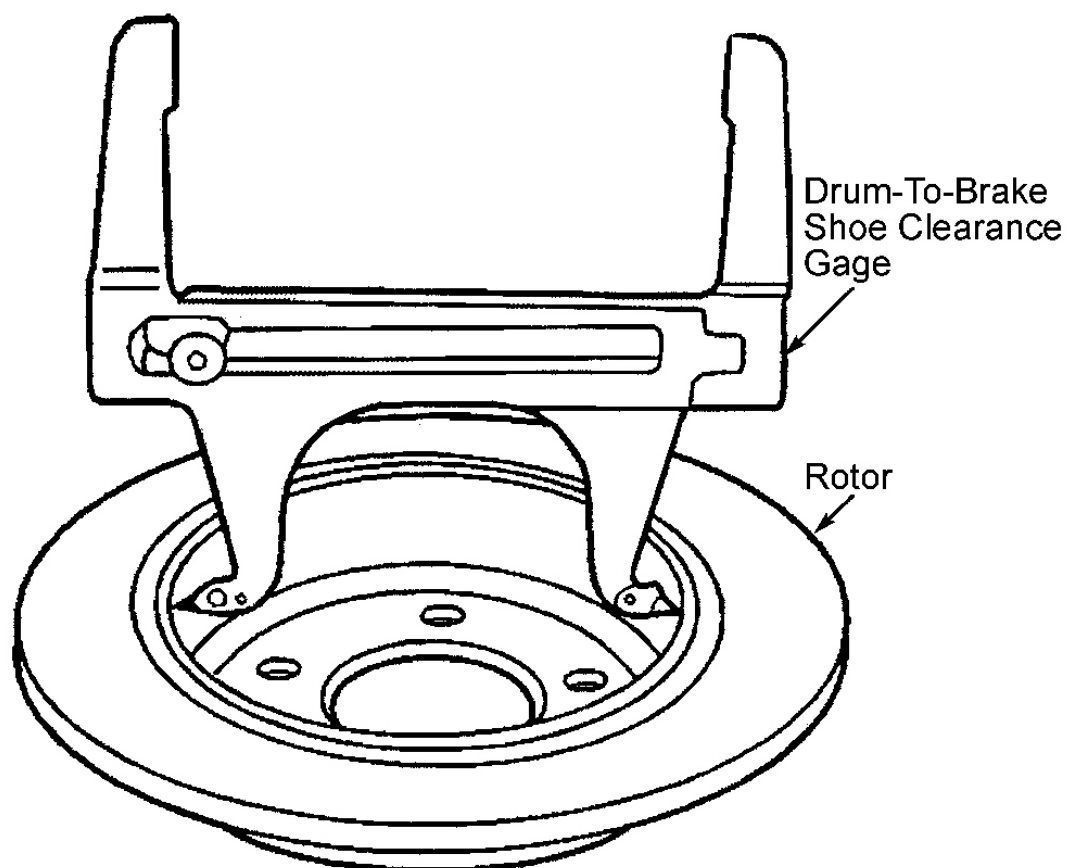
ADJUSTMENTS

BRAKE PEDAL TRAVEL

1. With the ignition OFF and the brakes cool, apply the brakes 3-5 times, or until the brake pedal becomes firm, in order to deplete the brake booster power reserve.
2. Install the Brake Pedal Effort Gauge (J-28662) to the brake pedal.
3. Measure and record the distance from the brake pedal to the rim of the steering wheel; note the points of measurement.
4. Apply and maintain the brakes with 100 lbs (445 N) of force to the brake pedal, as indicated on the J-28662.
5. While maintaining 100 lbs (445 N) of force to the brake pedal, measure and record the distance from the same point on the brake pedal to the same point on the rim of the steering wheel.
6. Release the brakes and repeat steps 4 and 5 to obtain a second measurement. After obtaining a second measurement, go to next step.
7. Average the first and second measurements recorded during the 2 applies of the brakes.
8. Subtract the unapplied initial measurement from the averaged, applied measurement to obtain the brake pedal travel distance. Maximum brake pedal travel (measured with the ignition OFF, brake booster power assist depleted, and the brakes cool) is 2.4" (61 mm).

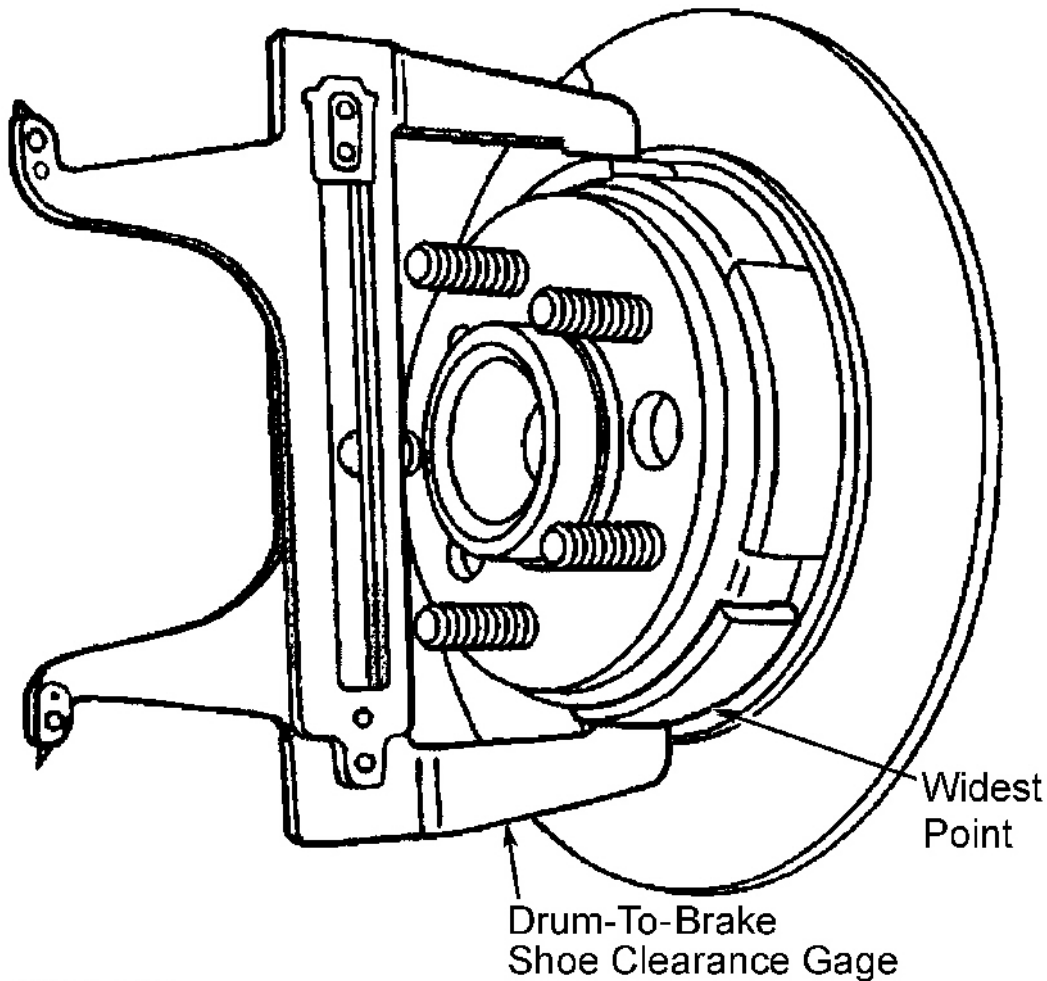
PARK BRAKE

1. Adjust the drum-to-brake shoe clearance gage (J-21177-A) until it contacts the inside diameter of the rotor. See **Fig. 2**.
2. Position the J-21177-A over the park shoe lining at the widest point. See **Fig. 3**. Turn the adjuster nut until the lining just contacts the J-21177-A.
3. Repeat steps 1 and 2 to adjust the right rear park brake. The clearance between the rear park brake shoe lining and the rotor should be 0.026" (0.66 mm).



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Fig. 2: Adjusting Drum-To-Brake Shoe Clearance Gage
Courtesy of ISUZU MOTOR CO.



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Fig. 3: Positioning Drum-To-Brake Shoe Clearance Gage (Left Side Shown)
Courtesy of ISUZU MOTOR CO.

PARK BRAKE CABLE AUTOMATIC ADJUSTER

CAUTION: Handling the parking brake cables during service requires extra care. Damage to the nylon coating reduces the corrosion protection. If the damage area passes through the nylon coating, increased parking brake effort could result. Avoid contacting the protective coating with sharp-edge tools or the sharp surfaces of the vehicle underbody.

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1. Place the park brake lever in the full release position. Raise and suitably support the vehicle.
2. Pull the park brake cable equalizer toward the rear of the vehicle and place a locking plier with protected jaws on the cable to hold the cable in an extended position.
3. Lower the vehicle. Rotate the self-adjust clip into the lock position with a flat bladed tool.
4. Raise the vehicle. Remove the locking plier from the park brake cable.
5. Lower the vehicle. Partially raise the park brake lever, stopping prior to the self-adjust clip activating on the mount bracket tab.
6. Insert a flat bladed tool behind the self-adjust clip and twist the tool 90 degrees to raise the self-adjust clip over the mount bracket tab. Raise the handle until it is fully applied and remove the screwdriver.

Enabling

1. Lower the park brake lever. Raise the park brake lever.
2. Lift the park brake lever boot to gain access to the multiplier lever at the front of the park brake lever assembly.
3. Pivot the multiplier lever up and down 3 times.
4. Cycle the park brake lever up and down three times for auto adjustment. Lower the park brake lever boot.

TROUBLE SHOOTING

WARNING: Brake fluid may irritate eyes and skin.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

BRAKE SYSTEM EXTERNAL LEAK TEST

NOTE: Use only Delco Supreme 11(R), GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid.

1. In order to inspect for external brake fluid leaks, first check the fluid level in the master cylinder. While a slight brake fluid level drop can be considered a normal condition due to brake lining wear, a very low level may indicate a brake fluid leak in the hydraulic system. If the fluid level is abnormally low, adjust the brake fluid level.
2. Start the engine and allow it to idle. Apply constant, moderate foot pressure to the brake pedal. If the brake pedal gradually falls away while under foot pressure, there may be a brake fluid leak.
3. Turn OFF the ignition. Visually inspect the following brake system components for brake fluid leaks, excessive corrosion, and damage. Give particular attention to all brakeline and flexible hose connections

to ensure that there are not any slight brake fluid leaks, even though the brake pedal may feel firm and hold steady:

- Master cylinder brakeline fittings.
 - All brakeline connections.
 - Brakelines.
 - Brake hoses and connections.
 - Brake calipers and/or wheel cylinders, if equipped.
4. 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.

BRAKE SYSTEM INTERNAL LEAK TEST

1. Start the engine and allow it to idle. Apply light, steady pressure to the brake pedal. Observe both the brake pedal feel and travel.
2. Release the brakes and turn ignition OFF.
3. If the brake pedal apply felt spongy, but the brake pedal travel was not excessive, perform the following steps:
 - A. Inspect the brake system for external leaks. See **BRAKE SYSTEM EXTERNAL LEAK TEST**.
 - B. Pressure bleed the brake system in order to purge any air that may be trapped in the system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM.
4. If the brake pedal apply did not feel spongy, but the brake pedal travel was excessive, perform the following steps:
 - A. Loosen the master cylinder-to-brake power booster mounting nuts.
 - B. Carefully pull the master cylinder away from the brake power booster just enough to inspect the mounting surface of the master cylinder.
 - C. Inspect the master cylinder mounting surface at the primary piston for brake fluid leaks.
5. If the master cylinder exhibits any leakage around the primary piston, then the primary piston primary seal and/or secondary seal is leaking and the master cylinder requires overhaul or replacement. See **MASTER CYLINDER** under OVERHAUL or **MASTER CYLINDER** under REMOVAL & INSTALLATION.
6. If the master cylinder primary piston does not exhibit any leakage, pressure bleed the brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM.
7. If the brake pedal apply did not feel spongy, and the brake pedal travel was initially steady and not excessive, but then gradually fell, then the master cylinder requires overhaul or replacement due to an internal leak past the secondary piston from the secondary piston primary seal or secondary seal.
8. 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. See appropriate ANTI-LOCK article in BRAKES.

BRAKE SYSTEM VACUUM SOURCE TEST

1. Disconnect the engine vacuum hose from the vacuum brake booster check valve.
 2. Install a vacuum gage to the engine vacuum hose. Start the engine and allow the engine to idle until normal operating temperatures are reached.
 3. Check to see if the engine vacuum reading is within the specified normal engine vacuum range of 14-20 in. Hg (47-68 kPa).
 4. Turn the ignition OFF. If the engine vacuum reading is within the specified normal range, go to step 7.
 5. If the engine vacuum reading is NOT within the specified normal range, inspect the engine vacuum hose for the following conditions.
 - Tight connection to the engine.
 - Collapse, deformation or contamination.
 - Cracks, cuts or dry-rot.
 6. If any of these conditions were found with the engine vacuum hose, replace the hose, then repeat steps 2-3 . 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.
 7. Remove the vacuum brake booster check valve from the booster.
 8. Install the check valve to the engine vacuum hose. Install the vacuum gage to the check valve.
 9. Start the engine and allow the engine to idle until normal operating temperatures are reached. Turn the ignition OFF.
 10. Check to see if the engine vacuum reading is maintained within the specified normal engine vacuum range of 14-20 in. Hg (47-68 kPa).
 11. If the engine vacuum reading is maintained within the specified normal range, go to next step. If the engine vacuum reading is NOT maintained within the specified normal range, replace the brake booster check valve, then repeat steps 8-10 .
 12. Inspect the brake booster check valve grommet for the following conditions:
 - Firm connection to the vacuum brake booster.
 - Deformation or contamination.
 - Cracks, cuts or dry-rot.
- If any of these conditions were found with the check valve grommet, replace the grommet.

HYDRAULIC BRAKE COMPONENT INSPECTION

1. With the tire and wheel assemblies removed and the brake rotors retained by wheel lug nuts, visually inspect the caliper piston dust boot sealing area to ensure that there are no brake fluid leaks.
2. If any evidence of a brake fluid leak is present, the brake caliper requires overhaul or replacement. For overhaul, see **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under OVERHAUL. For replacement, see **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.
3. While the brake system is at rest, observe the position of the caliper piston in relation to the caliper housing.
4. Have an assistant apply and release the brake pedal several times while you observe the operation of the

hydraulic brake caliper. Observe the caliper piston for unrestricted and even movement during each apply of the brake system. Observe the caliper piston for an unrestricted and even return motion during each release of the brake system.

5. If the caliper piston did not exhibit unrestricted and even movement during brake system apply and/or release, the piston square seal may be worn or damaged and the caliper may require overhaul or replacement. For overhaul, see **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under OVERHAUL. For replacement, see **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.

INTERMITTENT OR POOR CONNECTIONS

Most intermittent problems are caused by faulty electrical connectors or wiring. When an intermittent failure is encountered, check suspected circuits for damage:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

ROAD TEST

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. Inspect the brake master cylinder reservoir fluid level and adjust only if necessary for brake system road testing. Inspect the tire inflation pressures and adjust as necessary. Inspect the tire tread patterns to ensure that they are the same or very similar, especially per axle. Ensure that the vehicle is not loaded unevenly prior to brake system road testing.
2. Start the engine and allow it to idle. Check to see if the brake warning lamp remains illuminated. If the brake warning lamp remains illuminated, DO NOT test drive the vehicle until it is diagnosed and repaired. See appropriate GAUGES & INSTRUMENT PANELS article in ACCESSORIES & EQUIPMENT.
3. 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. With the transmission in PARK, lightly apply the brake pedal. Observe both the pedal feel and the pedal travel. 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 not excessive, go to next step.
4. Release and apply the brakes. While continuing to apply the brakes, shift the transmission into DRIVE, release the brakes and allow the engine to idle the vehicle away from the stopped position. Observe for a slow release of the brake system.
5. 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. 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, go to next step.
6. Drive the vehicle in the opposite direction, at the same low speed and lightly apply the brakes while

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driving past the assistant. Have the assistant observe for brake system noise from the side of the vehicle closest to him. 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.

7. Select a smooth, dry, clean and level road that is as free of heavy traffic as possible for brake system moderate speed road testing. Drive the vehicle at a moderate speed. Observe for a pull and/or incorrect tracking of the vehicle without the brakes applied. 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. 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, go to next step.
8. While continuing to drive the vehicle at a moderate speed, perform several moderate applies of the brakes. Observe the pedal effort and the pedal travel, observe for brake system pulsation and/or uneven braking action - either side to side, or front to rear. A small amount of vehicle front end dip is expected during a moderate apply of the brakes. 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.

SYSTEM DIAGNOSIS

Brake Assist

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
 2. Inspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL** under ADJUSTMENTS. If brake pedal travel distance is within specification, go to step 5. If brake pedal travel distance is not within specification, go to next step.
 3.
 - A. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components.
 - Inspect the brake pedal pushrod components. See **INSPECTION** under BRAKE PEDAL in REMOVAL & INSTALLATION.
 - Inspect the brake pedal bushings for excessive wear and/or damage and inspect the brake pedal for a misaligned, bent and/or damaged condition.
 - B. Replace the brake pedal system components that are worn, missing, misaligned, bent or damaged, refer to the following procedures as necessary.
 - Brake pedal assembly. See **BRAKE PEDAL** under REMOVAL & INSTALLATION.
 - Vacuum brake booster (for a bent or damaged pedal pushrod replacement). See **VACUUM BRAKE BOOSTER** under REMOVAL & INSTALLATION.
- If any worn, missing, misaligned, bent or damaged brake pedal system components were found and replaced, go to next step. If problem was not found, go to step 5.
4. Reinspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL** under ADJUSTMENTS. If brake pedal travel distance is within specifications, go to step 8. If brake pedal travel distance is not within specifications, go to next step.

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5. Check the engine vacuum source that supplies vacuum to the vacuum brake booster. See **BRAKE SYSTEM VACUUM SOURCE TEST**. If the vacuum reading is within specifications, go to next step. If the vacuum reading is not within specifications, inspect engine mechanical system. See appropriate ENGINE MECHANICAL article in ENGINE.
6. During the vacuum source inspection, if the vacuum booster check valve operates properly, go to step 8. If the vacuum booster check valve does not operate properly, go to next step.
7. Replace the vacuum booster check valve. See **VACUUM BRAKE BOOSTER CHECK VALVE &/OR HOSE** under REMOVAL & INSTALLATION. After replacement, go to next step.
8. Pump the brake pedal several times until the brake pedal becomes hard. Maintain moderate foot pressure on the brake pedal and start the engine. Observe pedal operation. If the brake pedal drops slightly, then remains firm after the engine was started, go to next step. If operation is not as specified, go to step 12.
9. Release the brake pedal. Turn the ignition OFF, then wait 15 seconds. Pump the brake pedal 2 times to check for vacuum booster available vacuum reserve. Observe pedal effort. If operating properly, the vacuum brake booster should maintain assist for at least 2 pedal applications. If the brake pedal effort increases significantly, go to step 12. If the brake pedal effort does not increase significantly, go to next step.
10. Inspect the brake pedal pushrod and the brake pedal for misalignment, a bent condition and/or damage. If the brake pedal pushrod and/or the brake pedal is misaligned, bent or damaged, go to next step. If the brake pedal pushrod and/or the brake pedal is okay, go to step 13.
11. Replace the brake pedal pushrod and/or the brake pedal, as necessary. Refer to the following procedure (s).
 - Brake pedal assembly. See **BRAKE PEDAL** under REMOVAL & INSTALLATION.
 - Vacuum brake booster (for a bent or damaged pedal pushrod replacement). See **VACUUM BRAKE BOOSTER** under REMOVAL & INSTALLATION.After replacements, go to step 13.
12. Replace the vacuum brake booster. See **VACUUM BRAKE BOOSTER** under REMOVAL & INSTALLATION. After replacement, go to next step.
13. Install or connect any components that were removed or disconnected during diagnosis. If diagnosis is completed, brake assist system is okay. Go to **SYMPTOM INDEX** table.

Disc Brake

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Visually inspect the disc brake pads for the following:
 - Lining thickness.
 - Uneven and/or abnormal wear (edge-to-edge and/or side-to-side).
 - Evidence of contamination from an external substance.
 - Looseness or damage (including pad hardware).

If there are problems with the front and/or rear disc brake pads, go to next step. If no problems were

found, go to step 12.

3. Check the front and/or rear disc brake pads for contamination. If the brake pads are contaminated, go to step 8. If the brake pads are okay, go to the next step.
4. Check the front and/or rear disc brake pads for uneven wear. If the brake pads are worn unevenly, go to step 7. If the brake pads are okay, go to the next step.
5. Check the front and/or rear disc brake pads and pad hardware looseness or damage. If brake pads and/or hardware is loose or damaged, go to step 7. If the brake pads and hardware are okay, go to the next step.
6. Remove and inspect the worn disc brake pads for glazing, looseness, heat spots or damage. Replace the worn disc brake pads as a complete axle set. See **FRONT DISC BRAKE PADS** and/or **REAR DISC BRAKE PADS** under REMOVAL & INSTALLATION. After inspection and replacement, go to step 12.

CAUTION: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from it's 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.

7.
 - A. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets and support the calipers. DO NOT disconnect the hydraulic brake flex hoses from the calipers. See **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - B. Inspect the disc brake caliper mounting bracket and the mounting/sliding hardware for the following conditions:
 - Loose, bent, cracked, or damaged caliper mounting bracket.
 - Binding or seized hardware.
 - Worn, damaged or missing hardware components.See INSPECTION under **FRONT DISC BRAKE HARDWARE** and/or **REAR DISC BRAKE HARDWARE** in REMOVAL & INSTALLATION.
 - C. Replace the following components as required:
 - Front and/or brake caliper bracket. See **FRONT BRAKE CALIPER BRACKET** and/or **REAR BRAKE CALIPER BRACKET** under REMOVAL & INSTALLATION.
 - Front and/or rear disc brake hardware. See INSPECTION under **FRONT DISC BRAKE HARDWARE** and/or **REAR DISC BRAKE HARDWARE** in REMOVAL & INSTALLATION.
 - D. Replace the unevenly-worn, loose or damaged disc brake pads as a complete axle set. See **FRONT DISC BRAKE PADS** and/or **REAR DISC BRAKE PADS** under REMOVAL & INSTALLATION.

After inspection and replacement, go to step 12.

8. Inspect the disc brake calipers, brake hoses and brakelines for evidence of an external brake fluid leak. Replace any components found to be leaking brake fluid. Refer to the following procedures as required:

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- Front and/or rear brake caliper overhaul. See **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under OVERHAUL.
- Front and/or rear brake hose replacement. See **FRONT BRAKE HOSE** and/or **REAR BRAKE HOSE** under REMOVAL & INSTALLATION.
- Brakeline replacement. See **BRAKELINE** under REMOVAL & INSTALLATION.

If source of leak causing pad contamination is found and corrected, go to step 11. If problem is not found, go to next step.

9.

- A. Inspect the wheel drive shaft outer seals (boots), if equipped, for damage and evidence of a grease leak. Replace any wheel drive shaft seal (boot) that is leaking grease which may be the source of pad contamination. Replace wheel drive shaft outer joint and seal. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES.
- B. Inspect the rear axle seals for damage and evidence of a lubricant leak. Replace any rear axle seal that is leaking lubricant which may be the source of pad contamination. Replace rear axle shaft seal and/or bearing. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES.

If source of leak causing pad contamination is found and corrected, go to step 11. If problem was not found, go to next step.

10. Inspect the following systems for damage and evidence of an external fluid leak:

- Power steering system. See appropriate POWER STEERING article in STEERING.
- Engine mechanical system. See appropriate ENGINE MECHANICAL article in ENGINE.
- Automatic transmission system. See appropriate AUTOMATIC TRANSMISSION article in TRANSAXLE/TRANSMISSION.

Replace any components found to be leaking fluid which may be the source of pad contamination. If source of the leak causing pad contamination is found and corrected, go to next step.

11.

- A. Clean the remaining disc brake system components to remove any traces of the contaminant.

CAUTION: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from it's 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.

- B. Remove the front and/or rear disc brake calipers, as appropriate, from the mounting brackets and support the calipers. DO NOT disconnect the hydraulic brake flex hoses from the calipers. See **FRONT BRAKE CALIPER** and/or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.
- C. Inspect the disc brake caliper mounting/sliding hardware for binding or seized hardware and distorted, worn, damaged or missing hardware components. See INSPECTION under **FRONT DISC BRAKE HARDWARE** and/or **REAR DISC BRAKE HARDWARE** in REMOVAL & INSTALLATION.

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- D. Replace the caliper mounting/sliding hardware components as required. See **INSPECTION** under **FRONT DISC BRAKE HARDWARE** and/or **REAR DISC BRAKE HARDWARE** in **REMOVAL & INSTALLATION**.
- E. Replace the contaminated disc brake pads as a complete axle set. See **FRONT DISC BRAKE PADS** and/or **REAR DISC BRAKE PADS** under **REMOVAL & INSTALLATION**.

After cleaning, inspection and replacement, go to next step.

- 12. Visually inspect each of the disc brake rotor shields/backing plates for evidence of contact with the brake rotors. If any of the brake rotor shields/backing plates contact the brake rotors, go to next step. If there is no shield/plate to rotor contact, go to step 14.
- 13. Repair or replace the disc brake rotor shields/backing plates as required. See **FRONT DISC BRAKE SPLASH SHIELD** and/or **REAR DISC BRAKE BACKING PLATE** under **REMOVAL & INSTALLATION**. After repair or replacement, go to next step.
- 14. Check the thickness of each of the disc brake rotors. Determine if each brake rotor can be refinished and remain above the minimum requirements. For specifications, see **BRAKES** in **SPECIFICATIONS - ASCENDER** article. If the disc brake rotor is within refinishing specification, go to the next step. If the rotor is not within specification, go to step 17.
- 15. Inspect each of the disc brake rotors for the following surface and wear conditions:
 - Heavy rust and/or pitting, cracks and/or heat spots and excessive blueing discoloration.
 - Deep or excessive scoring beyond maximum acceptable level, lateral runout beyond maximum acceptable level and thickness variation beyond maximum acceptable level.

If a brake rotor exhibits any of the previous conditions, it requires refinishing. If a brake rotor requires refinishing, go to next step. If refinishing is not required, go to step 20.

- 16. Refinish the brake rotor. For specifications, see **BRAKES** in **SPECIFICATIONS - ASCENDER** article. Inspect the brake rotor thickness. If brake rotor is within specification, go to step 20. If brake rotor is not within specification, go to step 19.
- 17. If brake rotor is at or below the discard requirements, go to step 19. For specifications, see **BRAKES** in **SPECIFICATIONS - ASCENDER** article. If rotor is above discard specification, go to next step.
- 18. Inspect each of the disc brake rotors for the following surface and wear conditions:
 - Heavy rust and/or pitting, cracks and/or heat spots and excessive blueing discoloration.
 - Deep or excessive scoring beyond maximum acceptable level, lateral runout beyond maximum acceptable level and thickness variation beyond maximum acceptable level.

If a brake rotor exhibits any of the previous conditions, it requires replacement. If a brake rotor needs to be replaced, go to the next step. If a brake rotor does not need to be replaced, go to step 20.

- 19. Replace the brake rotor. See **FRONT BRAKE ROTOR** and/or **REAR BRAKE ROTOR** under **REMOVAL & INSTALLATION**. After replacement, go to next step.
- 20. Install or connect components that were removed or disconnected during diagnosis. If diagnosis is completed, disc brake system is okay. Go to **SYMPTOM INDEX** table.

Hydraulic Brake

- 1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under **TROUBLE SHOOTING**. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.

NOTE: Use only Delco Supreme 11(R), GM P/N 12377967 (Canadian P/N 992667), or equivalent DOT-3 brake fluid.

2. Inspect and adjust the brake fluid level in the brake master cylinder. If the brake fluid level low, go to next step. If brake fluid level is not low, go to step 4.
3. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
 - Fluid separation indicates 2 types of fluid are present. A swirled appearance indicates an oil-based substance is present. A layered appearance indicates a silicone-based substance is present.
 - Fluid discoloration. A cloudy appearance indicates moisture is present. A dark appearance/suspended particles in fluid indicates dirt, rust, corrosion and/or brake dust is present.

Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. If any of the above conditions exist, go to step 5. If the above conditions do not exist, go to step 6.

4. Inspect the brake fluid for the following conditions, indicating brake fluid contamination:
 - Fluid separation indicates 2 types of fluid are present. A swirled appearance indicates an oil-based substance is present. A layered appearance indicates a silicone-based substance is present.
 - Fluid discoloration. A cloudy appearance indicates moisture is present. A dark appearance/suspended particles in fluid indicates dirt, rust, corrosion and/or brake dust is present.

Inspect the master cylinder reservoir cap diaphragm and the reservoir-to-master cylinder grommets for swelling, indicating fluid contamination. If any of the above conditions exist, go to next step. If the above conditions do not exist, go to step 12.

5.
 - A. Flush the hydraulic brake system.
 - B. 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, remove ALL of the following components listed. Each component contains internal rubber seals/linings which have been contaminated.
 - Master cylinder. See **MASTER CYLINDER** under OVERHAUL or **MASTER CYLINDER** under REMOVAL & INSTALLATION.
 - Brake master cylinder reservoir: Clean the brake master cylinder reservoir using denatured alcohol, or equivalent, then dry the reservoir using non-lubricated, filtered air, or if necessary, replace the brake master cylinder reservoir.
 - Replace the brake master cylinder reservoir cap diaphragm.
 - Brake hoses. See **FRONT BRAKE HOSE** and/or **REAR BRAKE HOSE** under REMOVAL & INSTALLATION.
 - Front brake caliper. See **FRONT BRAKE CALIPER** under OVERHAUL or **FRONT BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - Rear brake caliper. See **REAR BRAKE CALIPER** under OVERHAUL or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.

- Brake pressure modulator valve (BPMV). See appropriate ANTI-LOCK article in BRAKES.

Clean out the hydraulic brakelines using denatured alcohol, or equivalent. Dry the brakelines using non-lubricated, filtered air. Repair or replace ALL of the components listed above. Each component contains internal rubber seals/linings which have been contaminated.

- C. 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.
- D. Refill and manually bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. If operation and any required repairs and/or replacements are complete, go to step 9.

6.

- A. Inspect the following hydraulic brake system components for external fluid leaks. Repair or replace any of the components found to be leaking brake fluid.

- Master cylinder. See **MASTER CYLINDER** under OVERHAUL or **MASTER CYLINDER** under REMOVAL & INSTALLATION.
- Brake master cylinder reservoir cap diaphragm.
- Brake hoses. See **FRONT BRAKE HOSE** and/or **REAR BRAKE HOSE** under REMOVAL & INSTALLATION.
- Brakeline. See **BRAKELINE** under REMOVAL & INSTALLATION.
- Front brake caliper. See **FRONT BRAKE CALIPER** under OVERHAUL or **FRONT BRAKE CALIPER** under REMOVAL & INSTALLATION.
- Rear brake caliper. See **REAR BRAKE CALIPER** under OVERHAUL or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.
- Brake pressure modulator valve (BPMV). See appropriate ANTI-LOCK article in BRAKES.

- B. If you repaired or replaced any of the brake system components listed, manually bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. If problem was found and corrected, go to next step. If problem was not found, go to step 12.

- 7. If there is air in the system at a bleeder valve location other than at the repair location and if the brake master cylinder was not replaced, go to step 19. If not as specified, go to next step.
- 8. If the flow of brake fluid was unrestricted and even per axle during the bleeding procedure, go to next step. If brake fluid flow was restricted and uneven, go to step 10.
- 9. Inspect the hydraulic function of the brake calipers for proper operation. See **HYDRAULIC BRAKE COMPONENT INSPECTION**. If the hydraulic function of the brake calipers operates properly, go to step 21. If the hydraulic function does not operate properly, go to step 14.
- 10. If the flow of brake fluid was restricted or uneven through front axle hydraulic components during the bleeding procedure, go to step 13. If the flow of brake fluid is not restricted and uneven, go to next step.
- 11. If the flow of brake fluid was restricted or uneven through rear axle hydraulic components during the bleeding procedure, go to step 17.
- 12. Inspect the hydraulic function of the brake calipers for proper operation. See **HYDRAULIC BRAKE COMPONENT INSPECTION**. If the hydraulic function of the brake calipers operates properly, go to step 15. If the hydraulic function does not operate properly, go to next step.
- 13. Determine if the brake caliper is restricting the flow of brake fluid and/or not operating properly:

- A. Raise and support the vehicle. Remove the tire and wheel assemblies.
- B. Open the suspected caliper bleeder valve.
- C. Using a large C-clamp, compress the caliper piston and observe for an unrestricted flow of brake fluid and for free movement of the caliper piston. See **Fig. 4**.
- D. Close the caliper bleeder valve.

