

BRAKES

12

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BASE BRAKES

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GENERAL INFORMATION