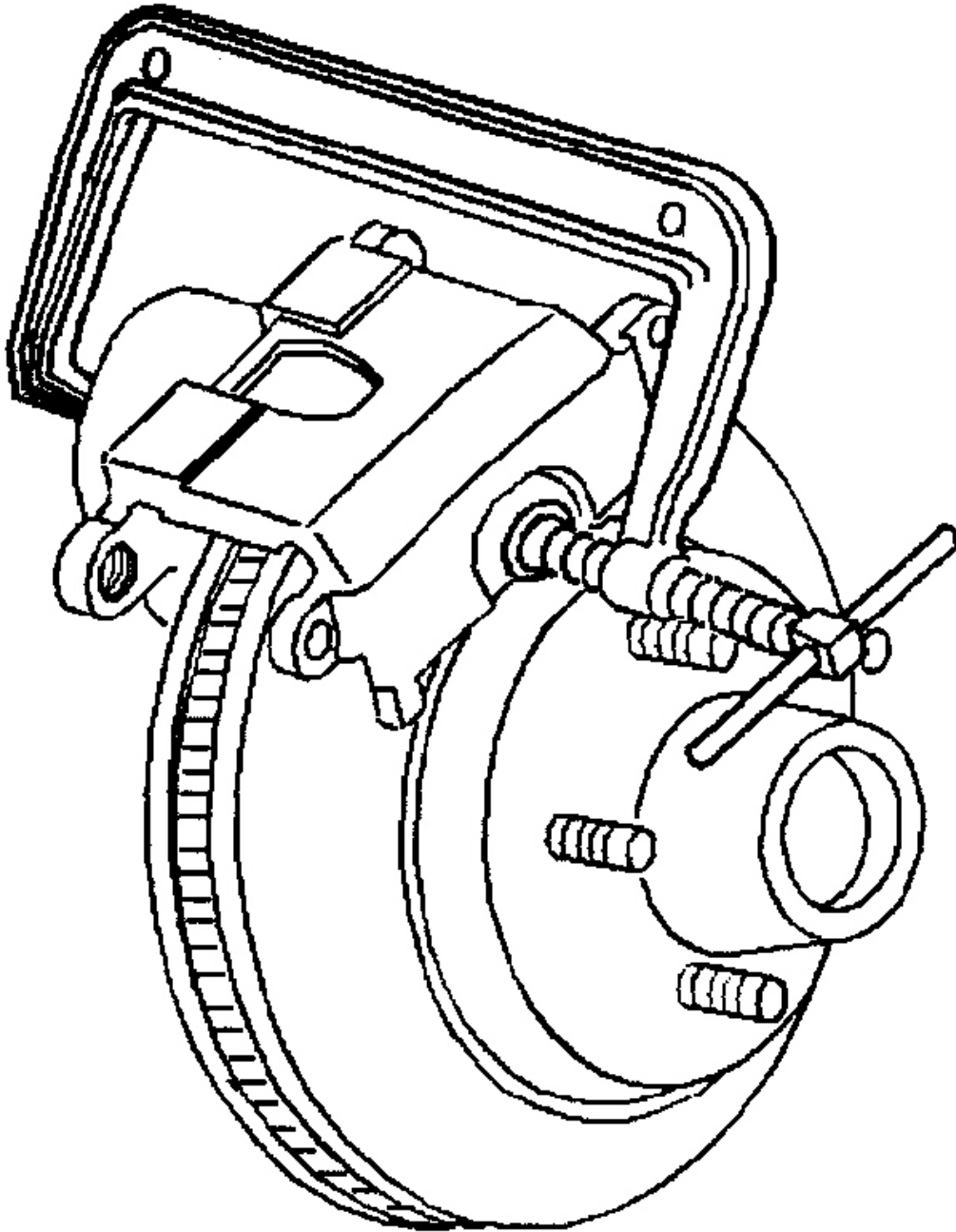
If the flow of brake fluid was unrestricted and the caliper piston moved freely, go to step 17. If brake fluid flow was restricted and the caliper piston did not move freely, go to next step.

14. Repair or replace any brake caliper that was not operating properly. Refer to the appropriate procedure.
- Front brake caliper. See **FRONT BRAKE CALIPER** under OVERHAUL or **FRONT BRAKE CALIPER** under REMOVAL & INSTALLATION.
 - Rear brake caliper. See **REAR BRAKE CALIPER** under OVERHAUL or **REAR BRAKE CALIPER** under REMOVAL & INSTALLATION.

After repair or replacement, go to step 21.

15. Manually 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. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. If there is air in the system, go to step 19. If there is not air in the system, go to the next step.
16. If the flow of brake fluid was unrestricted and even per axle during the bleeding procedure, go to step 21. If the brake fluid flow was restricted and uneven, go to next step.
- 17.
- A. Inspect the hydraulic brakelines and flexible brake hoses for signs of a fluid restriction; such as being bent, kinked, pinched or damaged.
 - B. Replace any of the hydraulic brakelines and/or flexible brake hoses found to be bent, kinked, pinched, or damaged. See **BRAKELINE**, **FRONT BRAKE HOSE** and/or **REAR BRAKE HOSE** under REMOVAL & INSTALLATION.
 - C. If none of the hydraulic brakelines or flexible brake hoses were visibly bent, kinked, pinched, or damaged, replace the hydraulic brake flex hose at the restricted location. If problem was found and corrected, go to step [21](#). If problem was not found, go to next step.
18. Replace the brake pressure modulator valve (BPMV), in order to correct the hydraulic brake dynamic rear proportioning mechanical operation. See appropriate ANTI-LOCK article in BRAKES. After replacement, go to step 21.
19. 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. Inspect the hydraulic brake system components for evidence of a recent repair, which may have introduced air into the system. Repair or replace any of the components that are installed incorrectly or seeping brake fluid. If problem is found and corrected, go to step 21. If problem was not found, go to next step.
20. Inspect the brake master cylinder for internal fluid leaks. See **BRAKE SYSTEM INTERNAL LEAK TEST**. Repair or replace the brake master cylinder if it is found to be leaking brake fluid internally. See **MASTER CYLINDER** under OVERHAUL or **MASTER CYLINDER** under REMOVAL & INSTALLATION. If problem is found and corrected, go to next step. If problem is not found, go to **SYMPTOM INDEX** table.
21. Install or connect components that were removed or disconnected during diagnosis. If diagnosis is

completed, hydraulic brake system is okay. Go to **SYMPTOM INDEX** table.



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Fig. 4: Compressing Brake Caliper Piston
Courtesy of ISUZU MOTOR CO.

Park Brake

1. If you were sent here from a SYMPTOM TEST, go to step 4. If you were not sent here from a SYMPTOM TEST, go to next step.
2. If the symptom is related to the ability of the park brake system to hold and/or release, inspect for aftermarket devices which could affect the operation of the park brake system and inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom. If the symptom is not related to the park brake system's ability to hold and/or release, go to next step.
3. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions.
4. Raise and support the vehicle with the rear axle supported by jack stands. Shift the transmission into NEUTRAL. With the park brake RELEASED, attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. If the rear brakes have a significant amount of drag, go to step 11. If the rear brakes do not have a significant amount of drag, go to next step.
5. Shift the transmission into NEUTRAL. Apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. If the rear brakes have a significant amount of drag, go to next step. If the rear brakes do not have a significant amount of drag, go to step 7.
6. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction in the amount of drag. If the rear brakes exhibit a significant reduction in the amount of drag, go to step 20. If the rear brakes do not exhibit a significant reduction in the amount of drag, go to step 11.
7. Visually check the park brake cable connections and the cables that are accessible on the underside of the vehicle for disconnections and/or damage. If any of the park brake cables are disconnected and/or damaged, go to next step. If the park brake cables are not disconnected and/or damaged, go to step 9.
8. Reconnect or replace the park brake cables as necessary. See **PARK BRAKE CABLE** under REMOVAL & INSTALLATION. After repairs, go to next step.
9. Check the adjustment of the park brake. See **PARK BRAKE** under ADJUSTMENTS. If the park brake is adjusted properly, go to step 11. If the park brake is not adjusted properly, go to next step.
10. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If adjustment of park brake was obtained, go to step 16. If adjustment of park brake was not obtained, go to next step.

CAUTION: DO NOT depress the brake pedal with the brake rotors and/or the brake drums removed, or with the brake calipers repositioned away from the brake rotors, or damage to the brake system may result.

11. Remove the rear brake rotors. See **REAR BRAKE ROTOR** under REMOVAL & INSTALLATION. Inspect the park brake shoe hardware for looseness, damaged, broken or missing components. Check the park brake actuators for a seized condition. If the park brake hardware and/or the park brake actuators need to be replaced, go to next step. If the park brake hardware and/or the park brake actuators do not

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need to be replaced, go to step 13.

12. Replace park brake hardware components as necessary. See **PARK BRAKE SHOE** under REMOVAL & INSTALLATION. Replace the park brake actuators as necessary. See **PARK BRAKE ACTUATOR** under REMOVAL & INSTALLATION. After repairs, go to next step.
13. Have an assistant apply and release the park brake, while you observe the park brake cables for free movement. If the park brake cables move freely, go to next step. If the park brake cables do not move freely, go to step 17.
14. Check the adjustment of the park brake. See **PARK BRAKE** under ADJUSTMENTS. If the park brake is adjusted properly, go to step 16. If the park brake is not adjusted properly, go to next step.
15. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If adjustment of park brake was obtained, go to next step. If adjustment of park brake was not obtained, go to step 25.
16. With the transmission still in NEUTRAL, apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. If the park brake applies and releases properly, go to step 27. If the park brake does not apply and release properly, go to **TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE** under SYMPTOM TESTS.
17. Disconnect the park brake cable connections that are accessible on the underside of the vehicle one at a time and check each cable for free movement. If any of the park brake cables accessible on the underside of the vehicle require replacement, go to next step. If the park cables do not require replacement, go to step 19.
18. Replace any of the park brake cables that do not have free movement (not releasing properly). See **PARK BRAKE CABLE** under REMOVAL & INSTALLATION. After replacement, go to 23.
19. Replace the park brake pedal assembly (not releasing properly). See **PARK BRAKE LEVER ASSEMBLY** under REMOVAL & INSTALLATION. After replacement, go to step 24.
20. Check the adjustment of the park brake. See **PARK BRAKE** under ADJUSTMENTS. If the park brake is adjusted properly, go to step 27. If the park brake is not adjusted properly, go to next step.
21. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If adjustment of park brake was obtained, go to step 26. If adjustment of park brake was not obtained, go to next step.
22. Remove the rear brake rotors, if they have not yet been removed. See **REAR BRAKE ROTOR** under REMOVAL & INSTALLATION. Check the park brake actuators for a seized condition. Replace the park brake actuators as necessary. See **PARK BRAKE ACTUATOR** under REMOVAL & INSTALLATION. If problem was found and corrected, go to next step. If problem was not found, go to step 25.
23. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If adjustment of park brake was obtained, go to step 26. If adjustment of park brake was not obtained, go to step 25.
24. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If adjustment of park brake was obtained, go to step 26. If adjustment of park brake was not obtained, go to **TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE** under SYMPTOM TESTS.
25. Replace the component that is used to adjust the park brake system. See **PARK BRAKE LEVER ASSEMBLY** under REMOVAL & INSTALLATION. Adjust the park brake. See **PARK BRAKE** under ADJUSTMENTS. If replacement and adjustment is completed, go to next step. If replacement and adjustment was not completed, go to **TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE** under SYMPTOM TESTS.

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26. With the transmission still in NEUTRAL, apply the park brake. Attempt to rotate the rear wheels to check the rear brakes for a significant amount of drag. Release the park brake. Rotate the rear wheels to check the rear brakes for a significant reduction of drag. If the park brake applies and releases properly, go to next step. If the park brake does not apply and release properly, go to **TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE** under SYMPTOM TESTS.
27. Install or connect any components that were removed or disconnected during diagnosis. If the operation is completed, the park brake system is okay. Go to **TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE** under SYMPTOM TESTS.

SYMPTOM TESTS

SYMPTOM INDEX

Symptom	Perform Test
Brake System Noise	<u>A</u>
Braking Action Uneven - Pulls To One Side	<u>B</u>
Braking Action Uneven - Front To Rear	<u>C</u>
Brake Pedal Excessive Travel	<u>D</u>
Brake Pedal Excessive Effort	<u>E</u>
Brakes Drag	<u>F</u>
Brake System Slow Release	<u>G</u>
Brake Fluid Loss	<u>H</u>
Park Brake Will Not Hold Or Release	<u>I</u>

TEST A: BRAKE SYSTEM NOISE

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
3. Inspect the brake assist system for proper operation. See **BRAKE ASSIST** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step **6**. If problem was not found, go to next step.
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
5. Inspect the park brake system for proper operation. See **PARK BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, go to step 1.
6. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE

SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST B: BRAKING ACTION UNEVEN - PULLS TO ONE SIDE

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the suspension system for proper operation. See appropriate SUSPENSION article. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
3. Inspect the steering system for proper operation. See appropriate POWER STEERING article in STEERING. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
5. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, go to step 1.
6. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST C: BRAKING ACTION UNEVEN - FRONT TO REAR

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the suspension system for proper operation. See appropriate SUSPENSION article. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
3. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 6. If problem was not found, go to next step.
4. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step [6](#). If problem was not found, go to next step.
5. Inspect the brake assist system for proper operation. See **BRAKE ASSIST** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, go to step 1.
6. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST D: BRAKE PEDAL EXCESSIVE TRAVEL

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1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL** under ADJUSTMENTS. If the brake pedal travel distance is within specification, go to step 5. If brake pedal travel distance is not within specification, go to next step.
3. Inspect for worn, missing, misaligned, bent or damaged brake pedal system components.
 - Inspect brake pedal pushrod. See **INSPECTION** under BRAKE PEDAL in REMOVAL & INSTALLATION.
 - Inspect the brake pedal bushings for excessive wear and/or damage and inspect the brake pedal for a misaligned, bent, and/or damaged condition.

Replace the brake pedal system components that are worn, missing, misaligned, bent or damaged. For brake pedal assembly replacement, see **BRAKE PEDAL** under REMOVAL & INSTALLATION. For pedal pushrod replacement, see **VACUUM BRAKE BOOSTER** under REMOVAL & INSTALLATION. If any worn, missing, misaligned, bent or damaged brake pedal system components were replaced, go to next step. If no brake pedal system components were replaced, go to step 5.

4. Inspect for proper brake pedal travel. See **BRAKE PEDAL TRAVEL** under ADJUSTMENTS. If the brake pedal travel distance is within specification, go to step 8. If the brake pedal travel distance is not within specification, go to next step.
5. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 8. If problem was not found, go to next step.
6. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step [8](#). If problem was not found, go to next step.
7. Inspect the brake assist system for proper operation. See **BRAKE ASSIST** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, step 1.
8. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST E: BRAKE PEDAL EXCESSIVE EFFORT

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the brake assist system for proper operation. See **BRAKE ASSIST** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 5. If problem was not found, go to next step.
3. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM

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DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 5. If problem was not found, go to next step.

4. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, step 1.
5. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST F: BRAKES DRAG

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the park brake system for proper operation. See **PARK BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 5. If problem was not found, go to next step.
3. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step [5](#). If problem was not found, go to next step.
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, step 1.
5. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST G: BRAKE SYSTEM SLOW RELEASE

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 5. If problem was not found, go to next step.
3. Inspect the brake assist system for proper operation. See **BRAKE ASSIST** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step [5](#). If problem was not found, go to next step.
4. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, step 1.
5. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST H: BRAKE FLUID LOSS

1. Perform a road test in order to duplicate the customer's concern. See **ROAD TEST** under TROUBLE SHOOTING. 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. Check for faulty electrical connections or wiring that may be the cause of intermittent conditions. Go to next step.
2. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to step 4. If problem was not found, go to next step.
3. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, step 1.
4. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If the problem is still present, go to step 2. If problem is not present, system is okay.

TEST I: PARK BRAKE WILL NOT HOLD OR RELEASE

1. Inspect for aftermarket devices which could affect the operation of the park brake system. Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
2. Inspect the park brake system for proper operation. See **PARK BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If a problem was found and corrected, go to step 5. If a problem was not found, go to next step.
3. Inspect the disc brake system for proper operation. See **DISC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If a problem was found and corrected, go to step [5](#). If a problem was not found, go to next step.
4. Inspect the hydraulic brake system for proper operation. See **HYDRAULIC BRAKE** under SYSTEM DIAGNOSIS in TROUBLE SHOOTING. If problem was found and corrected, go to next step. If problem was not found, go to step 1.
5. Road test the vehicle in order to confirm proper operation. See **ROAD TEST** under TROUBLE SHOOTING. If problem is still present, go to step 2. If problem is not present, system is okay.

REMOVAL & INSTALLATION

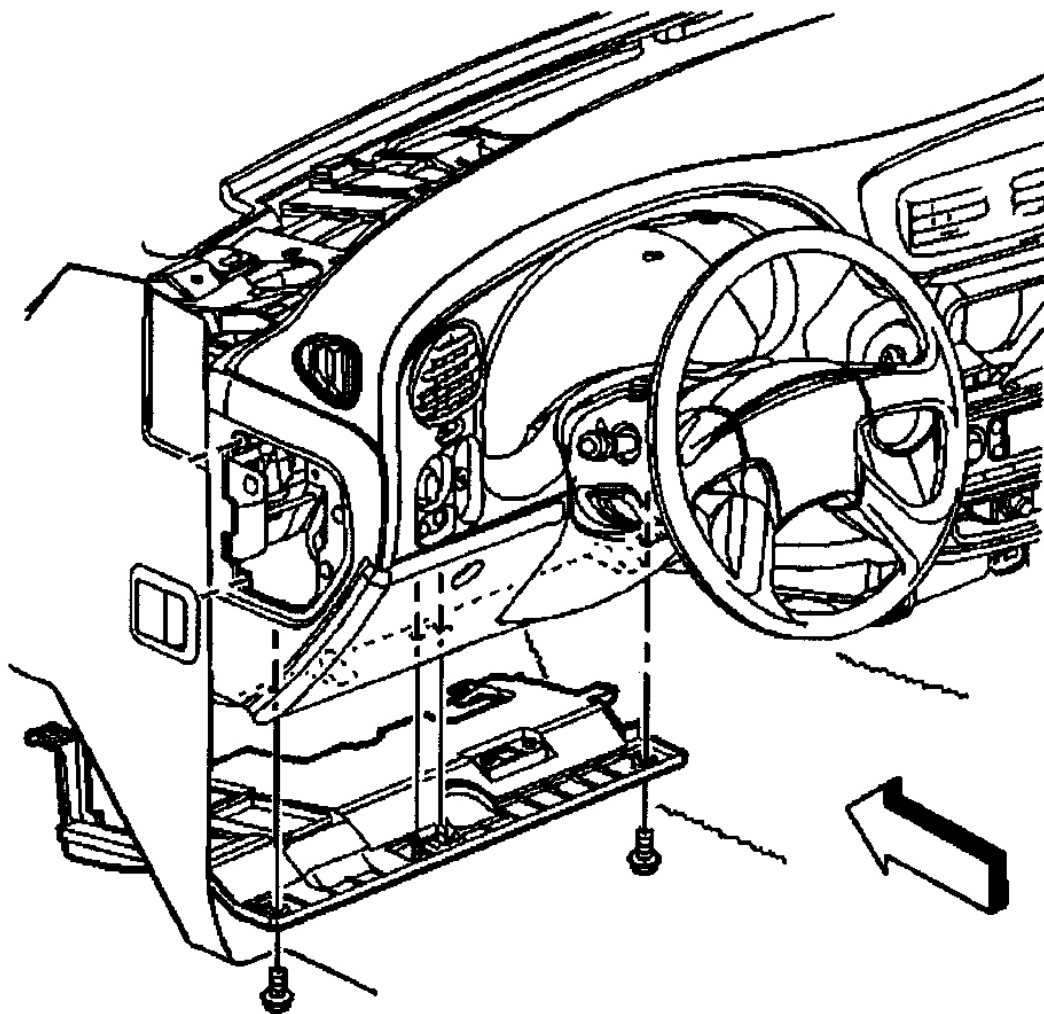
WARNING: Brake fluid may irritate eyes and skin.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

BRAKE PEDAL

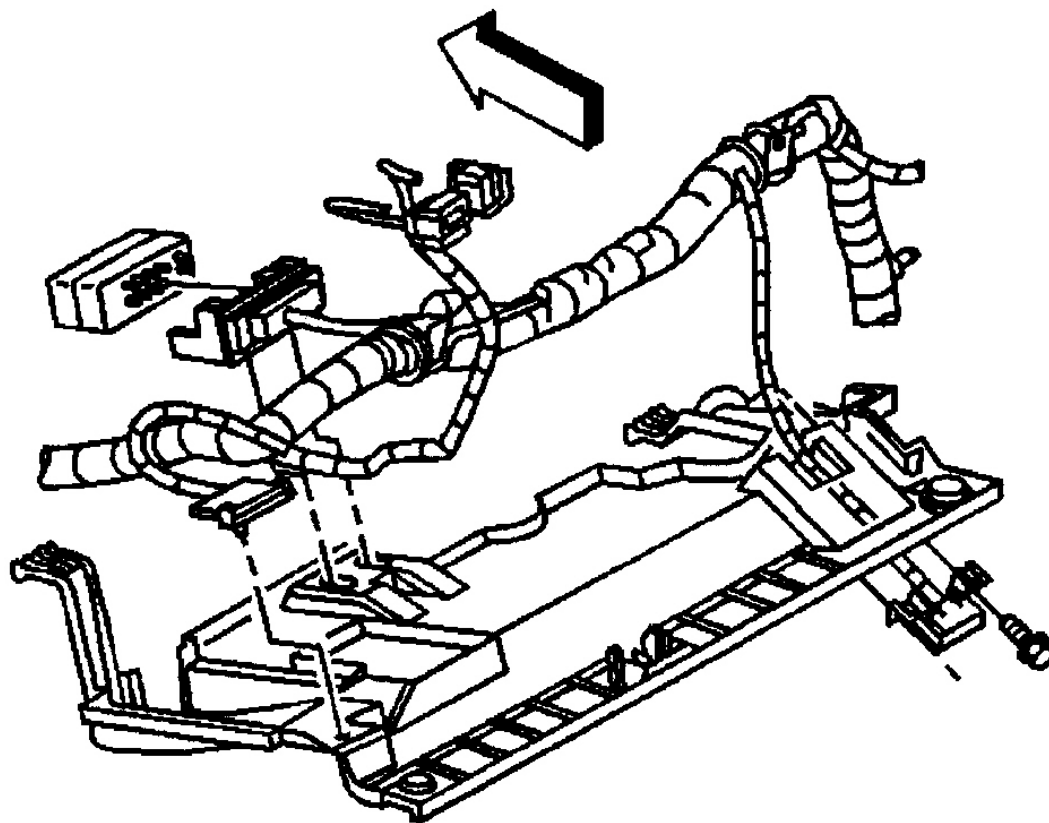
Removal

1. Remove the left closeout/insulator panel.
 - A. Remove the 2 screws that retain the insulator panel to the instrument panel (I/P). Release the insulator panel retaining clip from the I/P substrate. Lower the insulator panel. See **Fig. 5**.
 - B. Remove the 2 data link connector (DLC) retaining screws. Remove the DLC from the insulator panel.
 - C. Remove the splice pack from the insulator panel. Remove the hazard and turn signal flasher from the insulator panel. Remove the insulator panel from the I/P. See **Fig. 6**.
2. Remove the stoplight switch from the brake pedal. See **Fig. 7**.
3. Remove the brake pedal pivot bolt and discard the bolt. See **Fig. 8**. Remove the brake pedal.
4. Inspect the brake pedal pivot bushing for damage or wear.



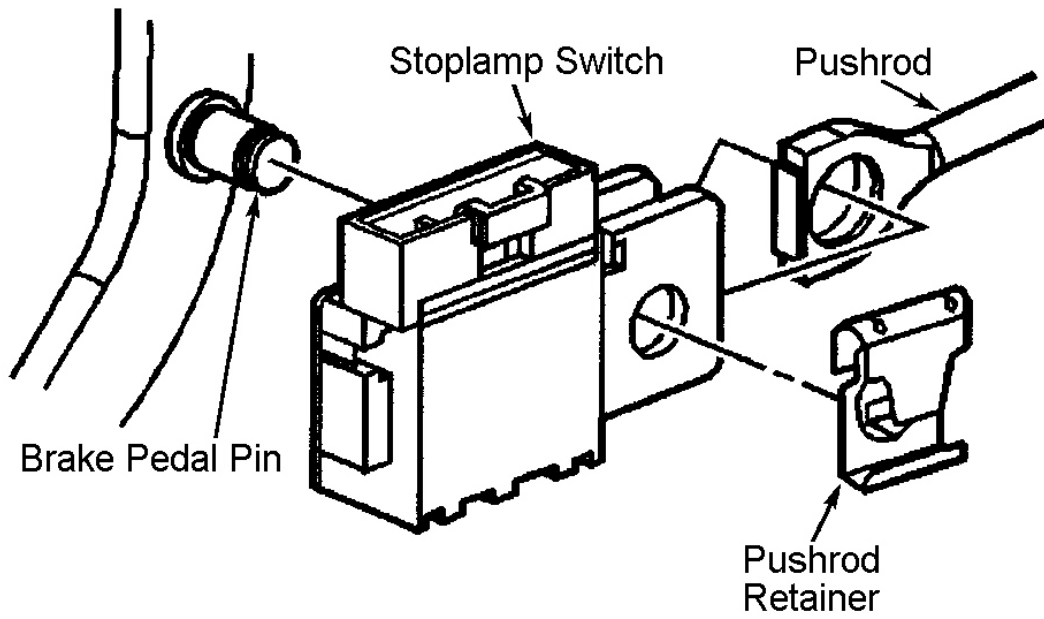
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Fig. 5: Lowering Left Insulator Panel
Courtesy of ISUZU MOTOR CO.



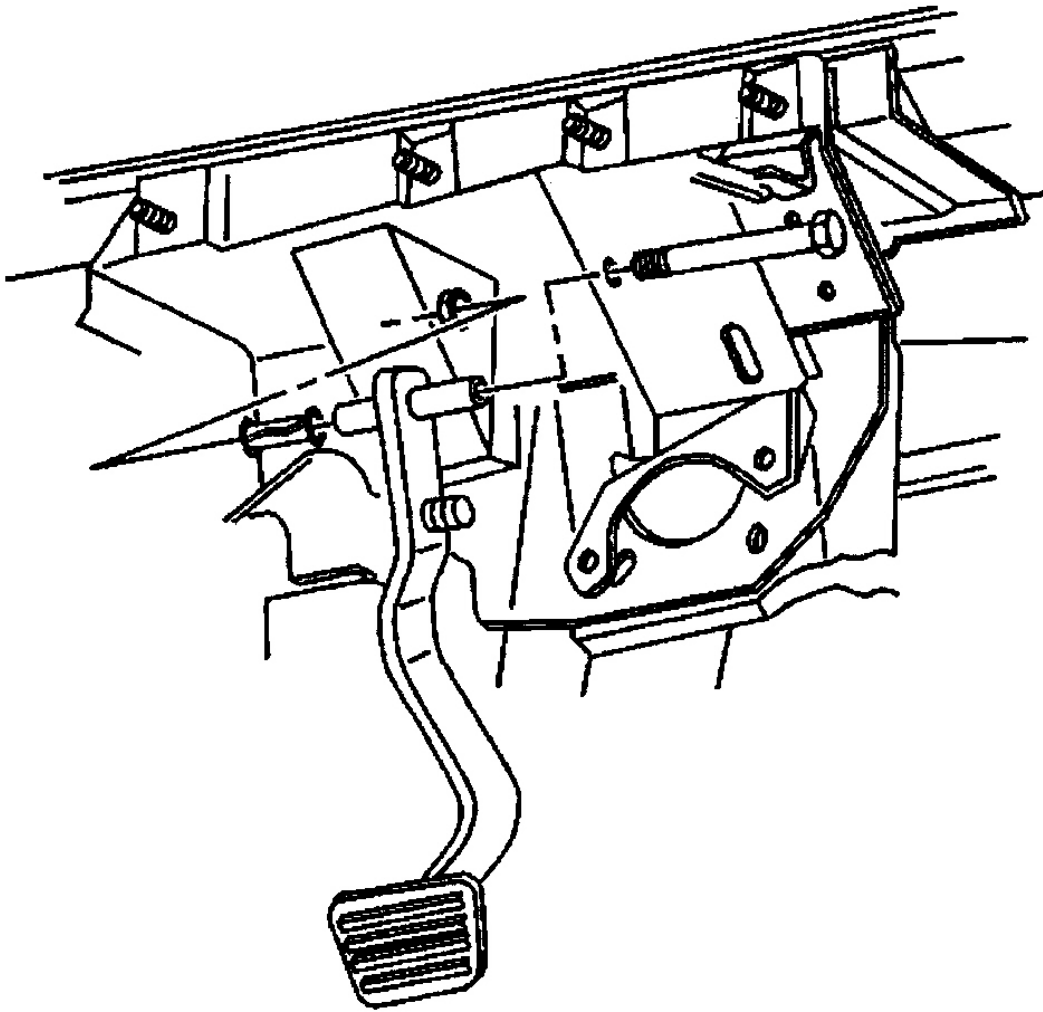
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Fig. 6: Removing Left Insulator Panel
Courtesy of ISUZU MOTOR CO.



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Fig. 7: Removing Stoplight Switch
Courtesy of ISUZU MOTOR CO.



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Fig. 8: Removing Brake Pedal
Courtesy of ISUZU MOTOR CO.

Inspection

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

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pushrod to the brake pedal.

Installation

1. If the brake pedal pivot bushing is damaged or worn, replace the bushing. Squeeze the end that will be facing the brake pedal pivot nut. Insert the bushing into the pivot hub just enough to hold the bushing in place. Push the bushing through the hub until the bushing snaps in place.

NOTE: **The brake pedal pivot bolt is a prevailing torque bolt and must be replaced each time the bolt is removed.**

2. Install the brake pedal. See **Fig. 8**. Install the NEW brake pedal pivot bolt and the brake pedal pivot nut. Tighten the brake pedal pivot bolt to specification. See **TORQUE SPECIFICATIONS**.
3. Install the stoplight switch to the brake pedal. See **Fig. 7**.
4. Install the left closeout/insulator panel.
 - A. Position the insulator panel to the instrument panel (I/P). Install the hazard and turn signal flasher to the insulator panel. Install the splice pack to the insulator panel. See **Fig. 6**.
 - B. Position the DLC to the insulator panel. Install the DLC retaining screws. Tighten the DLC retaining screws to 22 INCH lbs. (2.5 N.m).
 - C. Install the insulator panel tabs to the cowl slots. Raise the insulator panel to the I/P.
 - D. Install the insulator panel retaining clip to the I/P substrate. Install the 2 screws that retain the insulator panel to the I/P. See **Fig. 5**. Tighten the screws to 22 INCH lbs. (2.5 N.m).

BRAKELINE

NOTE: **Brakelines that run parallel to each other must maintain a 1/4" (6 mm) clearance.**

Removal

Disconnect the brakeline fittings. Remove the brakeline fasteners from the vehicle. Remove the brakeline from the vehicle.

Inspection

Visually inspect all of the brakelines for the following conditions:

- Kinks, improper routing, missing or damaged retainers.
- Leaking fittings, excessive corrosion.

If any of the brakelines exhibited any of the conditions listed, then the identified line, or lines, require replacement.

Installation

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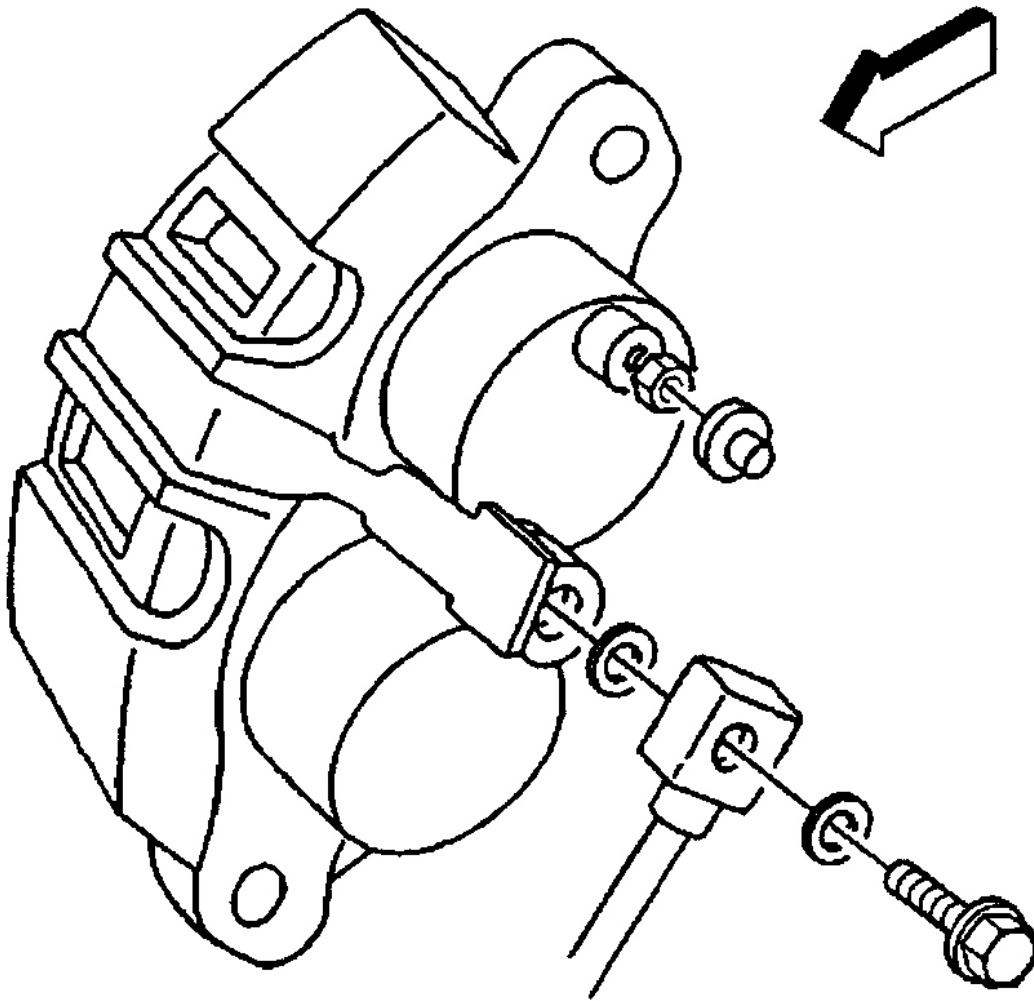
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1. Remove 1/4" of the protective coating before flaring the end of the brakeline. Bend the brakeline to achieve proper fit. Install the brakeline to the vehicle. Maintain a clearance of 3/4" (19 mm) for all moving or vibrating components. Install the brakeline fasteners to the vehicle.
2. After tightening the brakeline fittings to the proper specification, apply a small amount of silicone sealant to the area where the brakeline meeting the brakeline fitting. Connect the brakeline fittings. Tighten the brakeline fittings to specification. See **TORQUE SPECIFICATIONS**. Bleed the brake hydraulic system.
 - If the brakeline that was replaced was between the master cylinder and the brake pressure modulator valve (BPMV), refer to ABS automated bleeding procedure in appropriate ANTI-LOCK article.
 - If the brakeline that was replaced was between the BPMV and the wheel jounce hoses, bleed system manually. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM.

FRONT BRAKE CALIPER

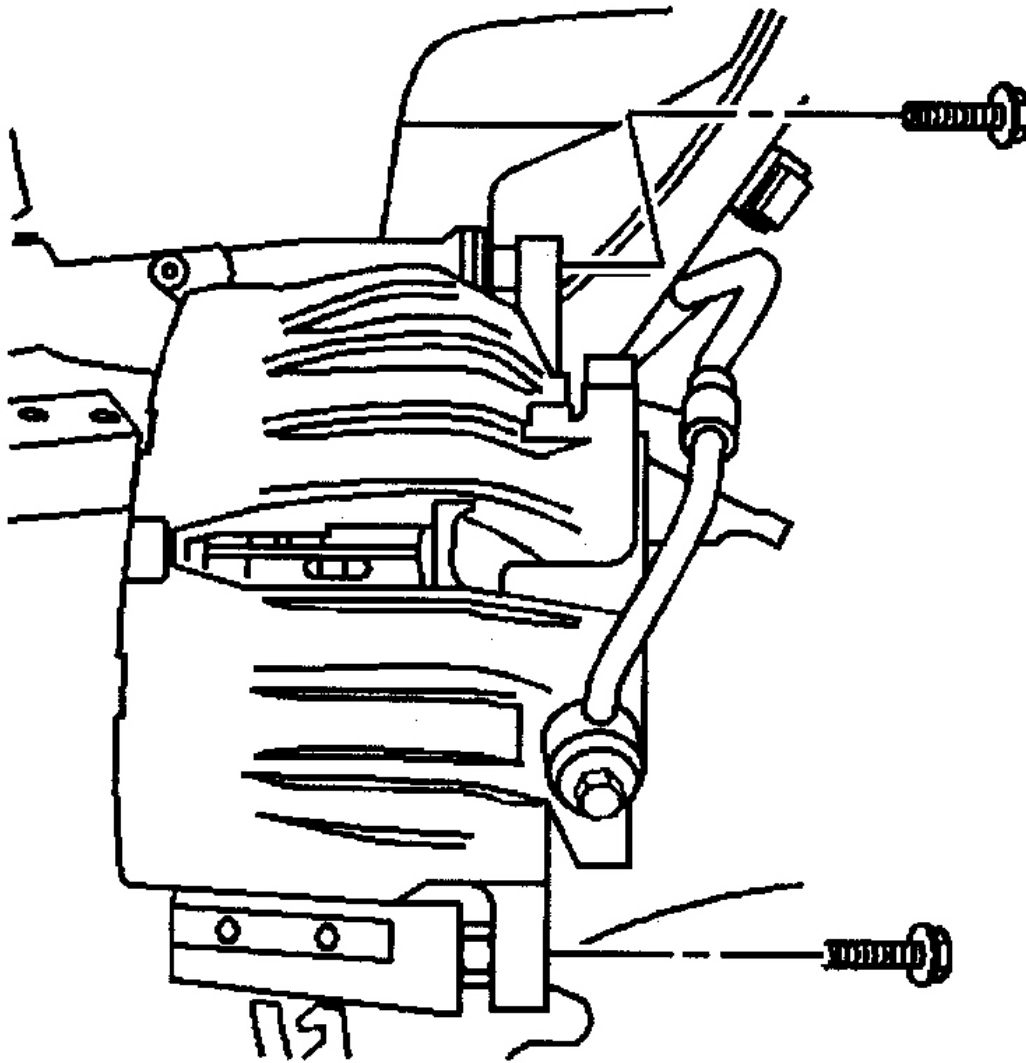
Removal

1. Raise the vehicle. Remove the tire and wheel assembly.
2. Remove the front brake hose bolt. See **Fig. 9**. Install a plug in the front brake caliper hose in order to prevent excessive brake fluid loss and contamination. Discard the metal/copper gaskets. DO NOT reuse them replace with NEW metal/copper gaskets.
3. Remove the front brake caliper mounting bolts. See **Fig. 10**. Remove the front brake caliper from the mounting bracket.



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Fig. 9: Removing Front Brake Hose From Caliper
Courtesy of ISUZU MOTOR CO.



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Fig. 10: Removing Front Brake Caliper
Courtesy of ISUZU MOTOR CO.

Inspection

- Inspect the brake caliper housing for cracks, excess wear, and/or damage. If any of these conditions are present, the brake caliper requires replacement.
- Inspect the caliper piston dust boot seal for cracks, tears, cuts, deterioration and/or improper seating in the caliper body. If any of these conditions are present, the brake caliper requires overhaul or replacement.
- Inspect for brake fluid leakage around the caliper piston dust boot seal and on the disc brake pads. If there

is any evidence of brake fluid leakage, the brake caliper requires overhaul or replacement.

- Inspect for smooth and complete travel of the caliper pistons into the caliper bores. The movement of the caliper pistons into the caliper bores should be smooth and even. If the caliper piston is frozen or difficult to bottom, the caliper requires overhaul or replacement.
- For single piston caliper applications, insert a discarded inner brake pad or block of wood in front of the piston. Using a large C-clamp installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the piston in the bore.
- For dual piston caliper applications, insert a discarded inner brake pad or block of wood in front of the pistons. Using 2 large C-clamps installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the pistons evenly into the bores.

Installation

1. If the brake caliper guide pin is to be reused, clean the brake caliper guide pin using denatured alcohol, or equivalent. Dry the brake caliper guide pin using non-lubricated, filtered air. Apply high temperature silicone brake lubricant to the brake caliper guide pin. DO NOT apply lubricant to the brake pad hardware.
2. Install the front brake caliper to the mounting bracket. Install the front brake caliper mounting bolts. See **Fig. 10**. Tighten the front brake caliper mounting bolts to specification. See **TORQUE SPECIFICATIONS**.
3. DO NOT reuse the metal/copper gaskets. Use only NEW metal/copper gaskets. Install the NEW metal/copper gaskets to the front brake caliper bolt. Install the front brake hose bolt and gaskets. See **Fig. 9**. Tighten the brake hose bolt to specification. See **TORQUE SPECIFICATIONS**.
4. Bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. Install the tire and wheel assembly. Lower the vehicle.

FRONT BRAKE CALIPER BRACKET

Removal

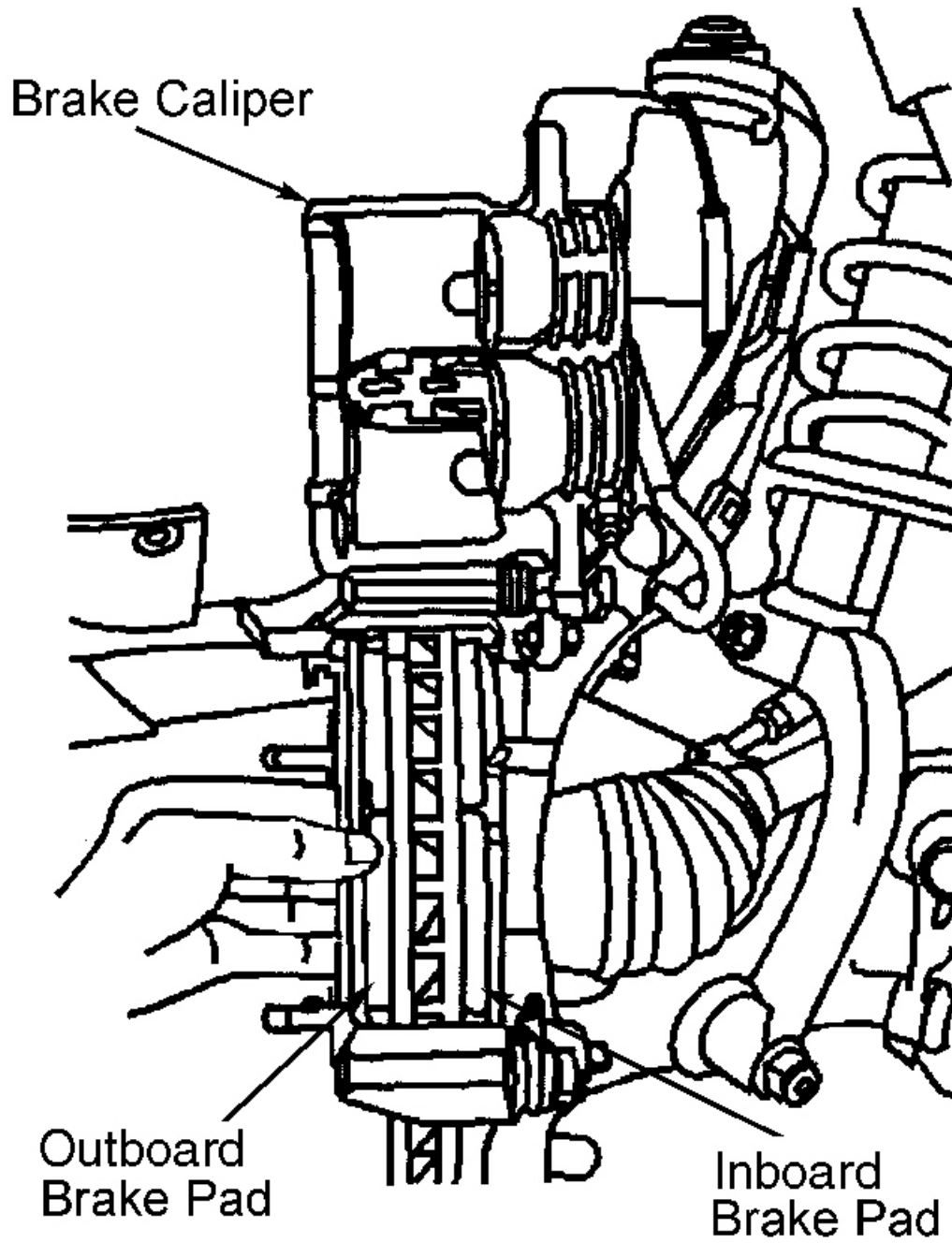
CAUTION: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from it's mount and the hydraulic flexible brake hose is still connected. Failure to support the caliper in this manner will cause the flexible brake hose to bear the weight of the caliper, which may cause damage to the brake hose and in turn may cause a brake fluid leak.

1. Raise the vehicle. Remove the tire and wheel assembly.
2. Inspect the brake caliper assembly. Remove the front brake caliper assembly, relocate the brake caliper to the side. See **FRONT BRAKE CALIPER**.
3. Inspect the brake pads. See **INSPECTION** under FRONT DISC BRAKE PADS. Remove the front brake pads from the mounting bracket. See **Fig. 11**. Inspect the brake hardware. See **INSPECTION** under FRONT DISC BRAKE HARDWARE.
4. Remove the brake pad retaining clips from the mounting bracket. See **Fig. 12**. Remove the brake caliper mounting bracket retaining bolts. See **Fig. 13**. Remove the brake caliper mounting bracket. See **Fig. 14**.

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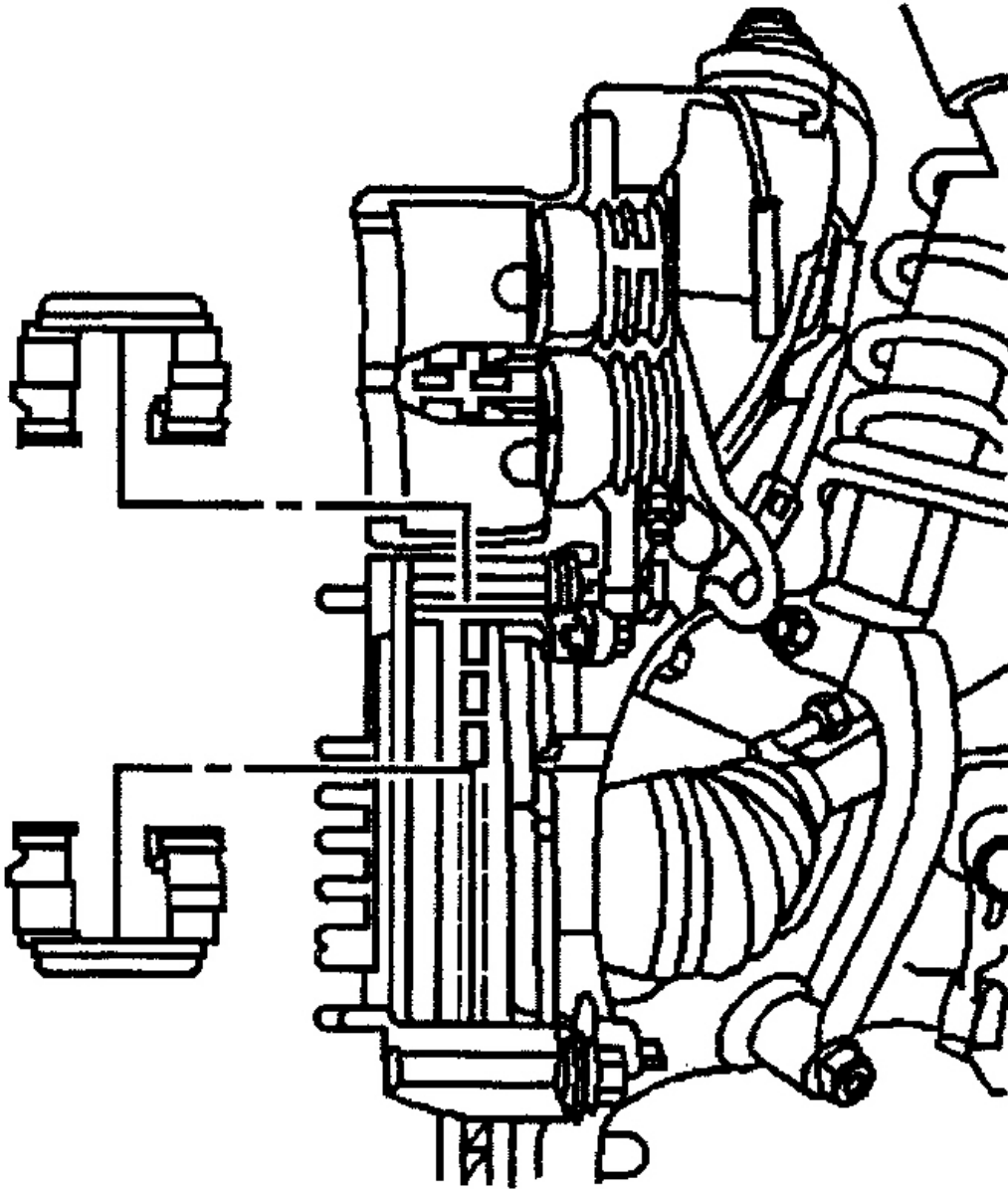
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5. Remove the guide pin seals from the brake caliper mounting bracket. See **Fig. 15**. Inspect the brake rotor thickness, surface and wear. For specifications, see **BRAKES** in SPECIFICATIONS - ASCENDER article.



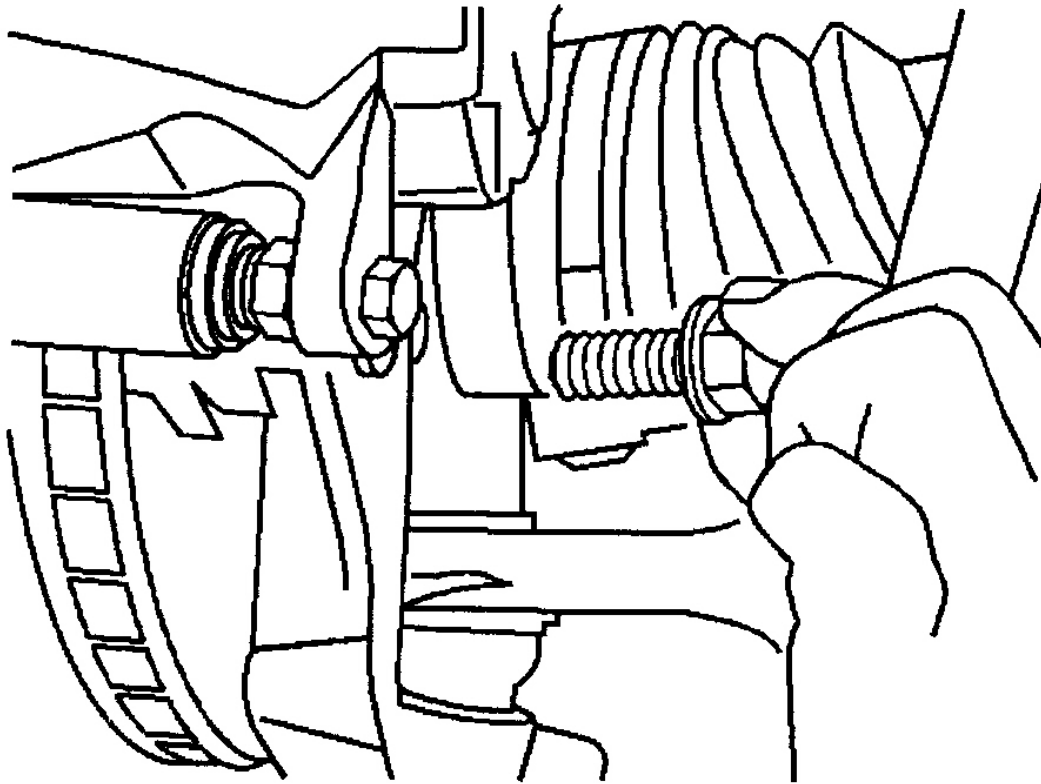
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Fig. 11: Removing Front Disc Brake Pads
Courtesy of ISUZU MOTOR CO.



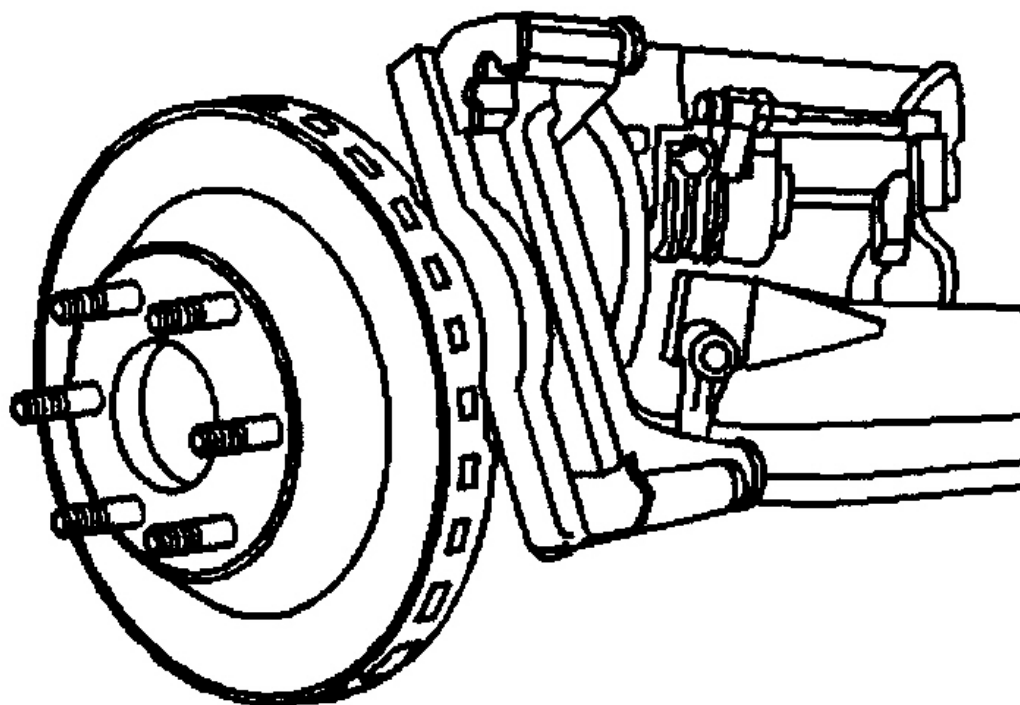
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Fig. 12: Removing Front Brake Pad Retaining Clips From Brake Caliper Mounting Bracket
Courtesy of ISUZU MOTOR CO.



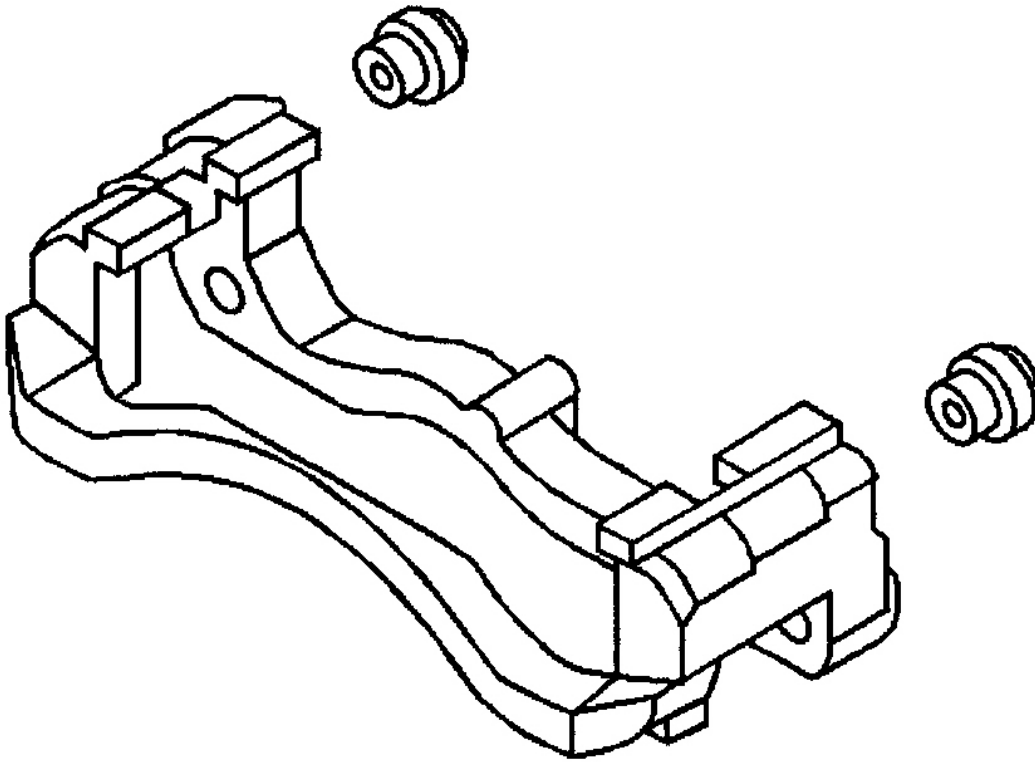
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Fig. 13: Removing Front Brake Caliper Bracket Bolts (Lower Shown)
Courtesy of ISUZU MOTOR CO.



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Fig. 14: Removing Front Brake Caliper Bracket
Courtesy of ISUZU MOTOR CO.



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Fig. 15: Removing Guide Pin Seals
Courtesy of ISUZU MOTOR CO.

Installation

1. Install the guide pin seals on the mounting bracket. See **Fig. 15**. If the guide pins and brake pad retaining clips are to be reused, use denatured alcohol to clean them. Dry the brake guide pins and brake pad retaining clips with non-lubricated, filtered air.
2. Apply high temperature silicone brake lubricant to the brake caliper guide pins. DO NOT apply the lubricant to the brake pad retaining clips.
3. Install the brake caliper mounting bracket and bolts. Tighten the brake caliper mounting bracket bolts to specification. See **TORQUE SPECIFICATIONS**.
4. Install the rear brake pad hardware to the brake caliper mounting bracket. See **Fig. 12**. Install the brake pads to the brake caliper mounting bracket. See **Fig. 11**.

WARNING: DO NOT move the vehicle until a firm brake pedal is obtained. Failure to obtain a firm pedal before moving vehicle may result in personal injury.

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5. Install the brake caliper assembly. See **FRONT BRAKE CALIPER**. Install the tire and wheel assembly. Lower the vehicle. Pump the brake pedal slowly and firmly in order to seat the brake pads.

FRONT BRAKE HOSE

Removal

1. Remove the brake hose retaining bolt from the frame.
2. Install a rubber cap or plug on the exposed brakeline fitting ends to prevent brake fluid loss and contamination.
3. Remove the brake hose bolt from the brake caliper assembly. Remove the brake hose from the vehicle.
4. The metal gaskets may be stuck to either the brake caliper or the brake hose end. Ensure that these gaskets are removed from the brake hose end and the brake caliper. Remove and discard the copper gaskets.

Inspection

1. Ensure that the vehicle axles are properly supported at ride height in order to maintain the proper relationship of the flexible brake hoses to the chassis.
2. Visually inspect all of the flexible brake hoses for the following conditions:
 - Kinks, improper routing, twists, chafing, missing or damaged retainers.
 - Leaking connections, cracking, dry-rot, blisters and bulges.
3. If any of the flexible brake hoses exhibited any of the conditions listed, then the identified flexible brake hose, or hoses require replacement.
4. Squeeze the flexible brake hoses with firm finger pressure to check for soft spots, indicating an internal restriction. Check the entire length of each flexible brake hose.
5. If any of the flexible brake hoses were found to have soft spots, then the identified flexible brake hose, or hoses require replacement.

Installation

NOTE: DO NOT reuse the old copper gaskets. Use only NEW copper gaskets.

1. Install the NEW copper gaskets to the brake hose and bolt. Install the brake hose bolt to the brake caliper. Install the brake hose to brake caliper. Tighten the brake hose bolt to specification. See **TORQUE SPECIFICATIONS**.
2. Install the brake hose retaining bolt to the frame. Tighten the brake hose bolt to specification. See **TORQUE SPECIFICATIONS**.
3. Remove the rubber cap or plug from the brake pipe fitting. Install the brakeline to the brake hose. Tighten the brake pipe fitting to specification. See **TORQUE SPECIFICATIONS**.
4. Fill the brake master cylinder reservoir. Bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. Install the front tires and wheels assembly. Lower the vehicle.

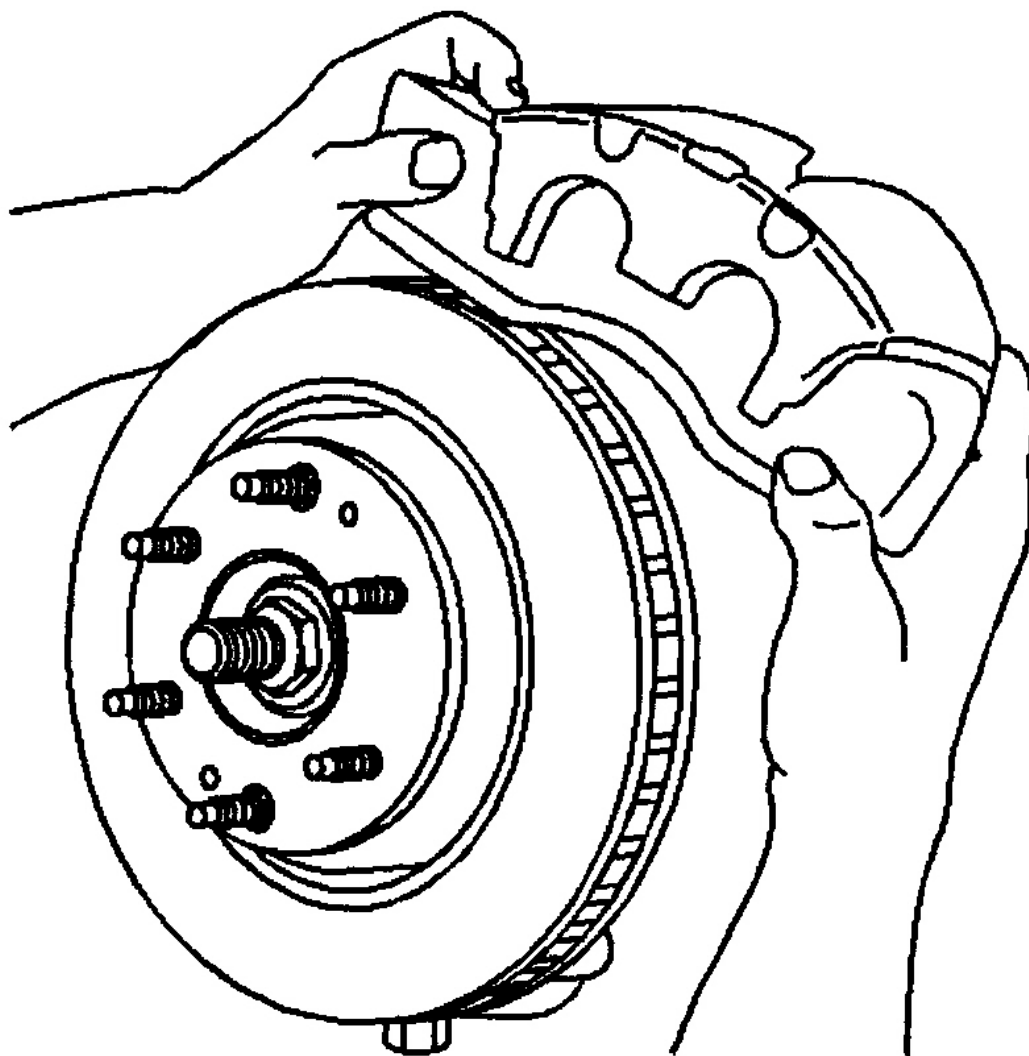
FRONT BRAKE ROTOR**Removal**

1. Inspect the brake fluid level in the brake master cylinder reservoir. If the brake fluid is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, using a appropriate tool, remove the brake fluid to the midway point before proceeding.
2. Raise the vehicle. Remove the tire and wheel assembly.
3. Compress the front brake caliper piston.
 - A. Install a large C-clamp over the top of the brake caliper housing and against the back of the outboard brake pad. See **Fig. 4**.
 - B. Slowly tighten the C-clamp until the piston pushes into the brake caliper enough to slide the brake caliper off the rotor.
 - C. Remove the C-clamp from the brake caliper.
4. Remove the mounting bolts from the brake caliper mounting bracket. See **Fig. 13**.
5. When performing the following service procedure, the front brake caliper assembly and the front brake caliper mounting bracket can be removed as an assembly. Remove the brake caliper and mounting bracket assembly. See **Fig. 16**.
6. Remove the retaining clips from the brake rotor. See **Fig. 17**.

CAUTION: Whenever the brake rotor has been separated from the wheel bearing flange, clean any rust or foreign material from the mating surface of the rotor and flange with the hub cleaning kit (J-42450). Failure to do this may result in increased lateral runout of the rotor and brake pulsation.

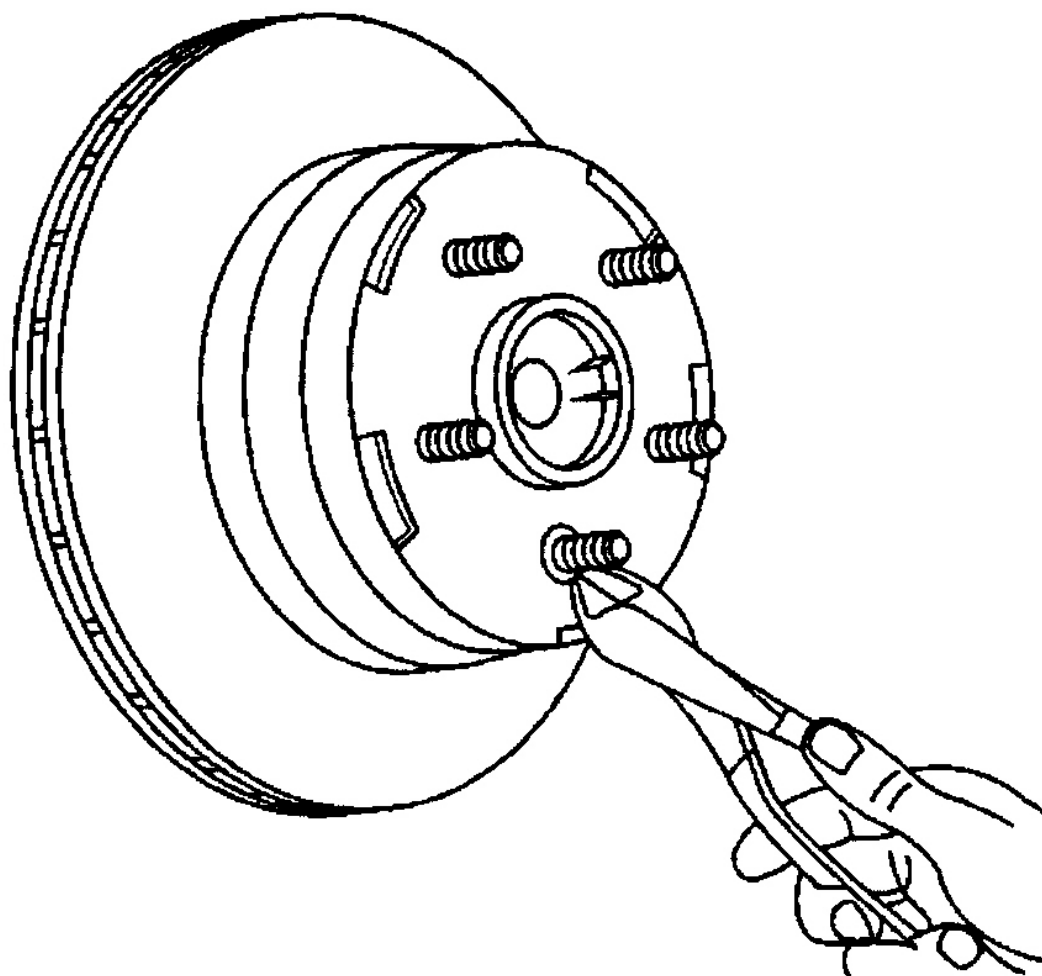
NOTE: If the brake rotor is not going to be replaced but just removed from the front hub, mark the relationship of the brake rotor and a wheel stud.

7. Remove the front brake rotor from the wheel hub. See **Fig. 18**.
8. Using the wheel hub cleaning kit (J-42450-A), clean the brake rotor contact area on the front hub. See **Fig. 19**.



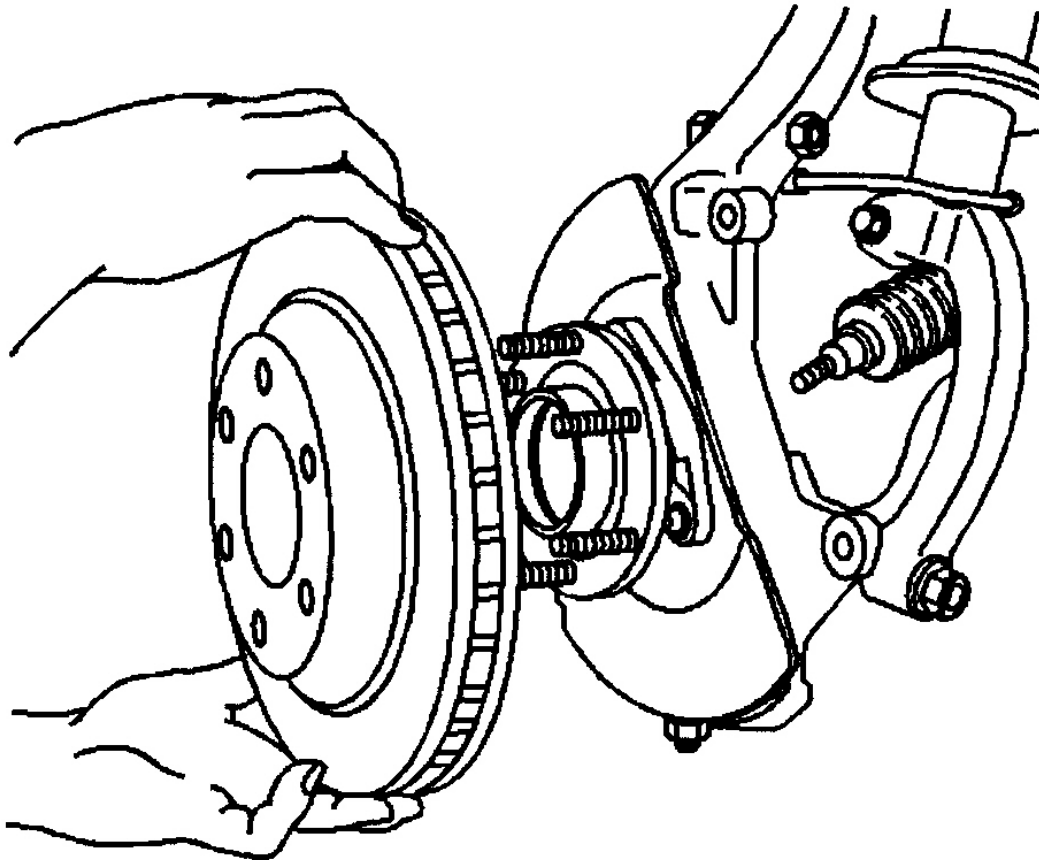
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Fig. 16: Removing Brake Caliper & Bracket Assembly
Courtesy of ISUZU MOTOR CO.



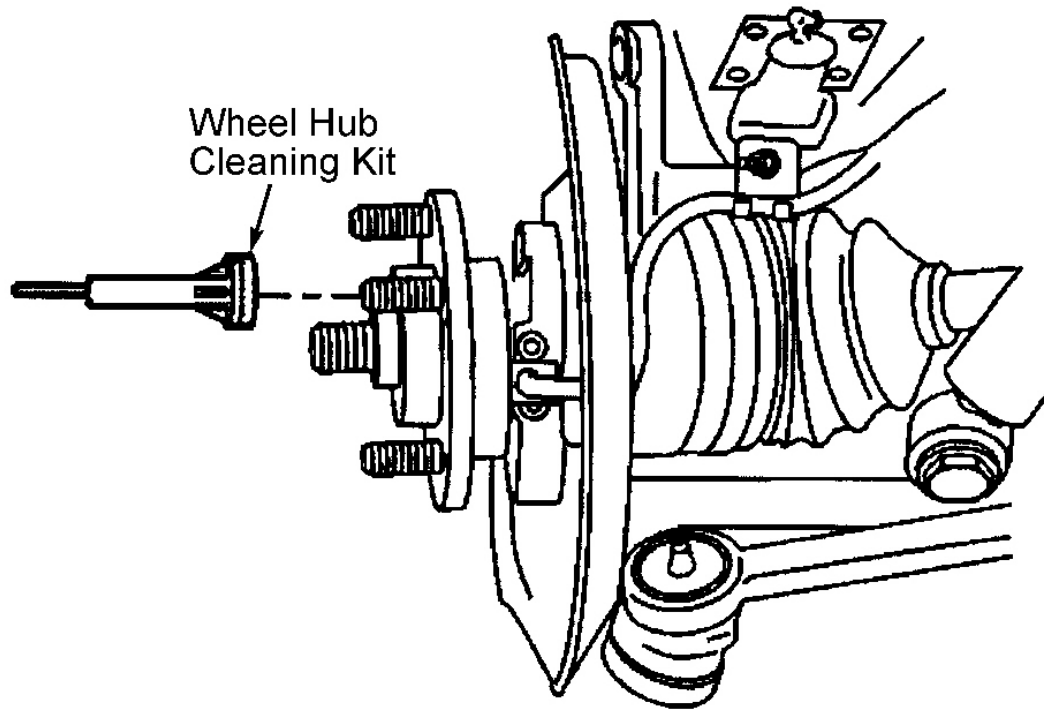
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Fig. 17: Removing Brake Rotor Retaining Clips
Courtesy of ISUZU MOTOR CO.



G00304701

Fig. 18: Removing Front Brake Rotor
Courtesy of ISUZU MOTOR CO.



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Fig. 19: Using Wheel Hub Cleaning Kit On Front Brake Rotor
Courtesy of ISUZU MOTOR CO.

Installation

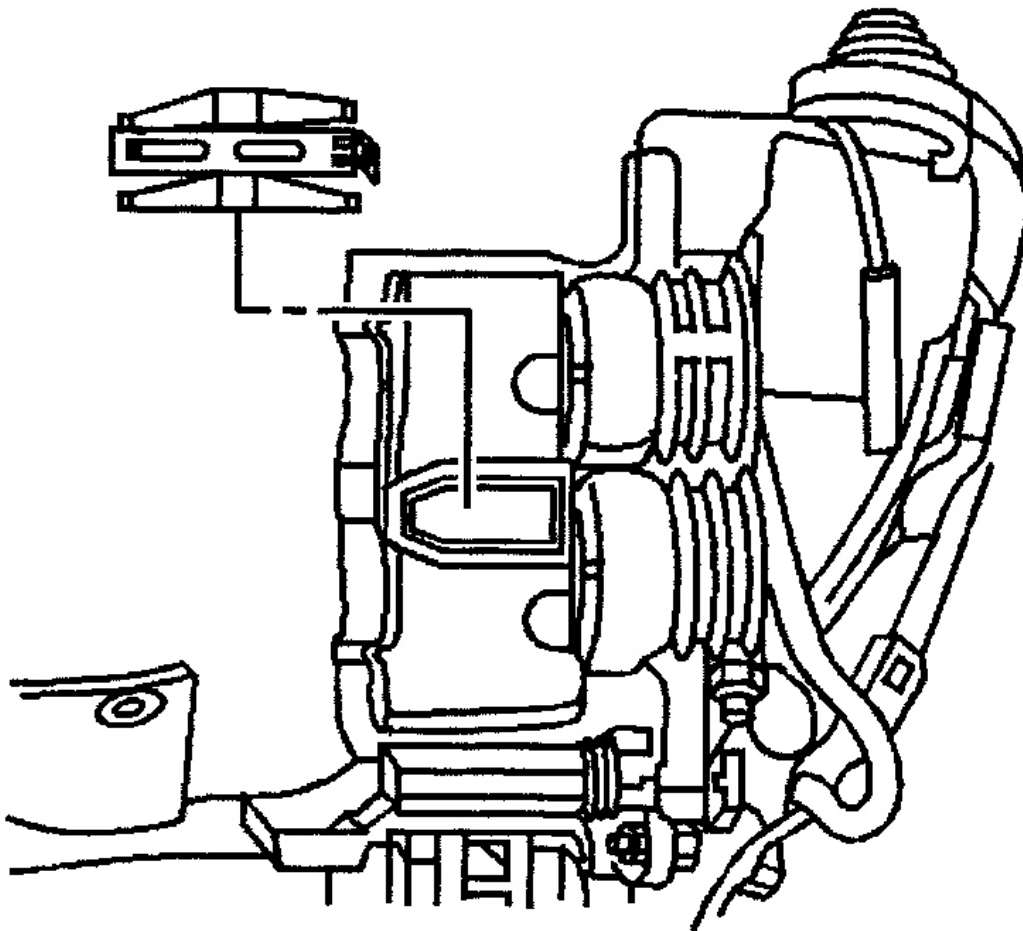
1. Ensure that the relationship marks on the brake rotor and the wheel stud are aligned before installing the brake rotor. Install the brake rotor to the wheel hub. See **Fig. 18**.
2. Install the brake caliper assembly to the steering knuckle. See **Fig. 16**.
3. Install the brake caliper mounting bolt. See **Fig. 13**. Tighten the brake caliper bracket mounting bolt to specification. See **TORQUE SPECIFICATIONS**. Install the tire and wheel assembly. Tighten wheel lug nuts to specification. See **TORQUE SPECIFICATIONS**. Lower the vehicle.

WARNING: DO NOT move the vehicle until a firm brake pedal is obtained.
Failure to obtain a firm pedal before moving vehicle may result in personal injury.

4. Fill the brake master cylinder to the proper level. Pump the brake pedal slowly and firmly in order to seat the brake pads. Burnish the replaced or refinished rotors approximately 20 times at 30 MPH.

Removal

1. Raise the vehicle. Remove the tire and wheel assembly. Remove and inspect the brake caliper assembly. See **FRONT BRAKE CALIPER**.
2. Remove the brake pad retaining clip from the brake caliper. See **Fig. 20**. Remove the brake pads from the brake mounting bracket. See **Fig. 11**.
3. Remove the brake caliper mounting bracket retaining bolts. See **Fig. 13**. Remove the brake caliper mounting bracket. See **Fig. 14**.
4. Remove the brake pad retaining clips from the mounting bracket. See **Fig. 12**. Remove the guide pin bushing from the brake caliper mounting bracket. See **Fig. 15**.
5. Clean the brake caliper mounting bracket with denatured alcohol. Dry the brake caliper mounting bracket using non-lubricated, filtered air.



G00304684

Fig. 20: Removing Front Brake Pad Retaining Clip From Brake Caliper
Courtesy of ISUZU MOTOR CO.

Inspection

1. Remove the disc brake caliper from the caliper mounting bracket. See **FRONT BRAKE CALIPER**.
2. Remove the disc brake pads from the caliper mounting bracket.
3. Inspect the disc brake pad mounting hardware for the following:
 - Missing mounting hardware.
 - Excessive corrosion.
 - Bent mounting tabs.
 - Looseness at the caliper mounting bracket.
 - Looseness at the disc brake pads.

If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.

4. Ensure the disc brake pads are held firmly in place on the caliper mounting bracket, yet slide easily on the mounting hardware without binding. Install the disc brake pads to the caliper mounting bracket. Install the disc brake caliper to the mounting bracket. See **FRONT BRAKE CALIPER**.

Installation

1. Install the guide pin bushing on the brake caliper mounting bracket. See **Fig. 15**.
2. Install the guide pins in the brake caliper mounting bracket. Apply high temperature silicone brake lubricant to the brake caliper guide pins. DO NOT apply lubricant to the brake pad hardware or retaining clips.
3. Install the brake caliper mounting bracket. See **Fig. 14**. Install the brake caliper mounting bracket bolts. See **Fig. 13**.
4. Install the brake pad retaining clips to the brake caliper mounting bracket. Install the brake pad retaining clip to the brake caliper. See **Fig. 20**.
5. Install the brake caliper assembly. See **FRONT BRAKE CALIPER**. Install the tire and wheel assembly. Lower the vehicle.

FRONT DISC BRAKE PADS

Removal

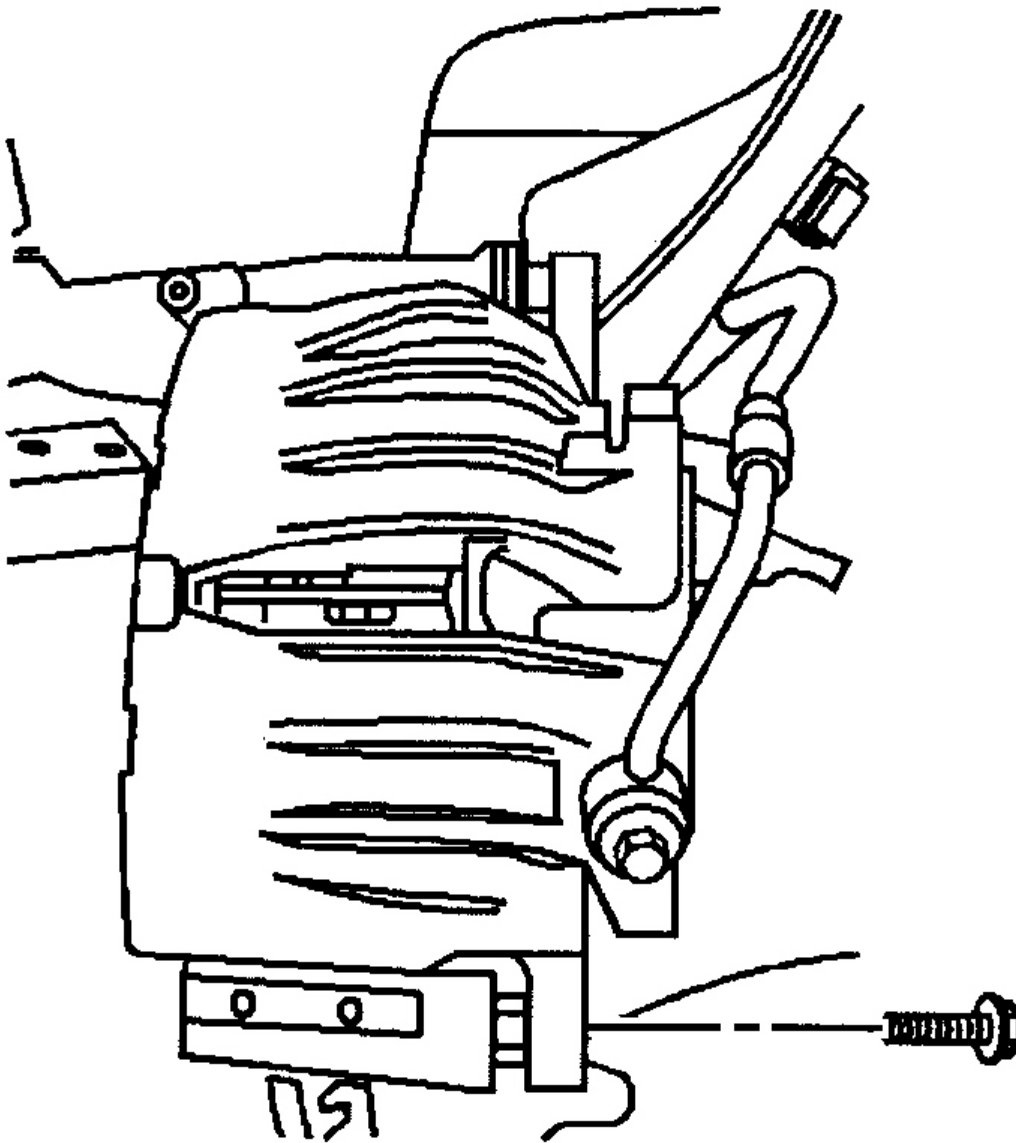
1. Inspect the brake fluid level in the brake master cylinder reservoir. If the brake fluid is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, remove the brake fluid with appropriate tool to the midway point before proceeding.
2. Raise the vehicle. Remove the tire and wheel assembly.
3. Compress the front brake caliper piston.
 - A. Install a large C-clamp over the top of the brake caliper housing and against the back of the

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outboard brake pad. See **Fig. 4**.

- B. Slowly tighten the C-clamp until the piston pushes into the brake caliper enough to slide the brake caliper off the rotor.
 - C. Remove the C-clamp from the brake caliper.
4. Remove the lower mounting bolt from the slide pin. See **Fig. 21**.
 5. Rotate the brake caliper upward until it stops. See **Fig. 11**. Remove the outboard brake pad. Remove the inboard brake pad.
 6. Remove the brake pad retaining clips from the brake caliper mounting bracket. See **Fig. 12**.
 7. Remove the brake pad retaining clip from the brake caliper. See **Fig. 20**. Remove all foreign material from the brake caliper using denatured alcohol.



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Fig. 21: Removing Brake Caliper Lower Mounting Bolt
Courtesy of ISUZU MOTOR CO.

Inspection

NOTE: Inspect the disc brake pads at regular intervals, or whenever the tire and wheel assemblies are removed from the vehicle. If replacement is necessary, always

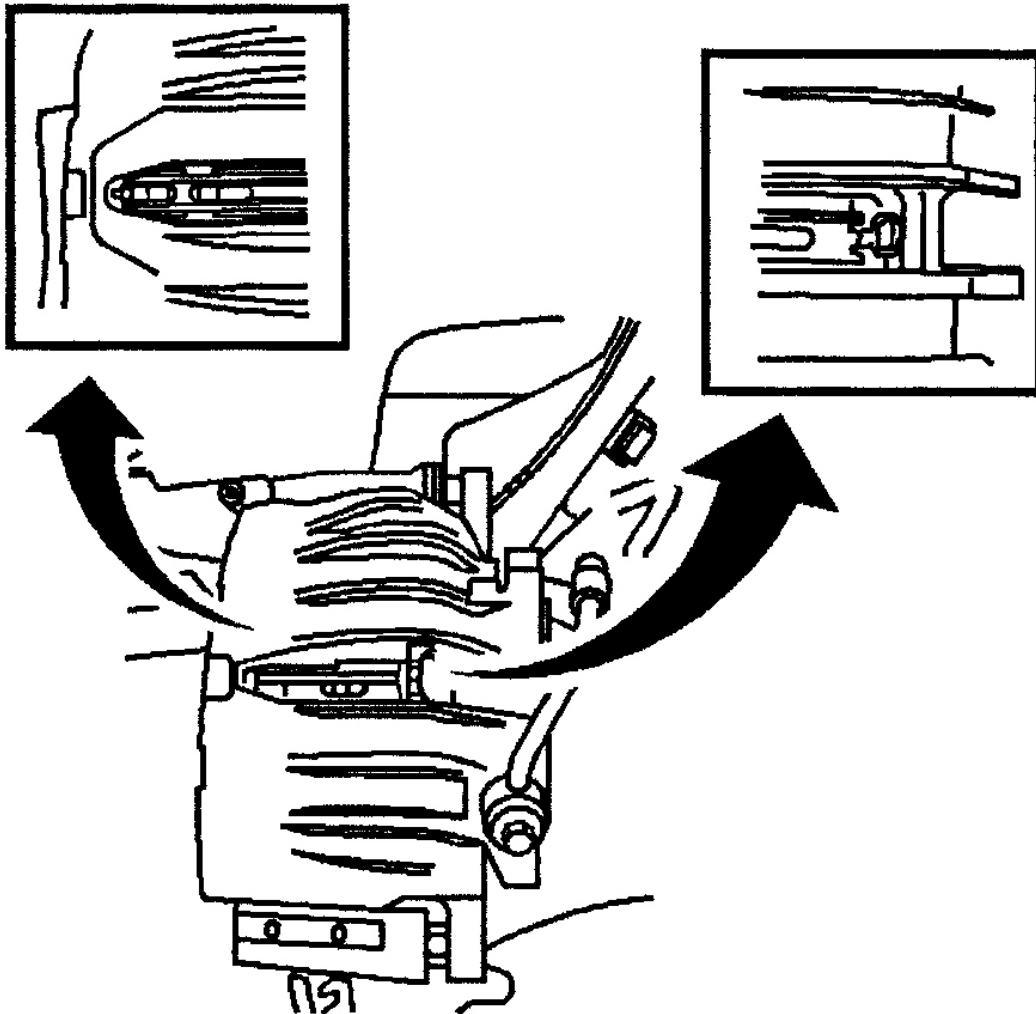
replace disc brake pads in axle sets.

- Inspect both edges of the disc brake pad friction surfaces. The highest rate of wear normally occurs at the trailing edge of the disc brake pads.
- Inspect the thickness of the disc brake pads in order to ensure that they have not worn prematurely. The disc brake pad wear should be approximately even per axle set.
- Replace the disc brake pads when the friction surface is worn to within 0.030" (0.76 mm) of the mounting plates.
- Remove the brake calipers and inspect the friction surfaces of the inner and outer disc brake pads to ensure that they are level. Place the disc brake pad friction surfaces together and measure the gap between the surfaces. If more than 0.005" (0.13 mm) gap exists midway between the length of the disc brake pads, replace the disc brake pads.
- Verify that any disc brake pad shims that may be required are in place and not damaged or excessively corroded. Replace any missing or damaged shims in order to preserve proper disc brake performance.
- Replace the disc brake pads if any have separated from the mounting plates. Inspect the disc brake pads friction surfaces for cracks, fractures, or damage which may cause noise or otherwise impair disc brake performance.

Installation

NOTE: When installing NEW brake pads, DO NOT reuse the old retaining clips for the brake pad. Use only NEW brake pad retaining clips.

1. Install the brake pad retaining clips to the brake caliper mounting bracket. See **Fig. 12**.
2. Install the brake pad retaining clip to the brake caliper. See **Fig. 20**.
3. Ensure that the brake pad retaining clip in the brake caliper is properly seated. See **Fig. 22**.
4. Install the inboard brake pad. See **Fig. 11**. Install the outboard brake pad. Rotate the brake caliper down into position.
5. Install the lower brake caliper mounting bolt. See **Fig. 21**. Tighten the brake caliper mounting bolt to specification. See **TORQUE SPECIFICATIONS**. Install the tire and wheel assembly. Lower the vehicle.
6. Fill the brake master cylinder reservoir. Pump the brake pedal slowly and firmly to seat the brake pads. Burnish the NEW brake pads approximately 20 times at 30 MPH.



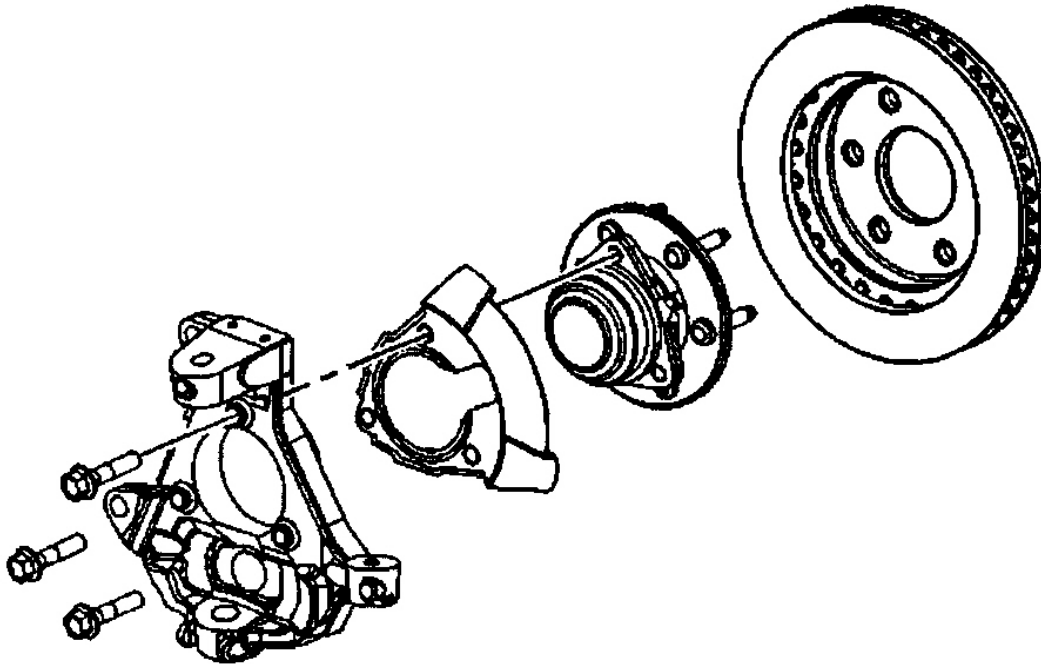
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Fig. 22: Installing Front Brake Pad Retaining Clip To Brake Caliper
 Courtesy of ISUZU MOTOR CO.

FRONT DISC BRAKE SPLASH SHIELD

Removal & Installation

1. Raise the vehicle. Remove the tire and wheel assembly. Remove the front hub and bearing assembly. See appropriate FRONT SUSPENSION article in SUSPENSION.
2. Remove the retaining bolts for the splash shield. See **Fig. 23**. Remove the splash shield.
3. For installation, reverse removal procedure. Tighten wheel lug nuts to specification. See **TORQUE SPECIFICATIONS**.



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Fig. 23: Removing Front Splash Shield
Courtesy of ISUZU MOTOR CO.

MASTER CYLINDER

Removal

1. Apply the parking brake. Disconnect the master cylinder fluid level sensor connector. See **Fig. 24**.
2. Disconnect the brakelines from the master cylinder.
3. Install a rubber cap or plug to the exposed brake hose fitting ends in order to prevent brake fluid loss and contamination. Plug the brakelines.
4. Remove the master cylinder mounting nuts. See **Fig. 25**. Remove the master cylinder assembly. Drain the master cylinder of brake fluid.

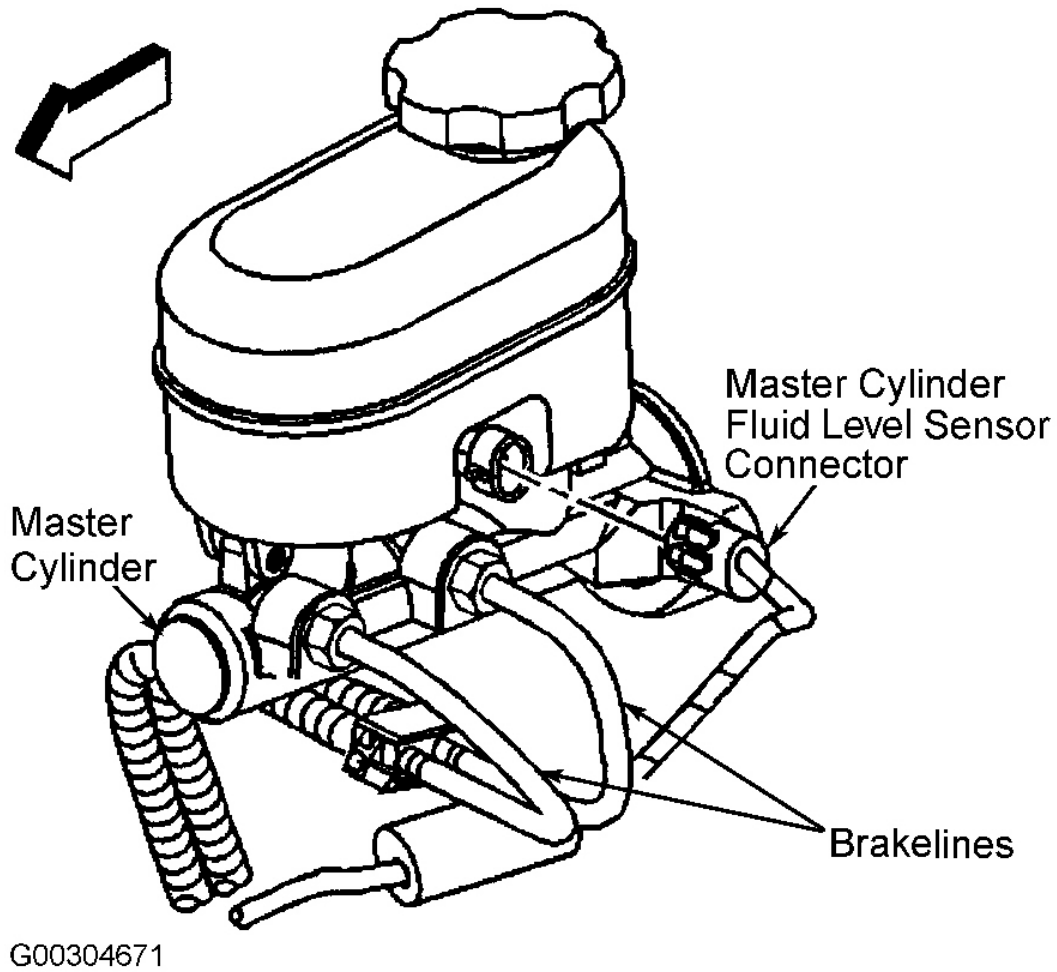
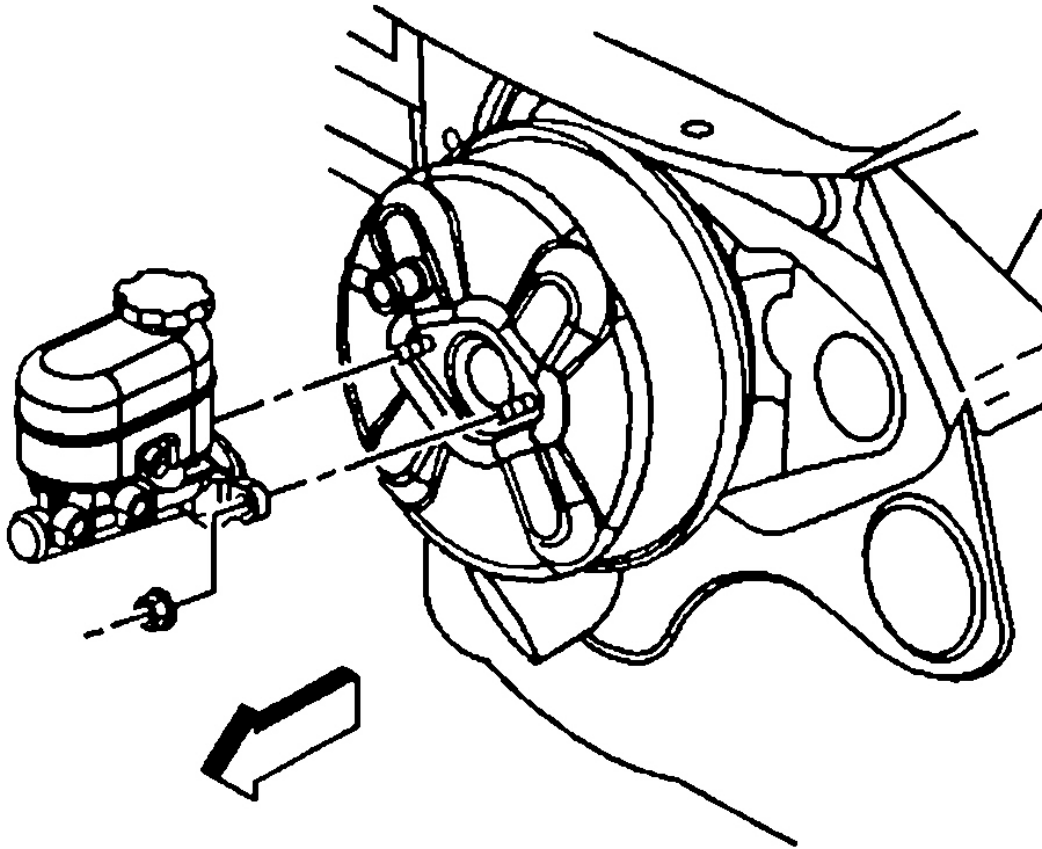


Fig. 24: Removing Master Cylinder Fluid Level Sensor Connector & Brakelines
Courtesy of ISUZU MOTOR CO.



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Fig. 25: Removing Master Cylinder
Courtesy of ISUZU MOTOR CO.

Installation

1. Bench bleed the master cylinder. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM.
2. Install the master cylinder assembly. See **Fig. 25**. Install the master cylinder mounting nuts. Tighten the master cylinder mounting nuts to specification. See **TORQUE SPECIFICATIONS**.
3. Remove the rubber plugs from the brakelines.
4. Connect the brakelines. See **Fig. 24**. Tighten the brakeline fittings to specification. See **TORQUE SPECIFICATIONS**.
5. Connect the master cylinder fluid level sensor connector. Bleed the hydraulic brakes system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM.

MASTER CYLINDER FLUID LEVEL SENSOR

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Removal & Installation

1. Disconnect the electrical connector from the fluid level sensor. See **Fig. 24**.

NOTE: When performing the following service procedure, it is NOT necessary to drain the master cylinder reservoir.

2. Using pair of needle nose pliers, compress the locking tabs for the fluid sensor located at the opposite side of the master cylinder.
3. Remove the fluid level sensor from the master cylinder reservoir.
4. For installation, reverse removal procedure.

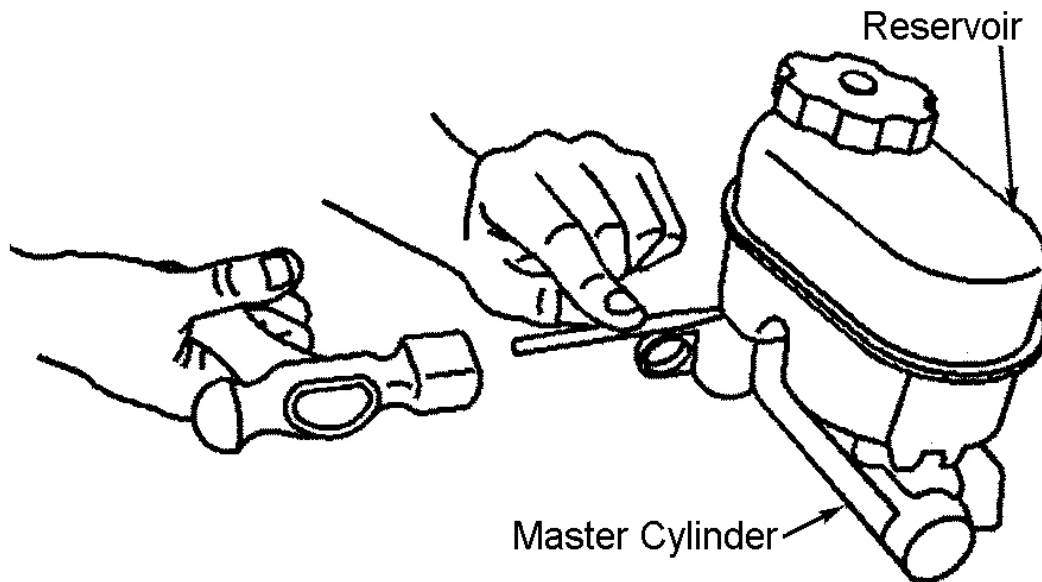
MASTER CYLINDER RESERVOIR

Removal

1. Remove the brake master cylinder assembly. See **MASTER CYLINDER** under REMOVAL & INSTALLATION.
2. Drain the brake fluid from the reservoir.

CAUTION: DO NOT clamp on the master cylinder body. Doing so may damage the master cylinder.

3. Clamp the flange of the master cylinder body in a vise.
4. Remove the retaining pins for the brake master cylinder reservoir. See **Fig. 26**. Remove the reservoir from the brake master cylinder.
5. Remove the seals from the brake master cylinder.
6. Clean the master cylinder area with denatured alcohol, or equivalent. Dry the master cylinder with non-lubricated, filtered air.



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Fig. 26: Removing Master Cylinder Reservoir Retaining Pins
Courtesy of ISUZU MOTOR CO.

Installation

1. Lubricate the NEW seals and the outer surface area of the reservoir-to-housing barrels with Delco Supreme 11(R), P/N 12377967, P/N 992667 or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
2. Install the lubricated seals, make sure that the seals are fully seated in the brake master cylinder.

NOTE: When performing the following service procedure, apply equal pressure to ensure proper seating of the reservoir and the pin holes are aligned.

3. Install the reservoir to the brake master cylinder. Install the reservoir retaining pins. See **Fig. 26**.
4. Remove the brake master cylinder from the vise. Install the brake master cylinder. See **MASTER CYLINDER**.

PARK BRAKE ACTUATOR

Removal

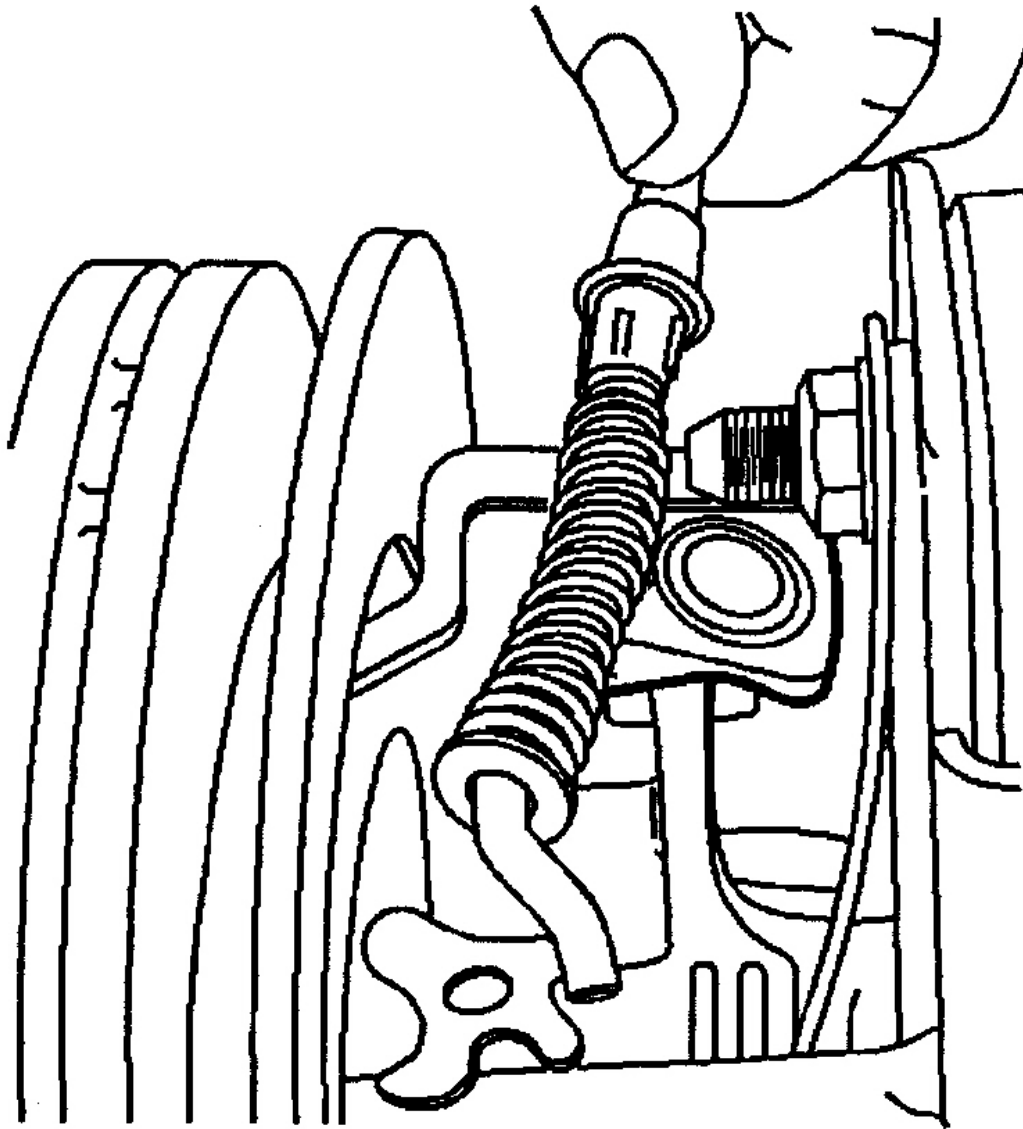
1. Disable the park brake automatic adjuster. See **DISABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS. Raise the vehicle. Remove the tire and wheel assembly.
2. Remove the park brake cable from the mounting bracket by depressing the locking tabs. Remove the rear

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park brake cable from the park brake actuator lever. See **Fig. 27**.

3. Remove the rear brake caliper and mounting bracket assembly. See **REAR BRAKE CALIPER BRACKET**. Remove the rear brake rotor. See **REAR BRAKE ROTOR**.
4. Remove the axle shaft. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES. Remove the park brake shoe. See **PARK BRAKE SHOE**.
5. Remove the backing plate bolts. Remove the park brake actuator lever housing from the backing plate. Using denatured alcohol, clean the backing plate and parking brake actuator. Using non-lubricated, filtered air, dry the backing plate.



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Fig. 27: Removing Park Brake Cable From Actuator
Courtesy of ISUZU MOTOR CO.

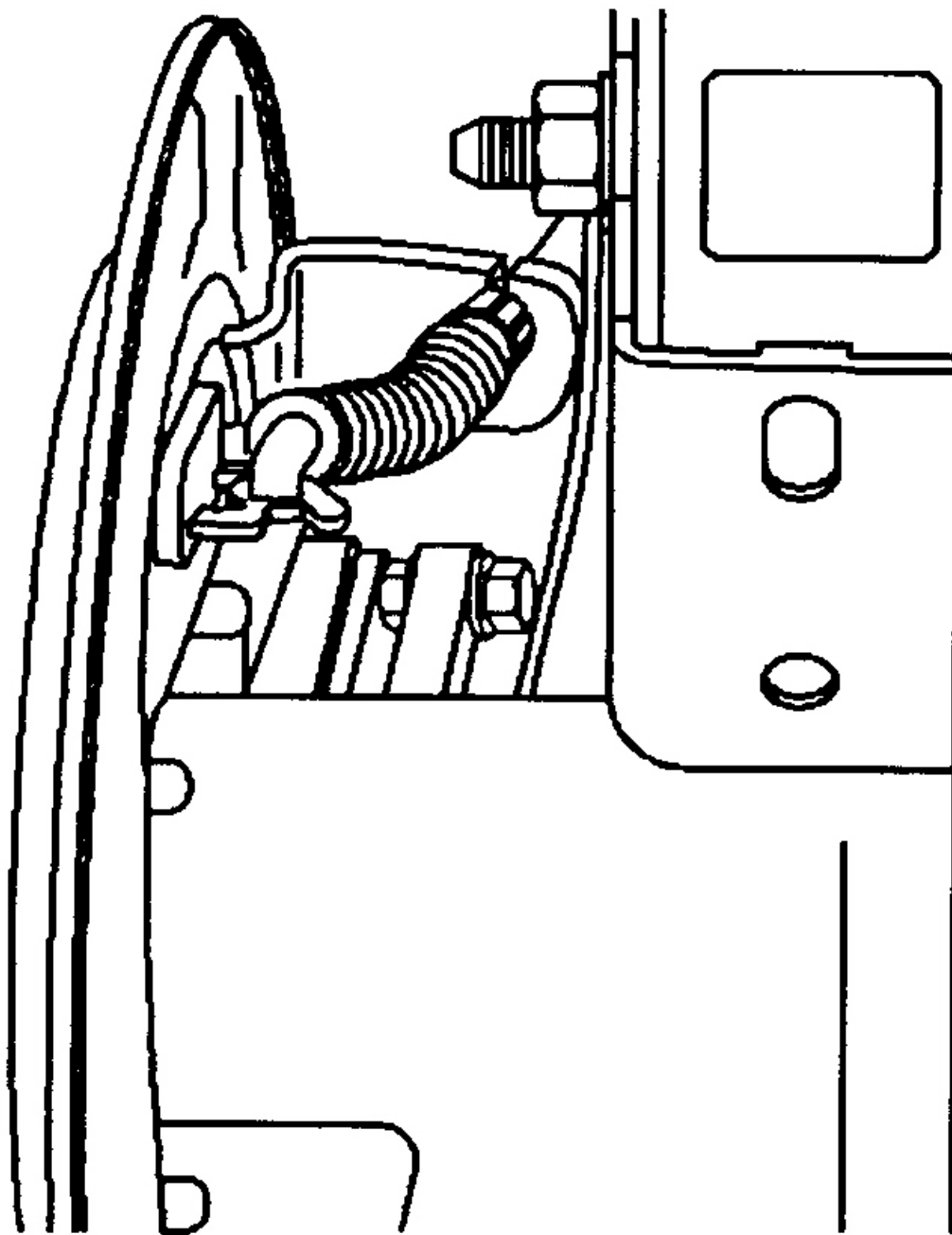
Installation

1. Install the park brake actuator lever housing to the backing plate.
2. Perform the following procedure before installing the backing plate bolts.

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- A. Remove all traces of the original adhesive patch.
 - B. Clean the threads of the bolt with denatured alcohol, brake parts cleaner or the equivalent and allow to dry.
 - C. Apply Threadlocker Red LOCTITE(tm) #272 or equivalent to the threads of the bolt.
3. Install the backing plate bolts. Tighten the backing plate bolts to specification. See **TORQUE SPECIFICATIONS**.
 4. Install the park brake shoe. See **PARK BRAKE SHOE**. Install the axle shaft. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES. Adjust the park brake shoe. See **PARK BRAKE** under ADJUSTMENTS.
 5. Install the rear brake rotor. See **REAR BRAKE ROTOR**. Install the rear park brake cable to the park brake actuator lever. See **Fig. 27**. Install the park brake cable to the mounting bracket, ensuring the locking tabs are secured. See **Fig. 28**. Install the rear brake caliper and mounting bracket assembly. See **REAR BRAKE CALIPER BRACKET**.
 6. Install the tire and wheel assembly. Lower vehicle. Enable the park brake automatic adjuster. See **ENABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS.



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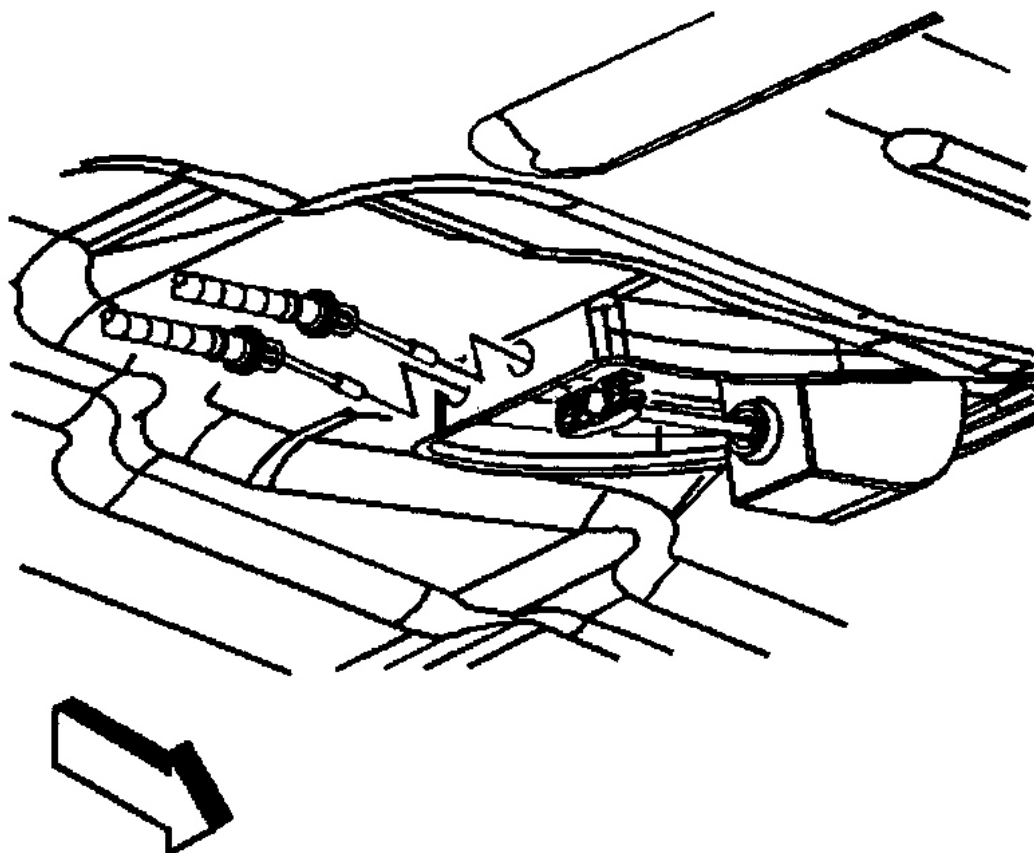
Fig. 28: Installing Park Brake Retainer To Frame (Left Rear Shown)
Courtesy of ISUZU MOTOR CO.

PARK BRAKE CABLE

CAUTION: Handling the parking brake cables during service requires extra care. Damage to the nylon coating reduces the corrosion protection. If the damage area passes through the nylon coating, increased parking brake effort could result. Avoid contacting the protective coating with sharp-edge tools or the sharp surfaces of the vehicle underbody.

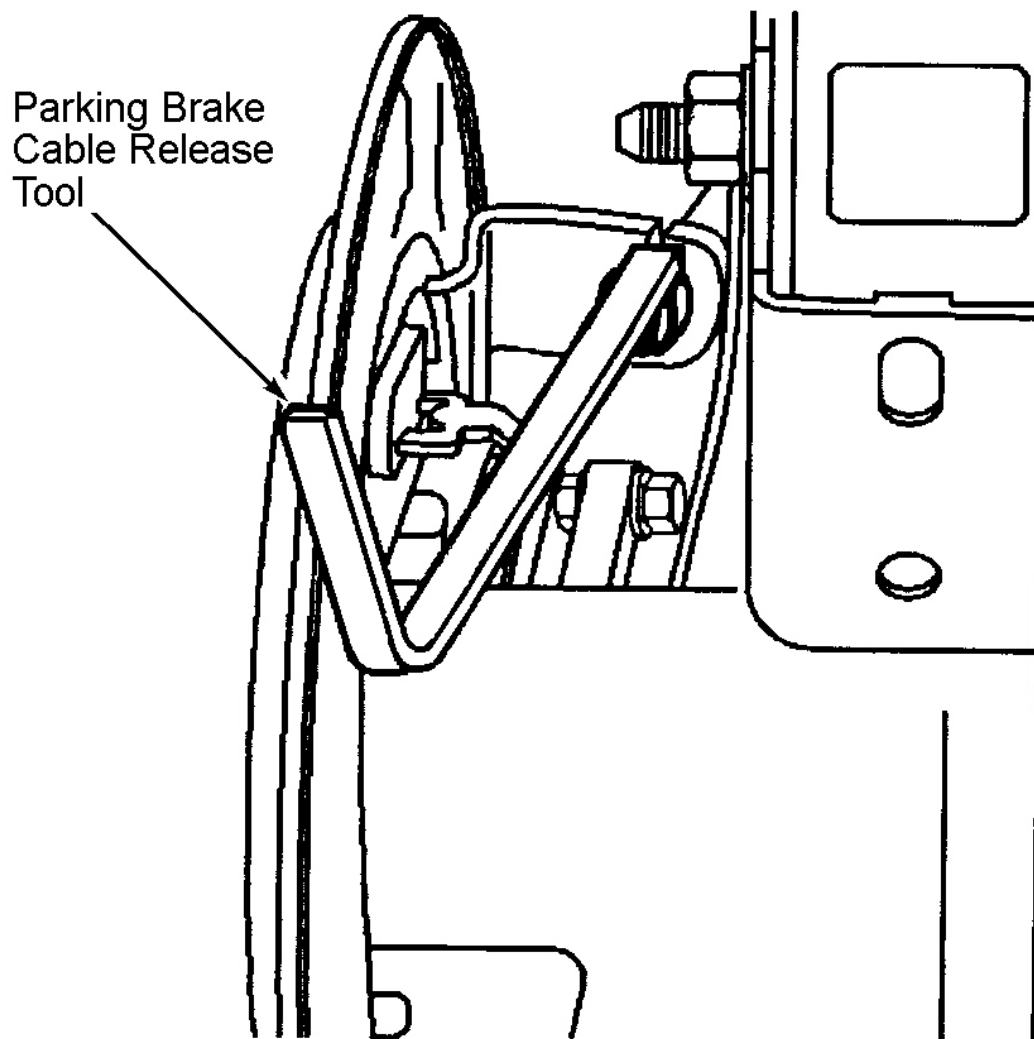
Removal

1. Disable the park brake automatic adjuster. See **DISABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS. Raise and suitably support the vehicle. Remove the rear drive shaft. See appropriate DRIVE SHAFTS article in DRIVELINE/AXLES.
2. Remove the park brake cables from the parking brake equalizer. See **Fig. 29**. Using the parking brake cable release tool (J-37043), remove the park brake cable. See **Fig. 30**. When serving the left park brake cable, the fuel tank DOES NOT have to be removed. Install a pole jack with a block of wood under the fuel tank.
3. Remove the shield for the fuel tank. Raise and support the vehicle. Remove the frame brace mounting bolts and frame brace. See **Fig. 31**. Remove the fuel tank shield to the frame retaining bolts and nut. See **Fig. 32**. Remove the fuel tank shield from the frame.
4. Remove the rear support bracket from the fuel tank. When performing this service procedure, the fuel tank will only drop about 4 inches when supported by the pole jack. It is not necessary to lower the fuel tank any further than that. Lower the fuel tank to allow access to the rear park brake cable retainer above the fuel tank.
5. Remove the park brake cable retaining nuts from the underbody mounting studs. See **Fig. 33**. Remove the park brake cable from the park brake cable retainers. See **Fig. 34**.
6. Remove the park brake retaining bracket bolt from the frame. See **Fig. 35**. Remove the park brake retainer from the frame.
7. Depress the retaining clips for the parking brake cable. See **Fig. 36**. Remove the park brake from the mounting bracket.
8. Remove the park brake cable from the actuator. See **Fig. 27**. Push the park brake cable through the frame toward the inside from the vehicle. Remove the park brake cables from the vehicle.



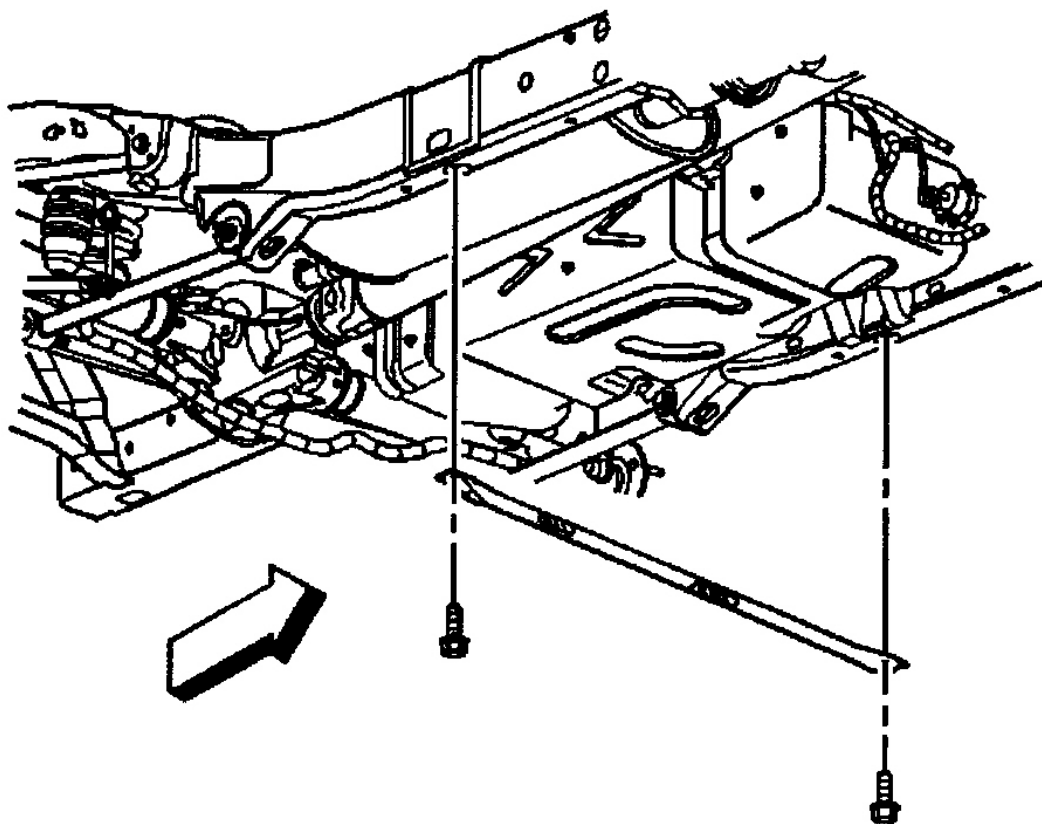
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Fig. 29: Disconnecting Park Brake Cables From Equalizer
Courtesy of ISUZU MOTOR CO.



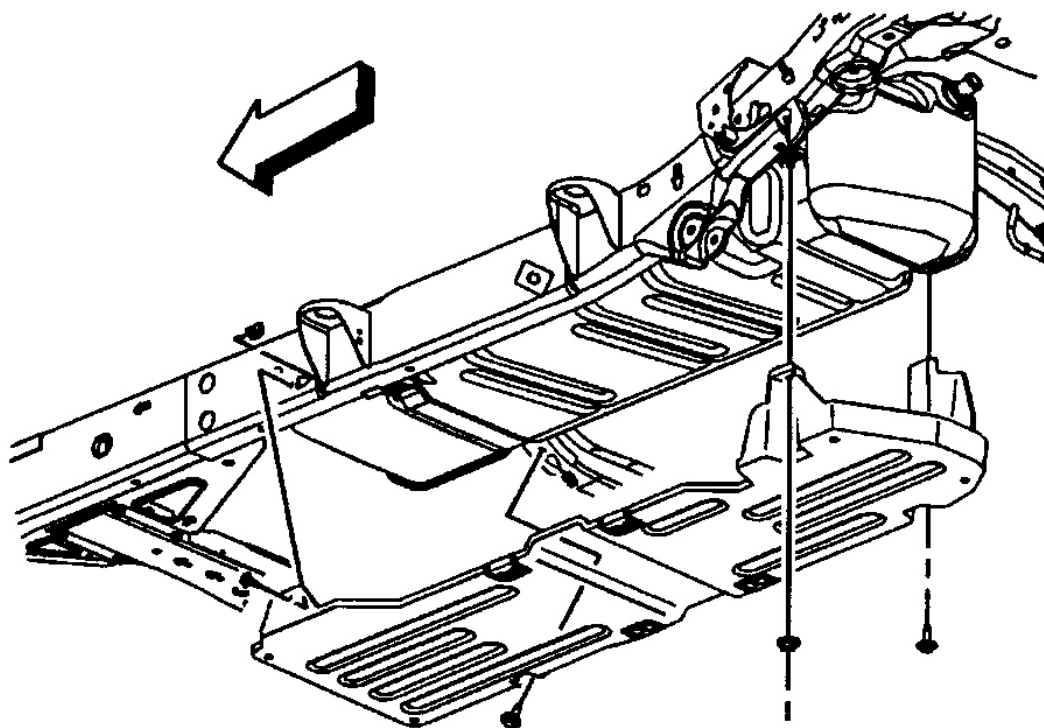
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Fig. 30: Removing Park Brake Cable Using Release Tool
Courtesy of ISUZU MOTOR CO.



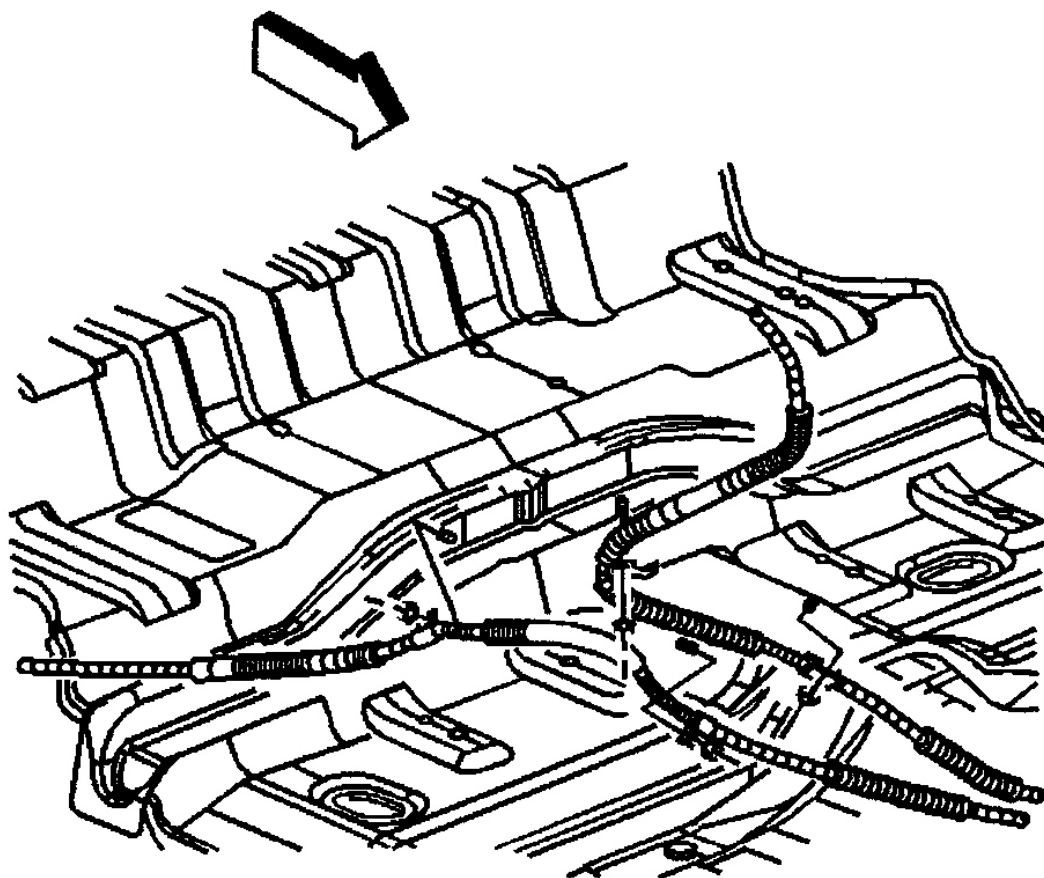
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Fig. 31: Removing Frame Brace
Courtesy of ISUZU MOTOR CO.



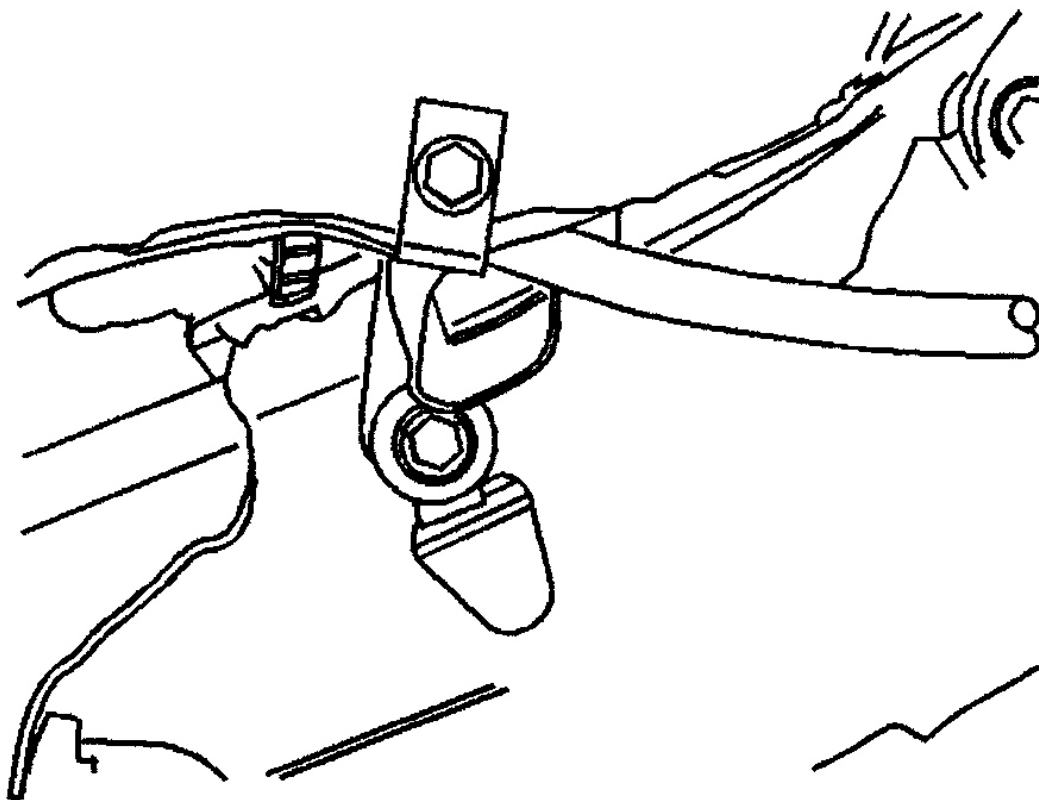
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Fig. 32: Removing Fuel Tank Shield
Courtesy of ISUZU MOTOR CO.



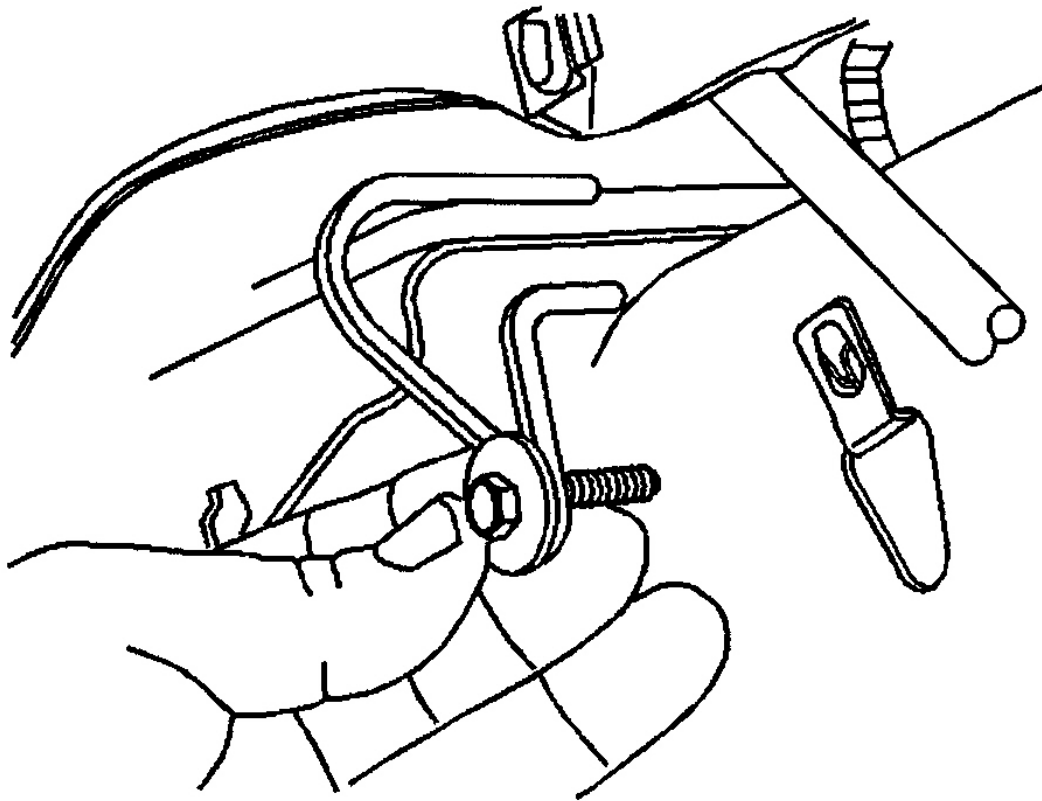
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Fig. 33: Removing Park Brake Cable Retaining Nuts From Underbody Mounting Studs
Courtesy of ISUZU MOTOR CO.



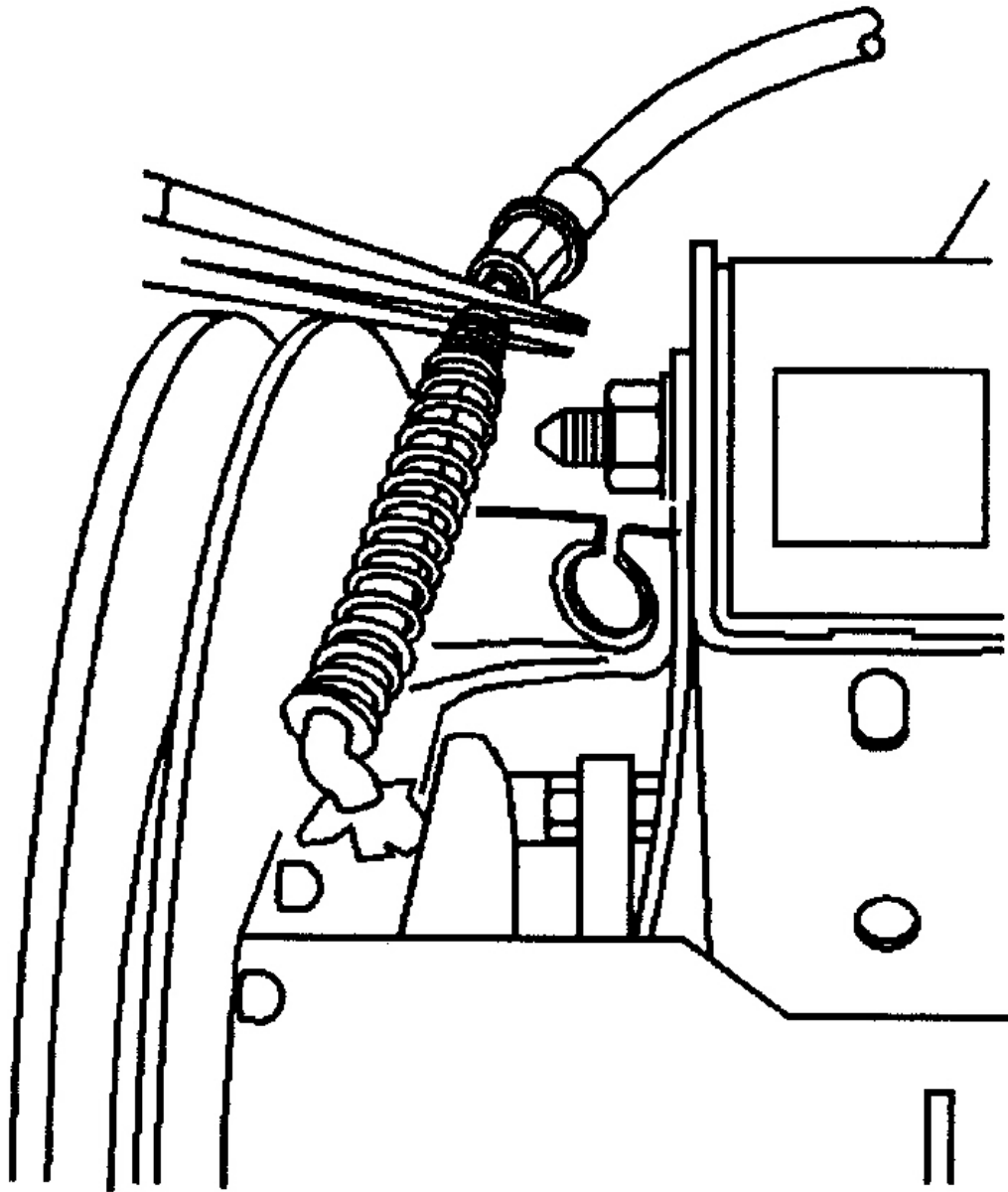
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Fig. 34: Removing Park Brake Cable From Retainers (Left Rear Shown)
Courtesy of ISUZU MOTOR CO.



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Fig. 35: Removing Park Brake Retaining Bracket From Frame (Left Rear Shown)
Courtesy of ISUZU MOTOR CO.



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Fig. 36: Depressing Park Brake Cable Retaining Clips
Courtesy of ISUZU MOTOR CO.

Installation

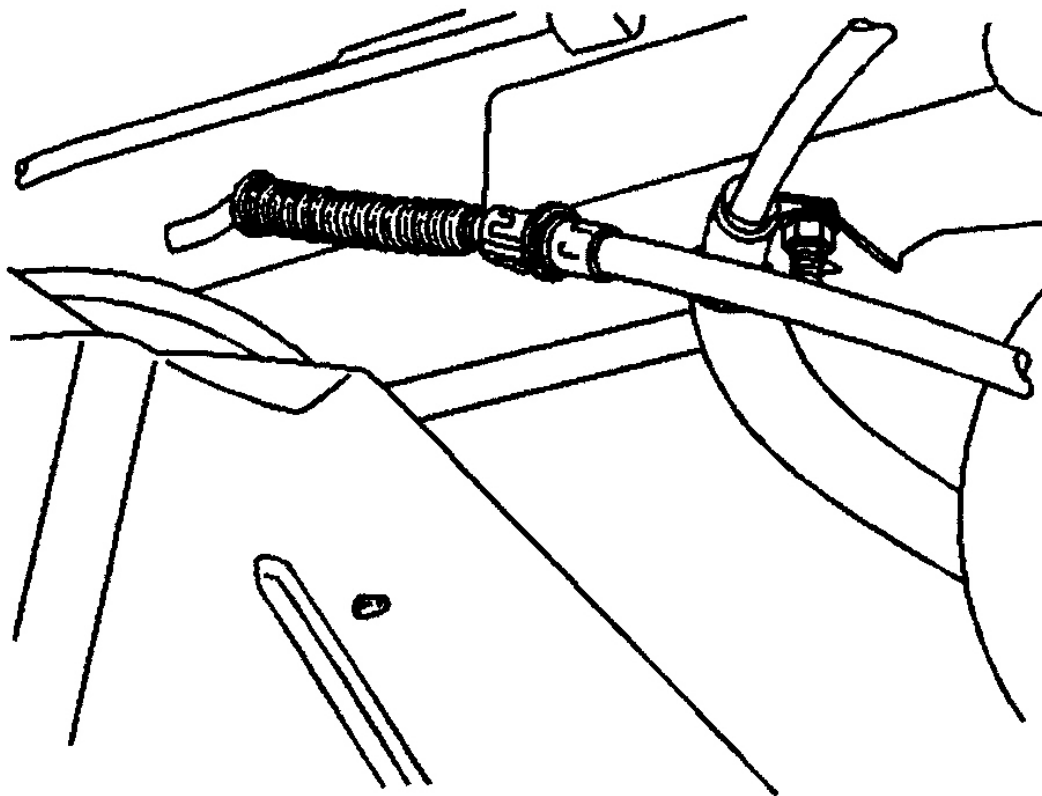
1. Install the park brake cables over the fuel tank assembly. See **Fig. 37**. Pull the park brake cable through

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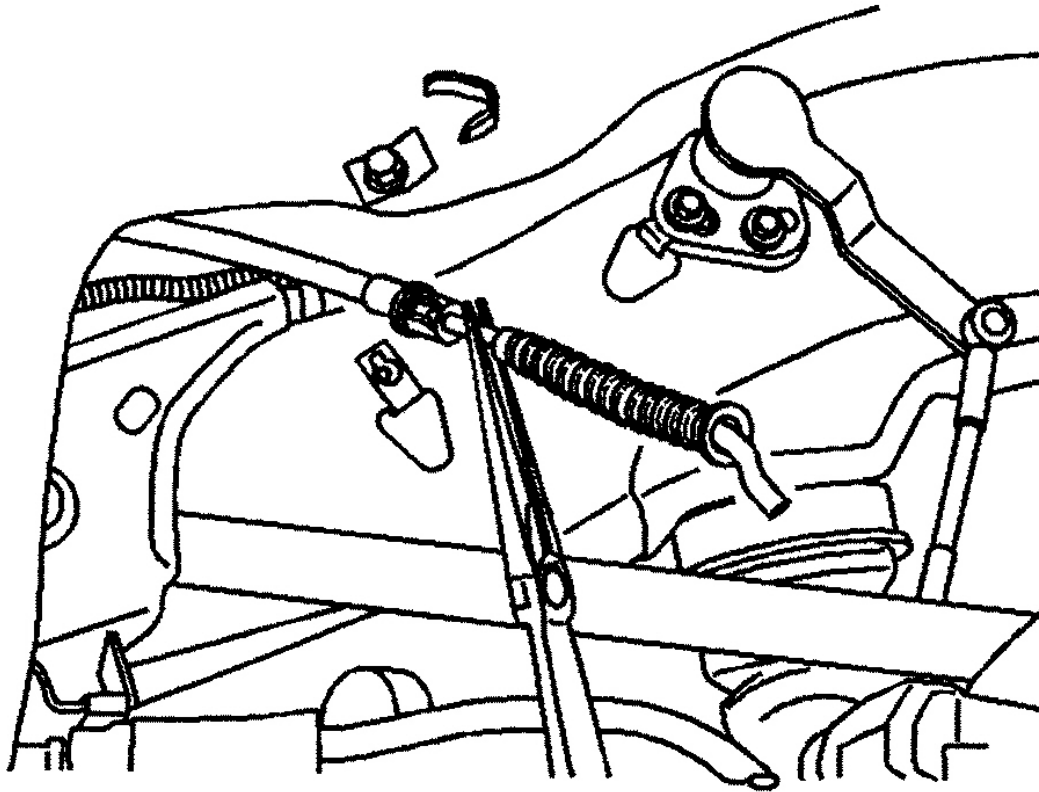
the frame toward the outside of the vehicle. See **Fig. 38**.

2. Install the park brake cable retaining nuts to the underbody mounting studs. See **Fig. 33**. Tighten the park brake cable retaining nuts to specification. See **TORQUE SPECIFICATIONS**.
3. Raise the fuel tank the fuel tank. Install the rear support bracket for the fuel tank. Remove the pole jack and the block of wood from the fuel tank.
4. Install the park brake cable on the actuator. See **Fig. 27**. Depress the retaining clips for the park brake cable. See **Fig. 36**.
5. Install the park brake retainer to the frame. See **Fig. 28**. Install the park brake retaining bracket bolt in the frame. See **Fig. 35**. Tighten park brake cable retaining bracket bolt to specification. See **TORQUE SPECIFICATIONS**.
6. Install the park brake cable to the park brake cable retainers. See **Fig. 34**.
7. Install the fuel tank shield to the frame. Install the fuel tank shield to the frame retaining bolts and nut. Tighten the fuel tank shield to the frame retaining bolts and nut to specification. See **TORQUE SPECIFICATIONS**. Install the frame brace and mounting bolts. Tighten the frame brace mounting bolts to specification. See **TORQUE SPECIFICATIONS**. Lower the vehicle.
8. Install the park brake cables to the retainer. See **Fig. 29**. Install the park brake cables to the park brake equalizer.
9. Install the rear drive shaft. See appropriate DRIVE SHAFTS article in DRIVELINE/AXLES. Lower the vehicle.
10. Enable the park brake automatic adjuster. See **ENABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS. Test the park brake operation. Adjust the park brake shoes. See **PARK BRAKE** under ADJUSTMENTS.



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Fig. 37: Installing Park Brake Cables Over Fuel Tank
Courtesy of ISUZU MOTOR CO.



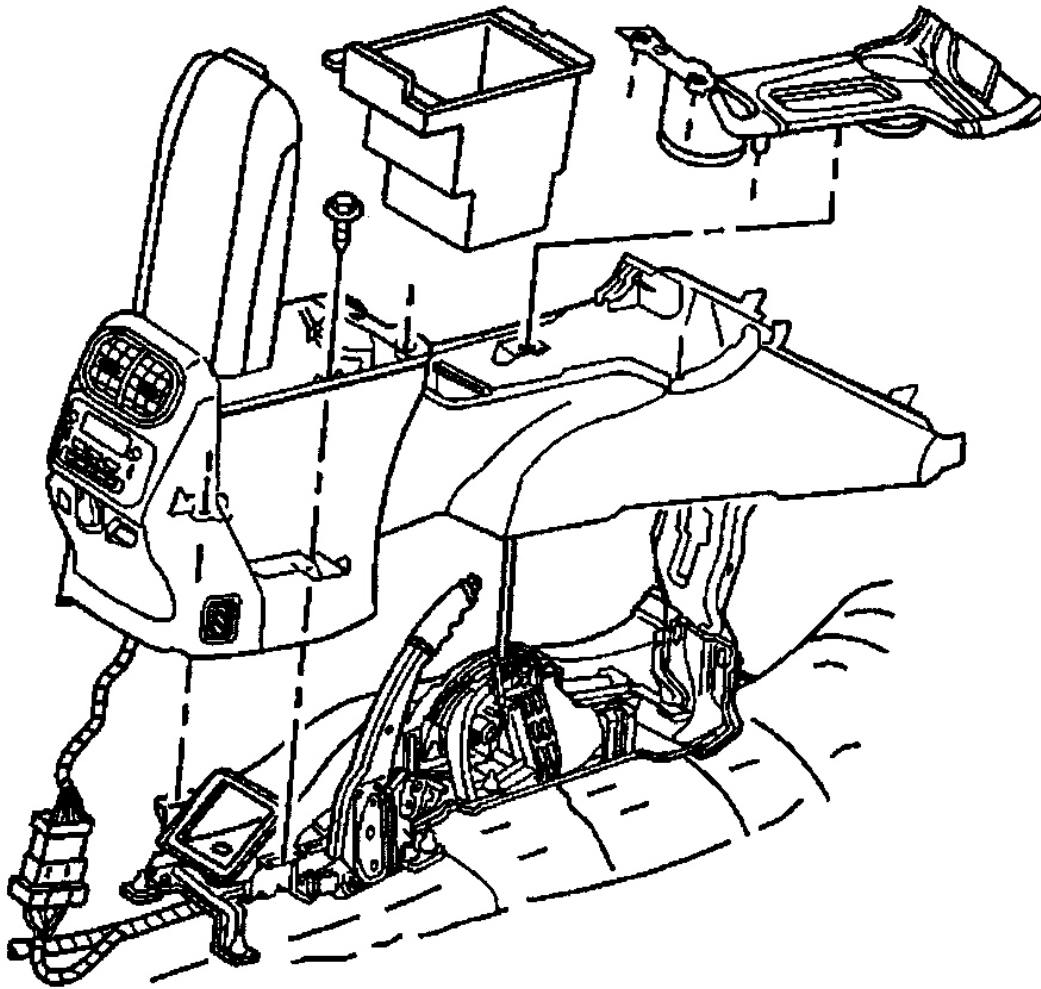
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Fig. 38: Pulling Park Brake Cable Through Frame
Courtesy of ISUZU MOTOR CO.

PARK BRAKE LEVER ASSEMBLY

Removal

1. Remove the floor console. See **Fig. 39**. Disable the park brake automatic adjuster. See **DISABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS. Raise and suitably support the vehicle.
2. Disconnect the park brake cables from the equalizer. See **Fig. 29**. Lower the vehicle. Disconnect the electrical connector from the park brake warning lamp switch.
3. Remove the remaining park brake lever retaining nut. Remove the park brake lever assembly from the vehicle.



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Fig. 39: Removing Floor Console
Courtesy of ISUZU MOTOR CO.

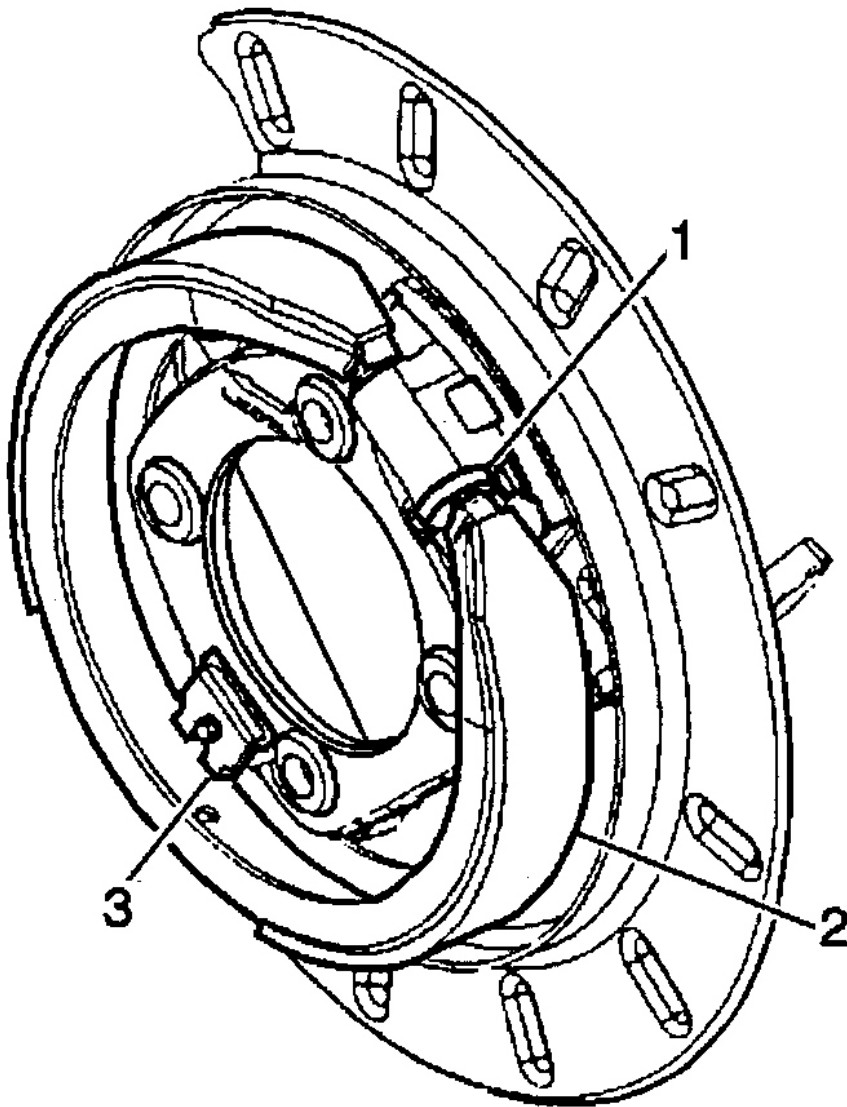
Installation

1. Install the park brake lever assembly to the vehicle. Install the right front park brake lever retaining nut. Tighten the park brake lever mounting nut to specification. See **TORQUE SPECIFICATIONS**.
2. Connect the electrical connector to the park brake warning lamp switch. Raise the vehicle.
3. Connect the park brake cables to the equalizer. Lower the vehicle. See **Fig. 29**.
4. Install the floor console. See **Fig. 39**. Enable the park brake automatic adjuster. See **ENABLING** under PARK BRAKE CABLE AUTOMATIC ADJUSTER in ADJUSTMENTS.

PARK BRAKE SHOE

Removal

1. Release the park brake, if applied. Raise and the vehicle. Remove the wheel and the tire.
2. In the following service procedure, the brake caliper and mounting bracket does not have to be separated. Relocate the brake caliper and bracket to the side and secure. Remove the brake caliper and bracket. See **REAR BRAKE CALIPER BRACKET**.
3. Remove the brake rotor. See **REAR BRAKE ROTOR**.
4. Remove the park brake cable from the park brake lever. See **Fig. 27**.
5. Slide the park brake shoe down until it is disengaged from the hold down spring. See **Fig. 40**. Lift the shoe away from the backing plate and slide the shoe up, off of the actuation mechanism. Remove the shoe over the axle flange and from the vehicle.
6. Clean the debris and the dust from the park brake components using a clean towel. Turn the adjustment screw to the fully home position in the notched adjustment nut, then back it off 1/4 turn. Align the slots in both the adjusting screw and tappet to be parallel with the backing plate face. Using denatured alcohol, clean the rear backing plate of dirt and foreign materials. Using non-lubricated, filtered air, dry the backing plate.



- 1. Actuation Mechanism
- 2. Park Brake Shoe
- 3. Hold Down Spring

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Fig. 40: Removing Park Brake Shoes
Courtesy of ISUZU MOTOR CO.

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Inspect the park brake shoe and lining and replace if any of the following conditions are found:

- Excessive wear indicated by the park brake lining being worn down to the shoe.
- Brake lining cracking.
- Oil or fluid contamination of the brake lining.

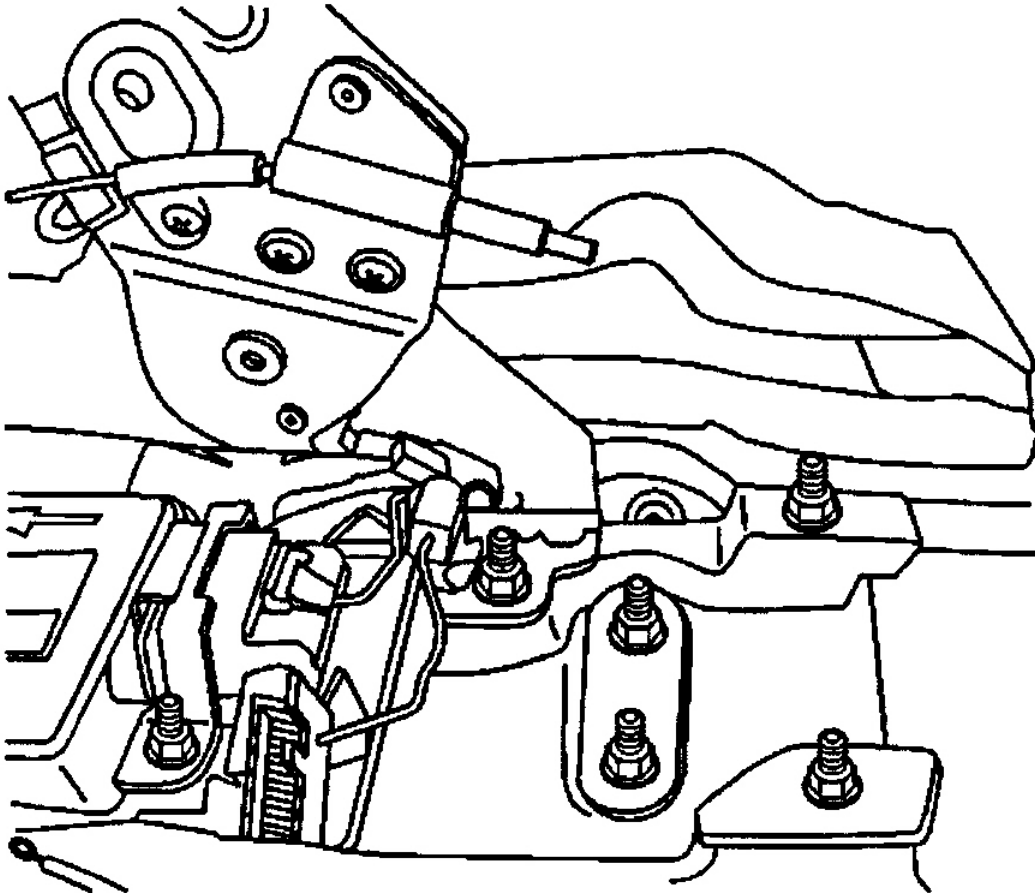
Installation

1. Install a NEW park brake shoe over the axle flange. See **Fig. 40**. Position the shoe on the actuation mechanism. Holding the lower end of the shoe away from the backing plate, slide the shoe down, over the top of the hold down spring. Place the lower end of the shoe against the backing plate. Slide the shoe up and under the hold down spring. Inspect the position of the shoe assembly. The shoe must be central on the backing plate and with both tips located in the slots of the actuation mechanism.
2. Manually check the park brake for proper operation by moving the park brake actuator lever and observing the movement of the actuation mechanism. Install the park brake cable to the park brake lever. See **Fig. 27**.
3. Adjust the park brake shoe. See **PARK BRAKE** under ADJUSTMENTS.
4. Install the brake rotor. See **REAR BRAKE ROTOR**. Install the brake caliper and mounting bracket. See **REAR BRAKE CALIPER BRACKET**.
5. Install the tire and wheel. Tighten wheel lug nuts to specification. See **TORQUE SPECIFICATIONS**. Lower the vehicle.

PARK BRAKE WARNING LAMP SWITCH

Removal & Installation

1. Remove the front passenger side seat. See appropriate POWER SEATS article in ACCESSORIES & EQUIPMENT.
2. Remove the park brake warning lamp switch electrical connector. Remove the park brake warning lamp switch retaining screw. Remove the park brake warning lamp switch from the vehicle. See **Fig. 41**.
3. For installation, reverse removal procedure. Tighten park brake warning lamp switch mounting bolt to specification. See **TORQUE SPECIFICATIONS**.



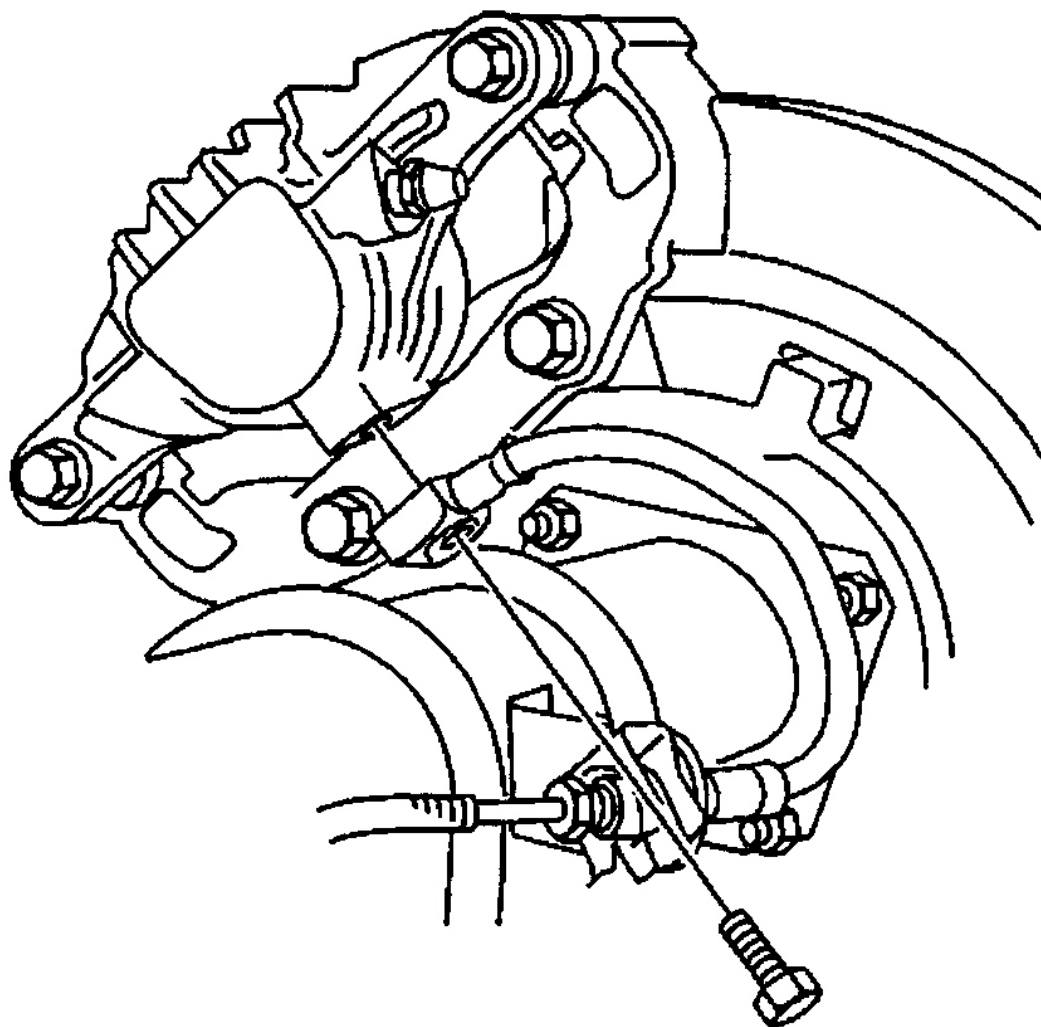
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Fig. 41: Removing Park Brake Warning Lamp Switch
Courtesy of ISUZU MOTOR CO.

REAR BRAKE CALIPER

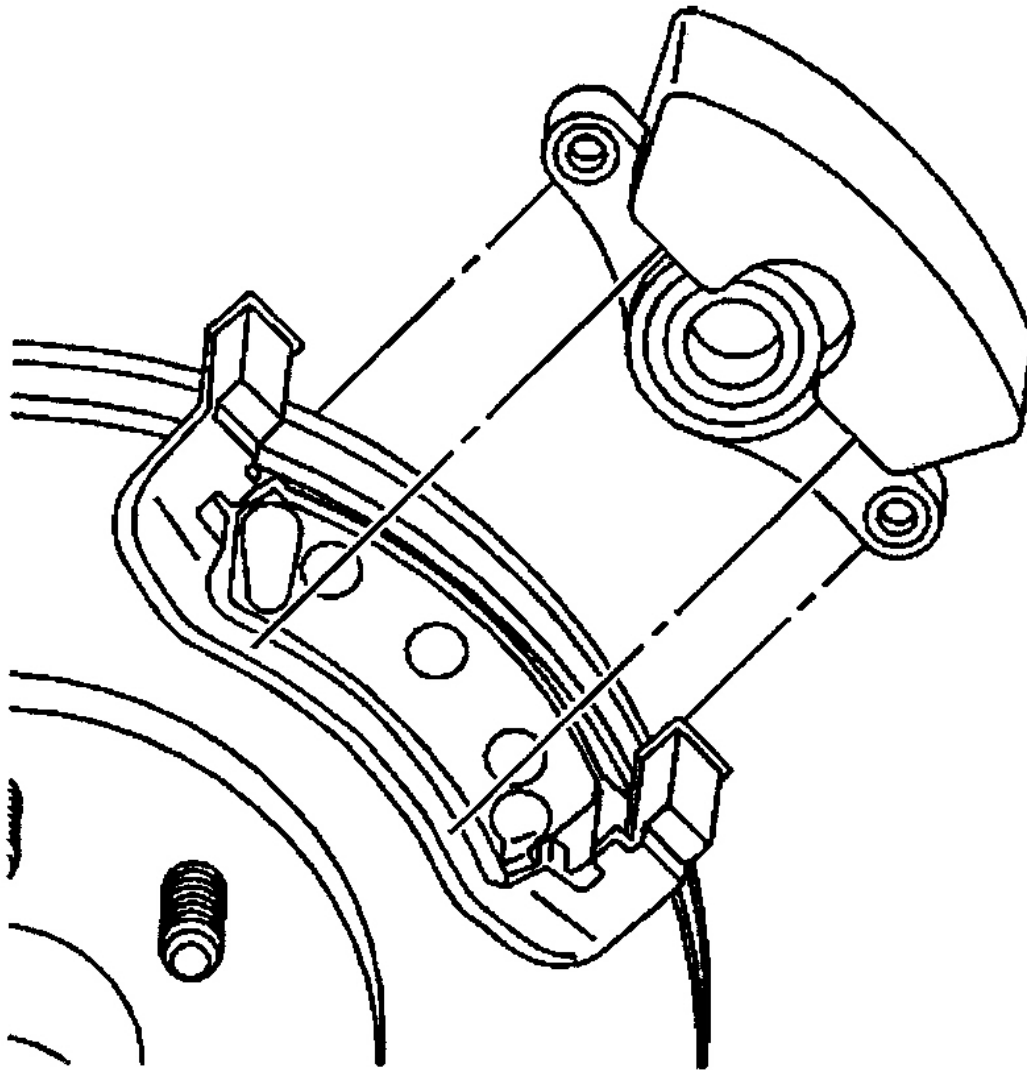
Removal

1. Raise the vehicle. Remove the tire and wheel assembly.
2. Remove the rear brake hose bolt from the rear brake caliper. See **Fig. 42**. Plug the opening of the brake hose in order to prevent excessive brake fluid loss and contamination.
3. Remove the metal (copper) gaskets from the brake hose bolt. Discard the metal (copper) gaskets. DO NOT reuse metal (copper) gaskets, replace them. Remove the rear brake caliper mounting bolts.
4. Remove the rear brake caliper from the brake caliper mounting bracket. See **Fig. 43**.



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Fig. 42: Removing Rear Brake Caliper Brake Hose
Courtesy of ISUZU MOTOR CO.



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Fig. 43: Removing Rear Brake Caliper
Courtesy of ISUZU MOTOR CO.

Inspection

- Inspect the brake caliper housing for cracks, excess wear, and/or damage. If any of these conditions are present, the brake caliper requires replacement.
- Inspect the caliper piston dust boot seal for cracks, tears, cuts, deterioration and/or improper seating in the caliper body. If any of these conditions are present, the brake caliper requires overhaul or replacement.
- Inspect for brake fluid leakage around the caliper piston dust boot seal and on the disc brake pads. If there

is any evidence of brake fluid leakage, the brake caliper requires overhaul or replacement.

- Inspect for smooth and complete travel of the caliper pistons into the caliper bores. The movement of the caliper pistons into the caliper bores should be smooth and even. If the caliper piston is frozen or difficult to bottom, the caliper requires overhaul or replacement.
- For single piston caliper applications, insert a discarded inner brake pad or block of wood in front of the piston. Using a large C-clamp installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the piston in the bore.
- For dual piston caliper applications, insert a discarded inner brake pad or block of wood in front of the pistons. Using 2 large C-clamps installed over the body of the caliper and against the brake pad or block of wood, slowly bottom the pistons evenly into the bores.

Installation

1. If the brake caliper guide pin is to be reused, clean the brake caliper guide pin using denatured alcohol, or equivalent. Dry the brake caliper guide pin using non-lubricated, filtered air. Apply high temperature silicone brake lubricant to the brake caliper guide pin. DO NOT apply lubricant to the brake pad hardware.
2. Install the rear brake caliper assembly to the mounting bracket. See **Fig. 43**.
3. Install the rear brake caliper on the mounting bracket. Tighten the brake caliper guide pins to specification. See **TORQUE SPECIFICATIONS**.
4. Install the NEW metal (copper) gaskets on the brake hose bolt. Remove the plug from the brake hose end. Install the brake hose bolt on the rear brake caliper. Tighten the brake hose bolt to specification. See **TORQUE SPECIFICATIONS**.
5. Bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. Install the tire and wheel assembly. Lower the vehicle.

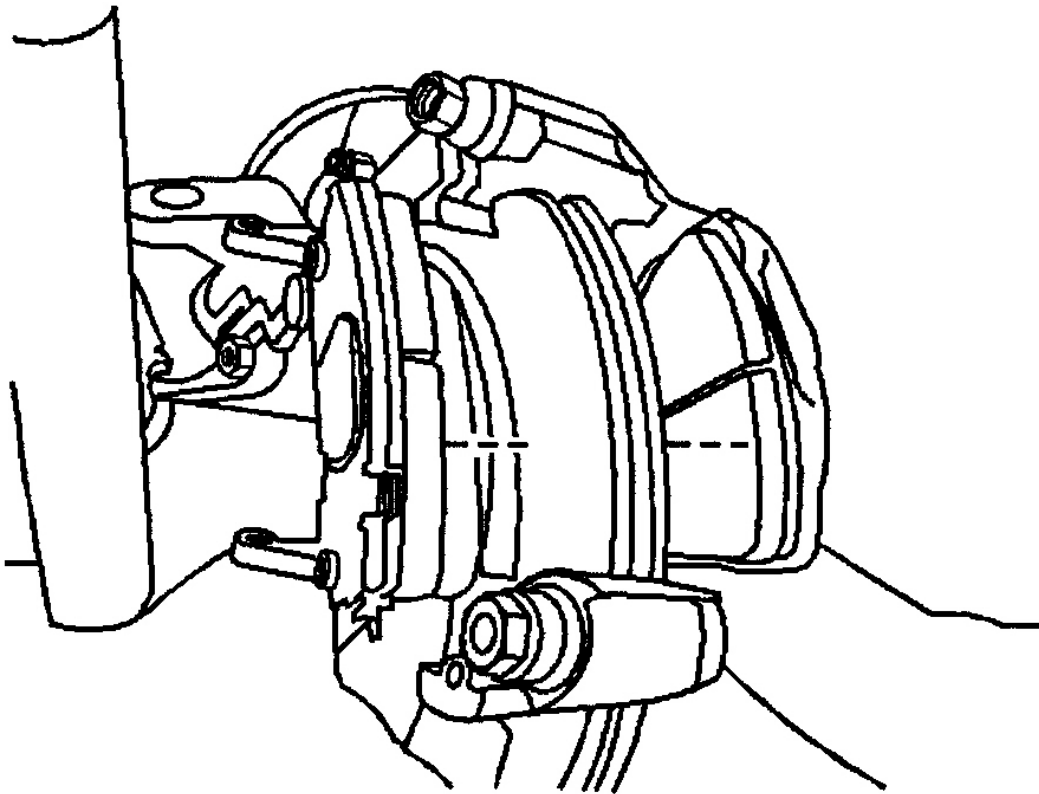
REAR BRAKE CALIPER BRACKET

Removal

CAUTION: Support the brake caliper with heavy mechanic's wire, or equivalent, whenever it is separated from it's 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.

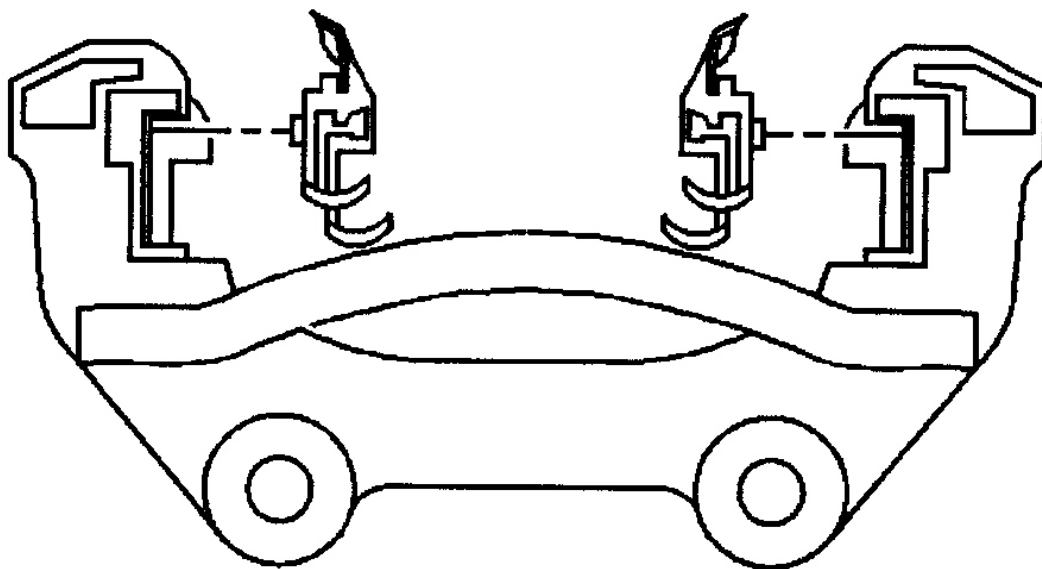
1. Raise the vehicle. Remove the tire and wheel assembly.
2. Inspect the brake caliper assembly. See **INSPECTION** under REAR BRAKE CALIPER. Remove the rear brake caliper assembly, relocate the brake caliper to the side. See **REAR BRAKE CALIPER**.
3. Inspect the brake pads. See **INSPECTION** under REAR DISC BRAKE PADS. Remove the front brake pads from the mounting bracket. See **Fig. 44**. Inspect the brake hardware. See **INSPECTION** under REAR DISC BRAKE HARDWARE.
4. Remove the brake pad retaining clips from the mounting bracket. See **Fig. 45**. Remove the brake caliper mounting bracket retaining bolts. See **Fig. 21**.

5. Remove the brake caliper mounting bracket. See **Fig. 46**. Remove the guide pin seals from the brake caliper mounting bracket. See **Fig. 15**. Inspect the brake rotor thickness, surface and wear. For disc brake specifications, see **BRAKES** in SPECIFICATIONS - ASCENDER article.



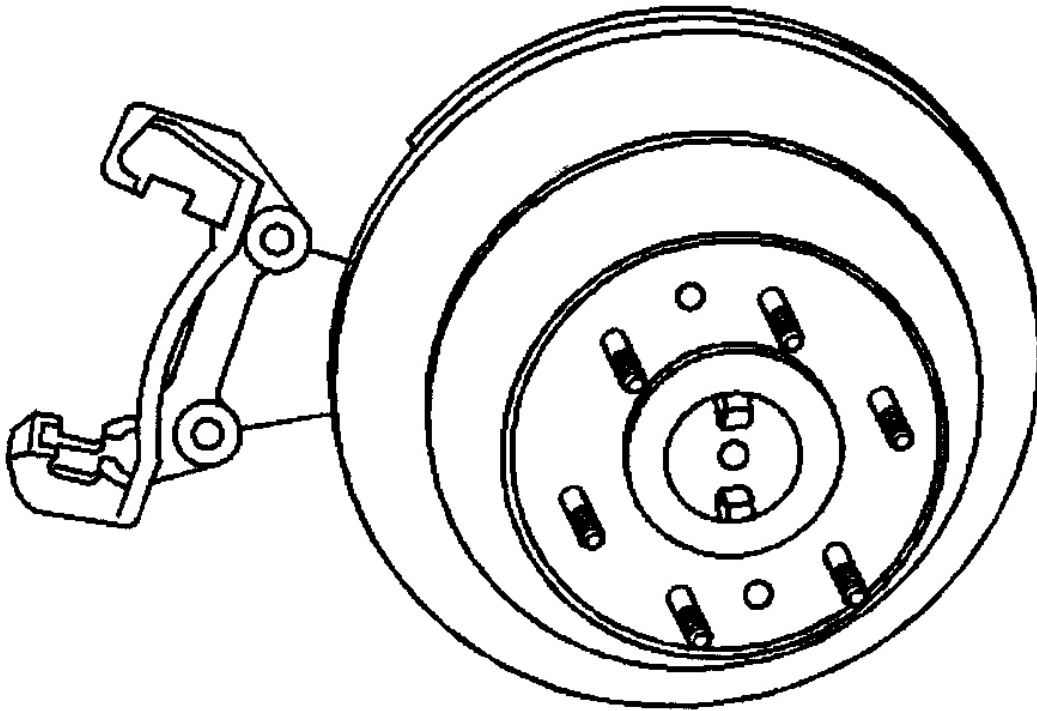
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Fig. 44: Removing Rear Brake Pads
Courtesy of ISUZU MOTOR CO.



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Fig. 45: Removing Rear Brake Pad Retaining Clips From Brake Caliper Mounting Bracket
Courtesy of ISUZU MOTOR CO.



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Fig. 46: Removing Rear Brake Caliper Bracket
Courtesy of ISUZU MOTOR CO.

Installation

1. Install the guide pin seals on the mounting bracket. See **Fig. 15**. If the guide pins and brake pad retaining clips are to be reused, use denatured alcohol to clean them. Dry the brake guide pins and brake pad retaining clips with non-lubricated, filtered air.
2. Apply high temperature silicone brake lubricant to the brake caliper guide pins. DO NOT apply the lubricant to the brake pad retaining clips. Install the brake caliper mounting bracket and bolts. See **Fig. 46**. Tighten the caliper mounting bracket bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Install the rear brake pad hardware to the brake caliper mounting bracket. See **Fig. 45**.
4. Install the brake pads to the brake caliper mounting bracket. See **Fig. 44**.

WARNING: DO NOT move the vehicle until a firm brake pedal is obtained.
Failure to obtain a firm pedal before moving vehicle may result in personal injury.

5. Install the rear brake caliper assembly. See **REAR BRAKE CALIPER**. Install the tire and wheel assembly. Lower the vehicle. Pump the brake pedal slowly and firmly in order to seat the brake pads.

REAR BRAKE HOSE

Removal

1. Raise the vehicle. Remove the tire and wheel assembly. Clean the all dirt and foreign material from the brake hose and brakeline fittings.
2. Using a backup wrench, remove the rear brake hose from the brakeline. Install the rubber plug and/or cap on the rear brake pipe fitting to prevent brake fluid loss and contamination.
3. Remove the brakeline retaining bolt at the frame.
4. Remove the brake hose bolt from the brake caliper. The metal gaskets may be stuck to either the brake caliper or the brake hose end. Ensure that these gaskets are removed from the brake hose end and the brake caliper. Remove the copper gaskets from the brake hose end. Discard the copper gaskets.

Inspection

1. Ensure that the vehicle axles are properly supported at ride height in order to maintain the proper relationship of the flexible brake hoses to the chassis.
2. Visually inspect all of the flexible brake hoses for the following conditions:
 - Kinks, improper routing, twists, chafing, missing or damaged retainers.
 - Leaking connections, cracking, dry-rot, blisters and bulges.
3. If any of the flexible brake hoses exhibited any of the conditions listed, then the identified flexible brake hose, or hoses require replacement.
4. Squeeze the flexible brake hoses with firm finger pressure to check for soft spots, indicating an internal restriction. Check the entire length of each flexible brake hose.
5. If any of the flexible brake hoses were found to have soft spots, then the identified flexible brake hose, or hoses require replacement.

Installation

NOTE: DO NOT reuse the old copper gaskets. Use only NEW copper gaskets.

1. Install the NEW copper gaskets to the rear brake caliper bolt. Install the rear brake hose to the rear brake caliper. Tighten the rear brake bolt to specification. See **TORQUE SPECIFICATIONS**.
2. Remove the rubber plug and/or cap from the rear brakeline fitting. Install the brakeline to the brake hose. Using a backup wrench, install the rear brakeline to the brake hose. Tighten the rear brake pipe fitting to specification. See **TORQUE SPECIFICATIONS**.
3. Install the brake pipe retaining bolt at the frame. Tighten the brake pipe retaining bolt to specification. See **TORQUE SPECIFICATIONS**. Bleed the hydraulic brake system. See **BLEEDING PROCEDURE** under BLEEDING BRAKE SYSTEM. Install the tire and wheel assembly. Lower the vehicle.

REAR BRAKE ROTOR

Removal

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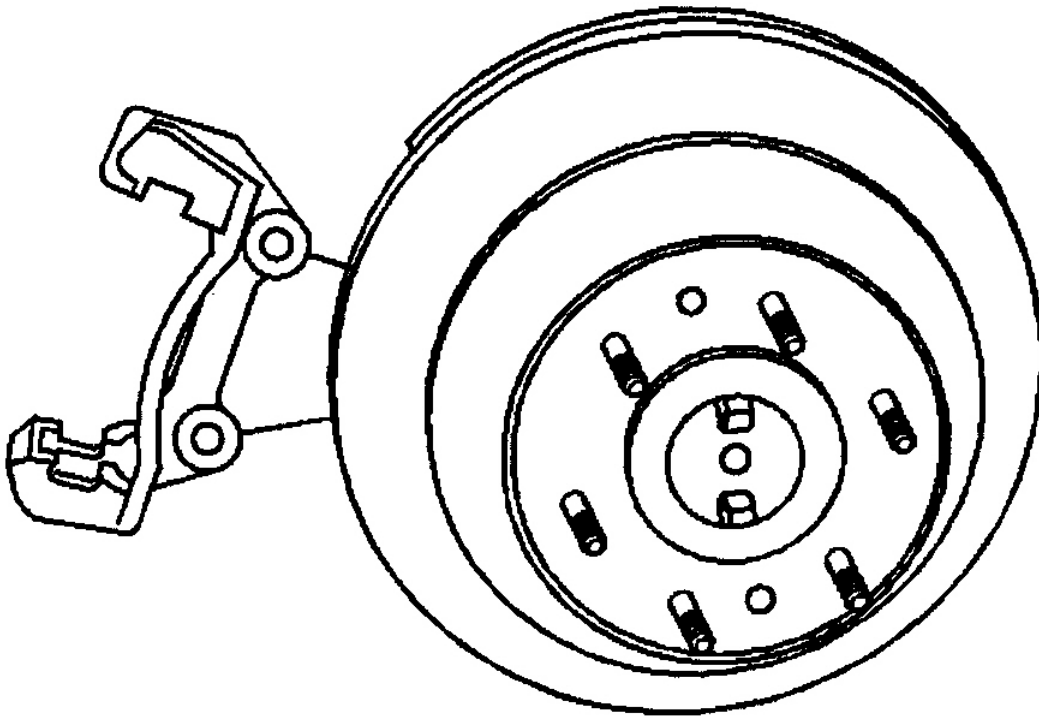
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1. Inspect the brake fluid level in the brake master cylinder reservoir. If the brake fluid is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, using a appropriate tool, remove the brake fluid to the midway point before proceeding.
2. Raise the vehicle. Remove the tire and wheel assembly.
3. Compress the front brake caliper piston.
 - A. Install a large C-clamp over the top of the brake caliper housing and against the back of the outboard brake pad. See **Fig. 4**.
 - B. Slowly tighten the C-clamp until the piston pushes into the brake caliper enough to slide the brake caliper off the rotor.
 - C. Remove the C-clamp from the brake caliper.
4. Remove the rear brake caliper mounting bracket. See **Fig. 47**.
5. Remove the brake rotor retaining clips, if equipped. See **Fig. 17**.

CAUTION: Whenever the rotor has been separated from the axle flange, clean any rust or foreign material from the mating surface of the axle flange and brake rotor. Failure to do this may result in increased lateral runout of the rotor and brake pulsation.

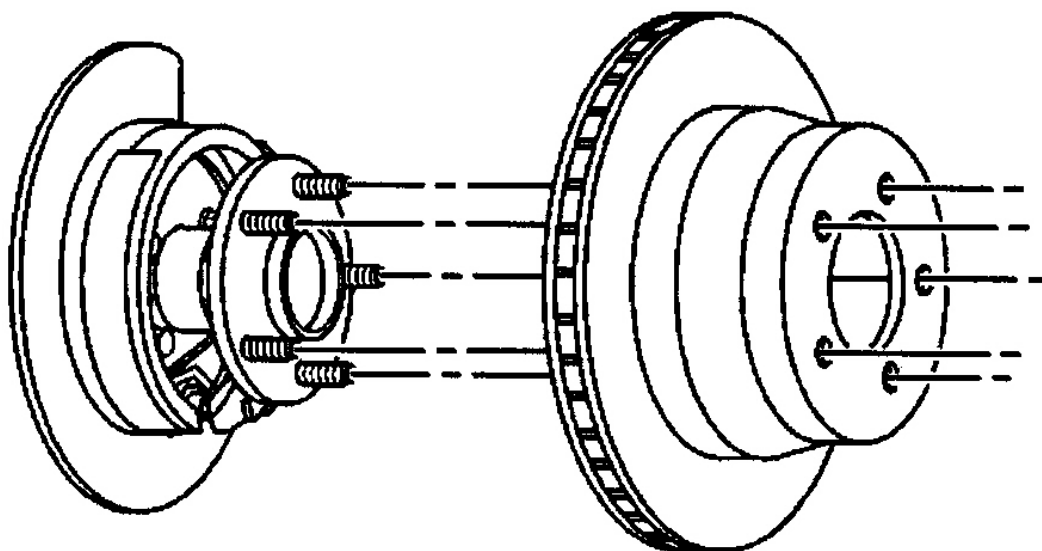
NOTE: If the brake rotor is not going to be replaced but just removed from the front hub to be refinished, mark the brake rotor left or right and relationship of the brake rotor and a wheel stud. In doing so, it will reduce the possibility of vibration in the brake system

6. Remove the brake rotor. See **Fig. 48**. Using the Wheel Hub Cleaning Kit (J-42450-A), clean the brake rotor to rear axle flange contact area. See **Fig. 49**. Refinish the rotor if necessary.



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Fig. 47: Removing Rear Brake Caliper Bracket
Courtesy of ISUZU MOTOR CO.



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Fig. 48: Removing Rear Brake Rotor
Courtesy of ISUZU MOTOR CO.

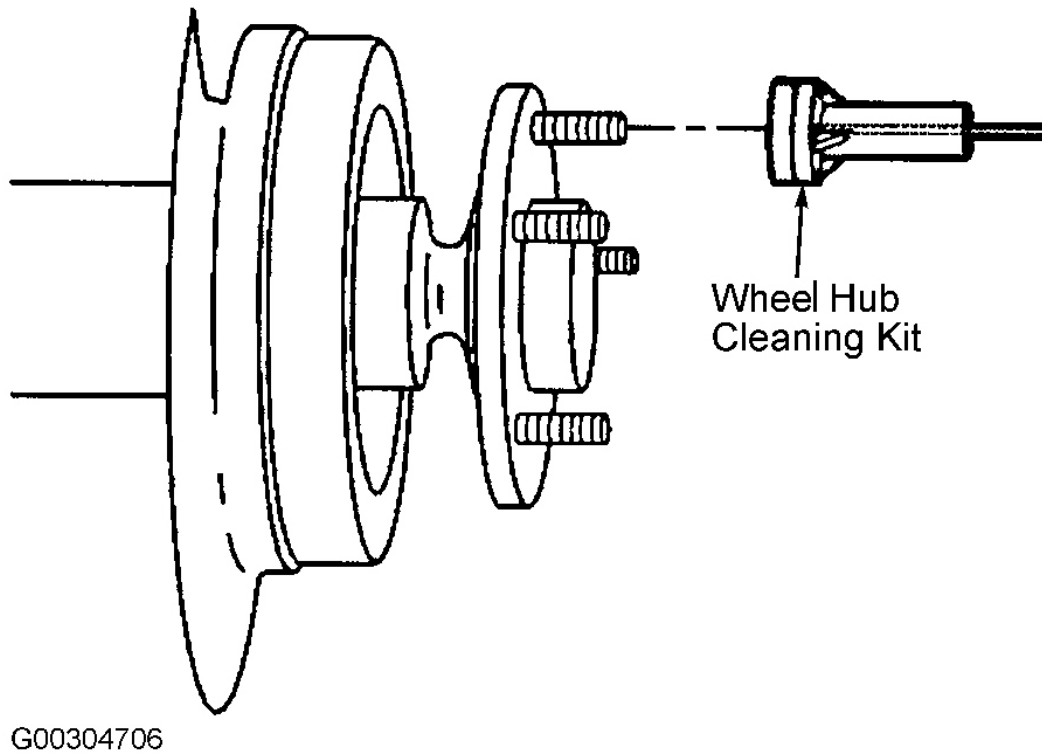


Fig. 49: Using Wheel Hub Cleaning Kit On Rear Brake Rotor
Courtesy of ISUZU MOTOR CO.

Installation

1. Clean the park brake shoes using denatured alcohol. Dry the park shoes using non-lubricated, filtered air. Lubricate the contact area between the park brake shoe and the backing plate with high temperature silicone brake lubricant. It may be necessary to readjust the park brake shoes to allow the brake rotor to be reinstalled. Adjust the park brake shoe. See **PARK BRAKE** under ADJUSTMENTS.
2. Ensure that the rotor to axle flange relationships marks are aligned, if the brake rotor has been refinished, after the brake rotor is installed. Install the brake rotor by slowly turning the rotor while pushing the rotor on the axle flange. See **Fig. 48**.
3. Install the rear brake caliper mounting bracket. See **REAR BRAKE CALIPER BRACKET**. Install the tire and wheel assembly. Tighten wheel lug nuts to specification. See **TORQUE SPECIFICATIONS**. Lower the vehicle.

WARNING: DO NOT move the vehicle until a firm brake pedal is obtained.
Failure to obtain a Firm pedal before moving vehicle may result in personal injury.

4. Refill the brake master cylinder reservoir, if needed. Pump the brake pedal slowly and firmly in order to

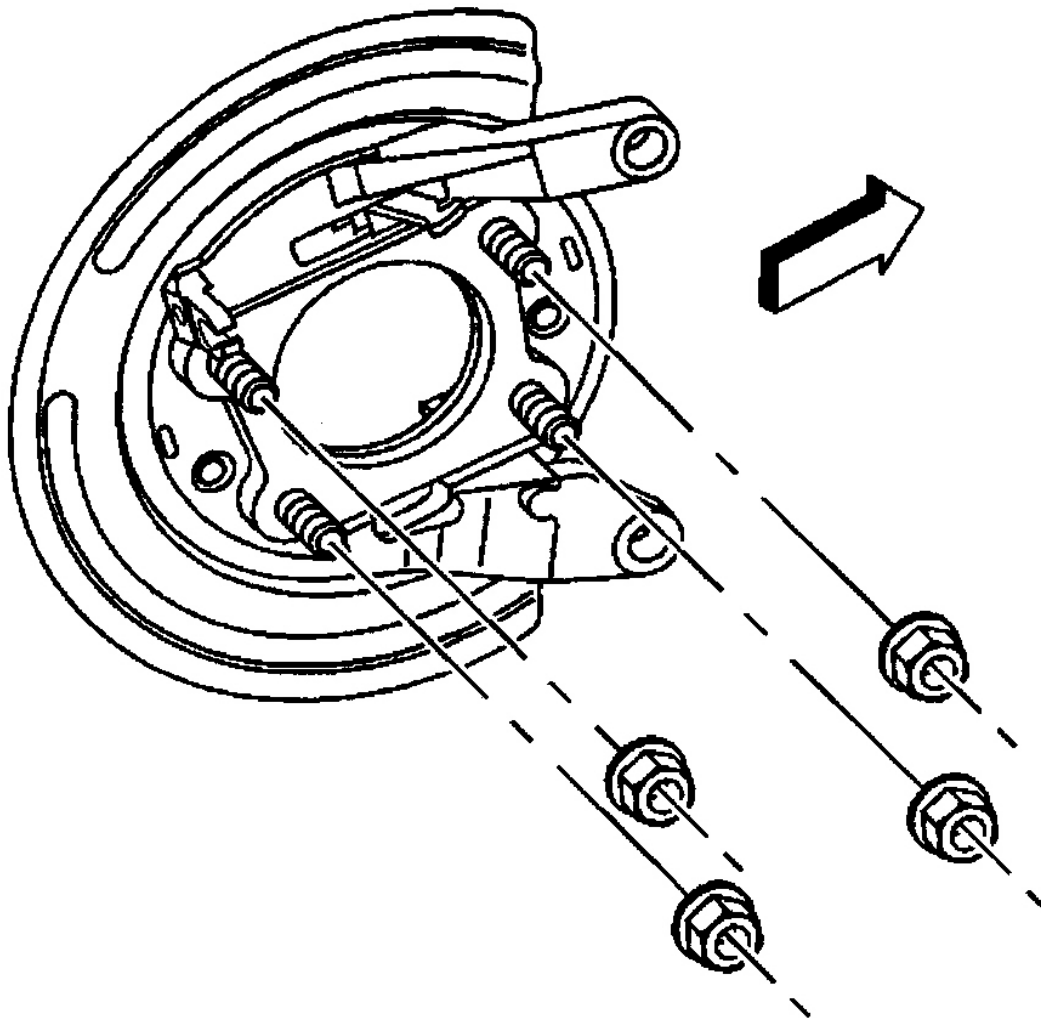
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seat the brake pads. Burnish the replaced or refinished rotors approximately 20 times at 30 MPH.

REAR DISC BRAKE BACKING PLATE

Removal

1. Raise the vehicle. Remove the tire and wheel assembly. Remove the park brake cable from the rear brake caliper. See **PARK BRAKE CABLE**.
2. Remove the brake caliper and bracket assembly. See **REAR BRAKE CALIPER BRACKET**.
3. Remove the rear brake rotor. See **REAR BRAKE ROTOR**. Remove the park brake shoe. See **PARK BRAKE SHOE**.
4. Remove the rear drive axle. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES.
5. Remove the retaining nuts from the backing plate. See **Fig. 50**. Remove the backing plate from the rear axle housing.



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Fig. 50: Removing Rear Backing Plate
Courtesy of ISUZU MOTOR CO.

Installation

1. Install the backing plate to the axle housing flange. See **Fig. 50**. Install the backing plate nuts. Tighten the backing plate nuts to specification. See **TORQUE SPECIFICATIONS**.
2. Install the rear drive axle. See appropriate AXLE SHAFTS article in DRIVELINES/AXLES.
3. Install the park brake shoe. See **PARK BRAKE SHOE**. Install the rear brake rotor. See **REAR BRAKE ROTOR**.
4. Install the brake caliper and bracket assembly. See **REAR BRAKE CALIPER BRACKET**.
5. Install the park brake cable from the rear brake caliper. See **PARK BRAKE CABLE**.

6. Adjust the park brake shoe. See **PARK BRAKE** under ADJUSTMENTS.
7. Install the tire and wheel assembly. Tighten wheel lug nuts to specification. See **TORQUE SPECIFICATIONS**. Lower the vehicle.

REAR DISC BRAKE HARDWARE

Removal

1. Raise the vehicle. Remove the tire and wheel assembly. Remove and inspect the brake caliper assembly. See **REAR BRAKE CALIPER**.
2. Remove the brake pad retaining clip from the brake caliper. See **Fig. 51**. Remove the brake pads from the brake caliper mounting bracket. See **Fig. 44**.
3. Remove the brake caliper mounting bracket. See **Fig. 46**. Remove the brake pad retaining clips from the brake caliper mounting bracket. See **Fig. 45**.
4. Remove the brake caliper guide pins from the brake caliper mounting bracket. Remove the guide pin bushing from the brake caliper mounting bracket. See **Fig. 15**.
5. Clean the brake caliper mounting bracket with denatured alcohol. Dry the brake caliper mounting bracket using non-lubricated, filtered air.

Inspection

1. Remove the disc brake caliper from the caliper mounting bracket. See **REAR BRAKE CALIPER**.
2. Remove the disc brake pads from the caliper mounting bracket.
3. Inspect the disc brake pad mounting hardware for the following:
 - Missing mounting hardware.
 - Excessive corrosion.
 - Bent mounting tabs.
 - Looseness at the caliper mounting bracket.
 - Looseness at the disc brake pads.

If any of the conditions listed are found, the disc brake pad mounting hardware requires replacement.

4. Ensure the disc brake pads are held firmly in place on the caliper mounting bracket, yet slide easily on the mounting hardware without binding.
5. Inspect the caliper bolts for the following:
 - Binding.
 - Seizing.
 - Looseness in the caliper mounting bracket.
 - Bent or damaged caliper bolts.
 - Cracked or torn boots.
 - Missing boots.
 - Bent or damaged caliper mounting bracket.

If any of the conditions listed are found, the caliper mounting hardware requires replacement.

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6. Install the disc brake pads to the caliper mounting bracket. Install the disc brake caliper to the mounting bracket. See **REAR BRAKE CALIPER**.

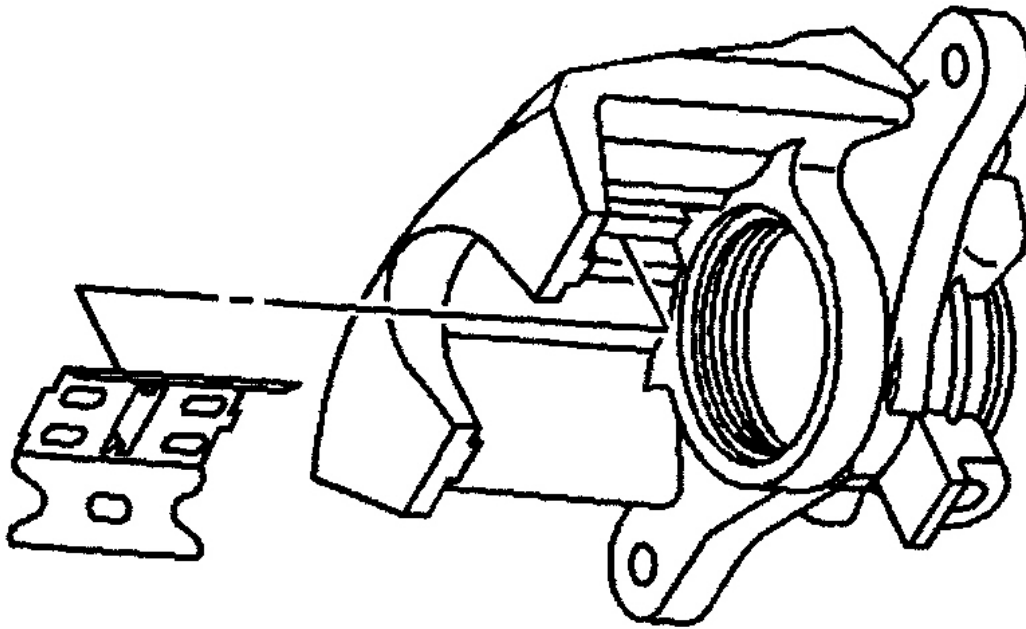
Installation

1. Install the guide pin bushing in the brake caliper mounting bracket. **Fig. 15**. Install the brake caliper guide pins.
2. Apply high temperature silicone brake lubricant to the brake caliper guide pins. DO NOT apply to the brake caliper hardware or the retaining clips.
3. Install the brake caliper mounting bracket. See **Fig. 46**. Install the brake caliper mounting bolts. Tighten the disc brake caliper mounting bracket bolts to specification. See **TORQUE SPECIFICATIONS**.
4. Install the brake pad retaining clips on the brake caliper mounting bracket. See **Fig. 45**. Install the brake pads to the brake caliper mounting bracket. See **Fig. 44**.
5. Install the brake pad retaining clip to the brake caliper. See **Fig. 51**. Install the brake caliper assembly. See **REAR BRAKE CALIPER**.
6. Install the tire and wheel assembly. Lower the vehicle. DO NOT move the vehicle until a firm brake pedal is obtained. Failure to obtain a firm pedal before moving vehicle may result in personal injury. Pump the brake pedal slowly and firmly in order to seat the brake pads.

REAR DISC BRAKE PADS

Removal

1. Inspect the brake fluid level in the brake master cylinder reservoir. If the brake fluid is midway between the maximum-full point and the minimum allowable level, no brake fluid needs to be removed from the reservoir before proceeding. If the brake fluid level is higher than midway between the maximum-full point and the minimum allowable level, remove the brake fluid with appropriate tool to the midway point before proceeding.
2. Raise the vehicle. Remove the tire and wheel assembly.
3. Compress the front brake caliper piston.
 - A. Install a large C-clamp over the top of the brake caliper housing and against the back of the outboard brake pad. See **Fig. 4**.
 - B. Slowly tighten the C-clamp until the piston pushes into the brake caliper enough to slide the brake caliper off the rotor.
 - C. Remove the C-clamp from the brake caliper.
4. Remove the upper brake caliper mounting bolt. Rotate the rear brake caliper downward until it stops.
5. Remove the rear brake pads. See **Fig. 44**. Remove the brake pad retaining clips from the brake caliper mounting bracket. See **Fig. 45**.
6. Remove the retaining clip from the brake caliper. See **Fig. 51**. Clean the brake caliper mounting bracket with denatured alcohol. Using non-lubricated, filtered air, dry the brake caliper mounting bracket.



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Fig. 51: Removing Retaining Clip From Rear Brake Caliper
Courtesy of ISUZU MOTOR CO.

Inspection

NOTE: **Inspect the disc brake pads at regular intervals, or whenever the tire and wheel assemblies are removed from the vehicle. If replacement is necessary, always replace disc brake pads in axle sets.**

- Inspect both edges of the disc brake pad friction surfaces. The highest rate of wear normally occurs at the trailing edge of the disc brake pads.
- Inspect the thickness of the disc brake pads in order to ensure that they have not worn prematurely. The disc brake pad wear should be approximately even per axle set.
- Replace the disc brake pads when the friction surface is worn to within 0.030" (0.76 mm) of the mounting plates.
- Remove the brake calipers and inspect the friction surfaces of the inner and outer disc brake pads to ensure that they are level. Place the disc brake pad friction surfaces together and measure the gap between the surfaces. If more than 0.005" (0.13 mm) gap exists midway between the length of the disc brake pads, replace the disc brake pads.
- Verify that any disc brake pad shims that may be required are in place and not damaged or excessively corroded. Replace any missing or damaged shims in order to preserve proper disc brake performance.

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- Replace the disc brake pads if any have separated from the mounting plates. Inspect the disc brake pads friction surfaces for cracks, fractures, or damage which may cause noise or otherwise impair disc brake performance.

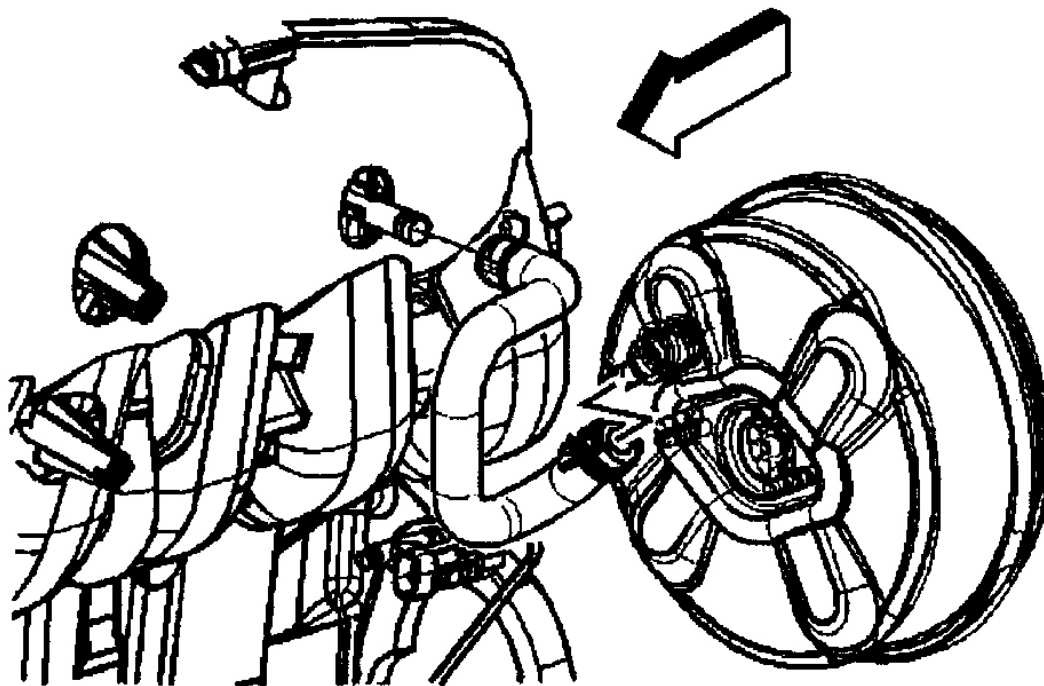
Installation

1. When installing NEW brake pads, DO NOT reuse the old retaining clips for the brake pad. Use only NEW brake pad retaining clips. Install the brake pad retaining clips on the brake caliper mounting bracket. See **Fig. 45**.
2. Install the brake pads to the brake caliper mounting bracket. See **Fig. 44**. Ensure that the retaining clip for the brake pads is properly seated in the brake caliper. Install the retaining clip from the brake caliper. See **Fig. 51**.
3. Rotate the rear brake caliper upward until the brake caliper assembly is in the proper position.
4. Install the upper brake caliper mounting bolt. Tighten the brake caliper bolt to specification. See **TORQUE SPECIFICATIONS**. Install the tire and wheel assembly. Lower the vehicle.
5. Fill the brake master cylinder reservoir (if needed). Pump the brake pedal slowly and firmly in order to seat the brake pads. Burnish the NEW brake pads approximately 20 times at 30 MPH.

VACUUM BRAKE BOOSTER

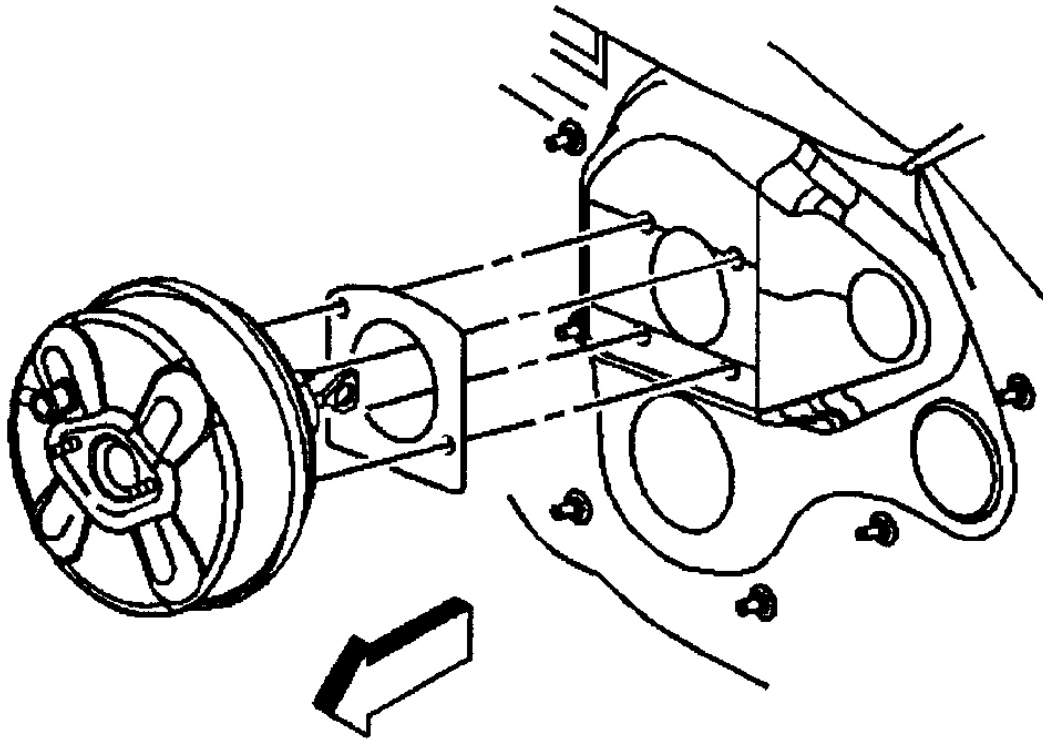
Removal

1. Apply the parking brake. Remove the master cylinder. See **MASTER CYLINDER**.
2. Disconnect the vacuum hose from the vacuum booster and from the engine. See **Fig. 52**.
3. Remove the left closeout/insulator panel.
 - A. Remove the 2 screws that retain the insulator panel to the instrument panel (I/P). Release the insulator panel retaining clip from the I/P substrate. Lower the insulator panel. See **Fig. 5**.
 - B. Remove the 2 data link connector (DLC) retaining screws. Remove the DLC from the insulator panel.
 - C. Remove the splice pack from the insulator panel. Remove the hazard and turn signal flasher from the insulator panel. Remove the insulator panel from the I/P. See **Fig. 6**.
4. Remove the pushrod retainer from the brake pedal pin. Remove the stop lamp switch and the pushrod from the brake pedal pin. See **Fig. 7**.
5. Remove the vacuum booster mounting nuts. Remove the vacuum booster assembly and gasket. See **Fig. 53**.



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Fig. 52: Removing Vacuum Booster Hose
Courtesy of ISUZU MOTOR CO.



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Fig. 53: Removing Vacuum Booster
Courtesy of ISUZU MOTOR CO.

Installation

1. Install the gasket and the vacuum booster assembly. See **Fig. 53**. Install the vacuum booster mounting nuts on the vacuum booster. Tighten the vacuum booster mounting nuts to specification. See **TORQUE SPECIFICATIONS**.
2. Position the stoplight switch on the pushrod and install on the brake pedal pin. See **Fig. 7**. Install the pushrod retainer to the brake pedal pin. The retainer will snap into place.
3. Install the left closeout/insulator panel.
 - A. Position the insulator panel to the instrument panel (I/P). Install the hazard and turn signal flasher to the insulator panel. Install the splice pack to the insulator panel. See **Fig. 6**.
 - B. Position the DLC to the insulator panel. Install the DLC retaining screws. Tighten the DLC retaining screws to 22 INCH lbs. (2.5 N.m).
 - C. Install the insulator panel tabs to the cowl slots. Raise the insulator panel to the I/P.
 - D. Install the insulator panel retaining clip to the I/P substrate. Install the 2 screws that retain the insulator panel to the I/P. See **Fig. 5**. Tighten the screws to 22 INCH lbs. (2.5 N.m).
4. Install the vacuum hose to the vacuum booster and to the engine. See **Fig. 52**. Install the master cylinder.

See MASTER CYLINDER.

VACUUM BRAKE BOOSTER CHECK VALVE &/OR HOSE

Removal & Installation

1. Remove the vacuum brake booster check valve from the vacuum brake booster. Remove the vacuum brake booster hose clamp at the check valve. Remove the vacuum brake booster check valve from the hose.
2. Disconnect the vacuum brake booster hose at the engine. See **Fig. 52**. Remove the vacuum brake booster hose from the vehicle.
3. For installation, reverse removal procedure.

OVERHAUL

WARNING: Brake fluid may irritate eyes and skin.

CAUTION: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, use a clean shop cloth to wipe away the fluid.

NOTE: For brake specifications, see BRAKES in SPECIFICATIONS - ASCENDER article.

FRONT BRAKE CALIPER

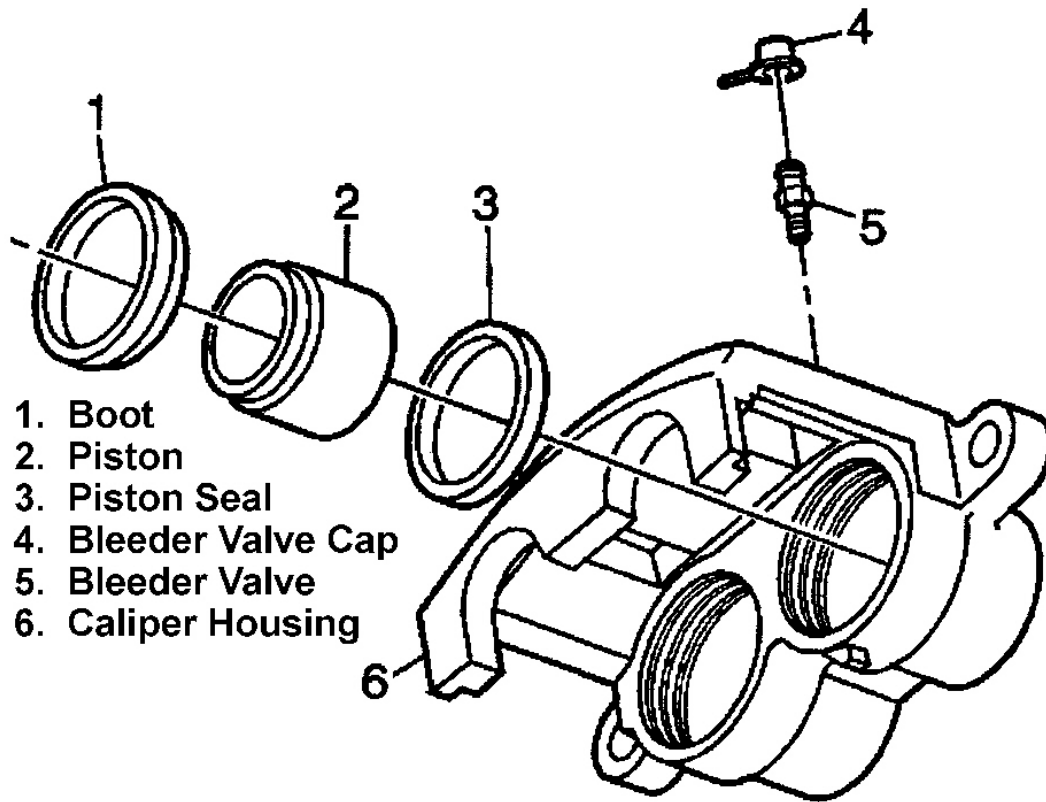
Disassembly

WARNING: DO NOT place your fingers in front of the piston in order to catch or protect the piston while applying compressed air. This could result in serious injury.

CAUTION: Use just enough air pressure to ease the piston out of the bore. You can damage a blown-out piston even with the padding.

Drain all the brake fluid from the caliper. Pad the interior of the caliper with clean shop towels. Disassemble caliper components. See **Fig. 54**.

NOTE: During reassembly, ensure that the seals are not twisted in the caliper bore grooves.



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Fig. 54: Exploded View Of Front Brake Caliper
Courtesy of ISUZU MOTOR CO.

Reassembly

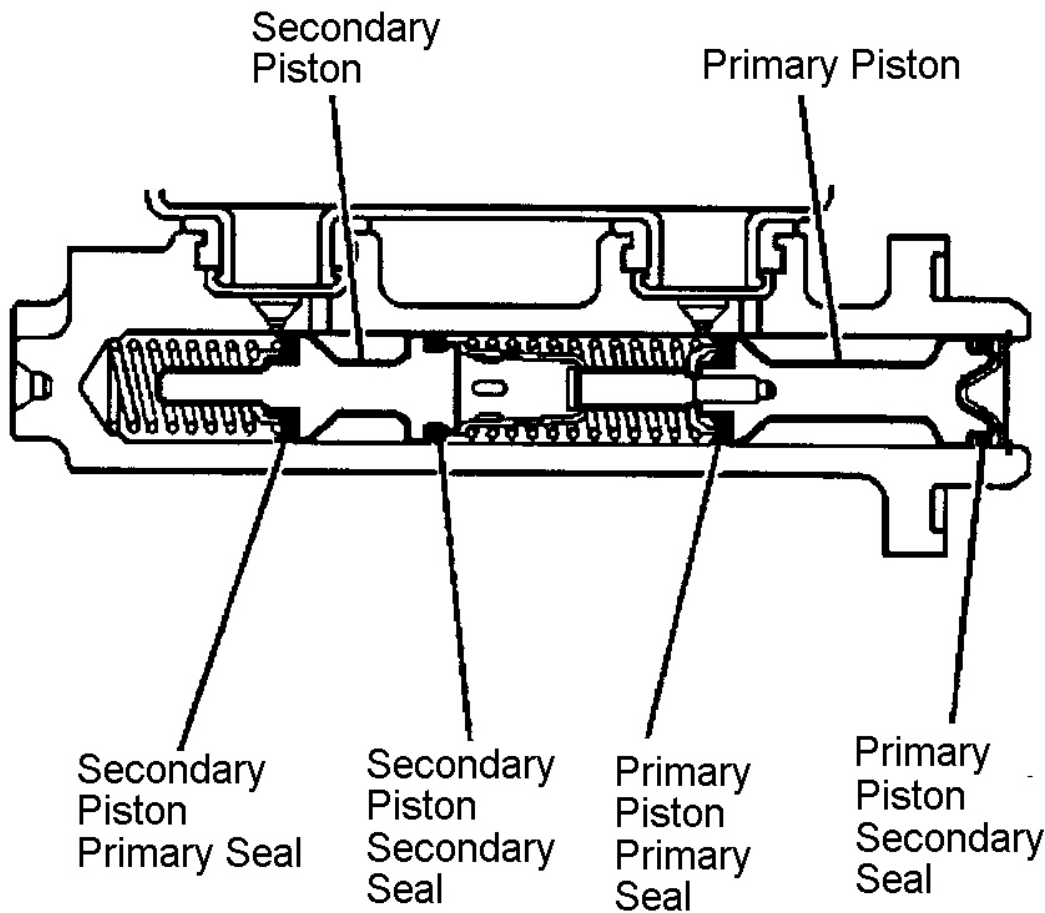
Lubricate NEW piston seals, caliper bores and pistons using clean brake fluid. When installing boot seals, use driver handle (J-8092) and boot seal installer (J-43885). Reassemble caliper components. See **Fig. 54**. See **TORQUE SPECIFICATIONS**.

MASTER CYLINDER

Disassembly

1. Remove the brake master cylinder from the vehicle. See **MASTER CYLINDER** under REMOVAL & INSTALLATION.
2. Secure the mounting flange of the brake master cylinder in a bench vise so that the rear of the primary piston is accessible. See **Fig. 55**.
3. Clean the outside of the master cylinder reservoir on and around the reservoir cap prior to removing the cap and diaphragm. Remove the reservoir cap and diaphragm from the reservoir.

4. Inspect the reservoir cap and diaphragm for cuts or cracks and nicks or deformation. If any of these conditions are present, replace the affected components.
5. Remove the master cylinder reservoir from the master cylinder. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION.
6. Using a smooth, round-ended tool, depress the primary piston and remove the piston retainer. Remove the primary piston assembly from the cylinder bore.
7. Plug the cylinder inlet ports and the rear outlet port. Apply low pressure, non-lubricated, filtered air into the front outlet port, in order to remove the secondary piston with the primary and secondary seals, and the return spring.
8. Discard the primary piston assembly, the piston retainer, and the seals and seal retainer from the secondary piston.



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Fig. 55: Disassembling Master Cylinder
Courtesy of ISUZU MOTOR CO.

Reassembly

CAUTION: DO NOT use abrasives to clean the brake master cylinder bore.

1. Clean the interior and exterior of the master cylinder, the secondary piston, and the return spring in denatured alcohol, or equivalent. See **Fig. 55**.
2. Inspect the master cylinder bore, inlet and outlet ports, the secondary piston, and the return spring for cracks, scoring, pitting, and/or corrosion. Replace the master cylinder if any of these conditions exist.
3. Dry the master cylinder and the individual components with non-lubricated, filtered air.
4. Lubricate the master cylinder bore, the secondary piston, the return spring, and all of the individual overhaul components with Delco Supreme 11(R), P/N 12377967, P/N 992667 or equivalent DOT-3 brake fluid from a clean, sealed brake fluid container.
5. Assemble the lubricated, NEW primary seal and retainer, and NEW secondary seal onto the secondary piston.
6. Install the lubricated return spring and secondary piston assembly into the cylinder bore. Install the lubricated, NEW primary piston assembly into the cylinder bore.
7. Using a smooth, round-ended tool, depress the primary piston and install the NEW piston retainer.
8. Install the master cylinder reservoir to the master cylinder. See **MASTER CYLINDER RESERVOIR** under REMOVAL & INSTALLATION. Install the reservoir cap and diaphragm to the reservoir.
9. Install the master cylinder to the vehicle. See **MASTER CYLINDER** under REMOVAL & INSTALLATION.

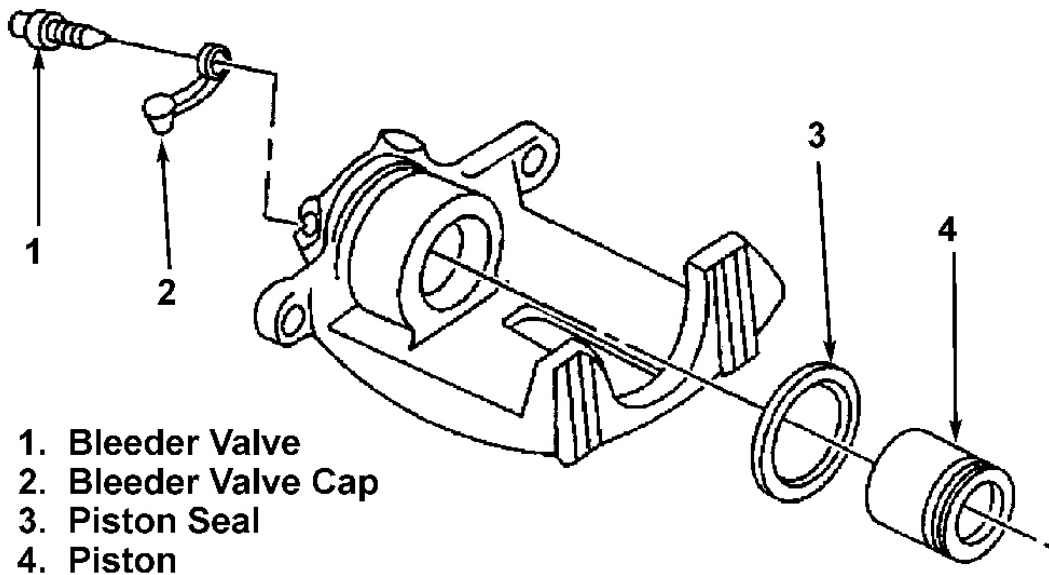
REAR BRAKE CALIPER

WARNING: DO NOT place your fingers in front of the piston in order to catch or protect the piston while applying compressed air. This could result in serious injury.

CAUTION: Use just enough air pressure to ease the piston out of the bore. You can damage a blown-out piston even with the padding.

Disassembly

Drain all the brake fluid from the caliper. Pad the interior of the caliper with clean shop towels. Disassemble caliper components. See **Fig. 56**.



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Fig. 56: Exploded View Of Rear Brake Caliper
Courtesy of ISUZU MOTOR CO.

Reassembly

NOTE: During reassembly, ensure that the seals are not twisted in the caliper bore grooves.

Lubricate NEW piston seal, caliper bore, and piston with clean brake fluid. Reassemble caliper components. See **Fig. 56**. See **TORQUE SPECIFICATIONS**.

SPECIFICATIONS

NOTE: For DISC BRAKE SPECIFICATIONS, see **DISC BRAKE SPECIFICATIONS** in SPECIFICATIONS - ASCENDER article.

TORQUE SPECIFICATIONS

NOTE: For TORQUE SPECIFICATIONS, see **TORQUE SPECIFICATIONS** in SPECIFICATIONS - ASCENDER article.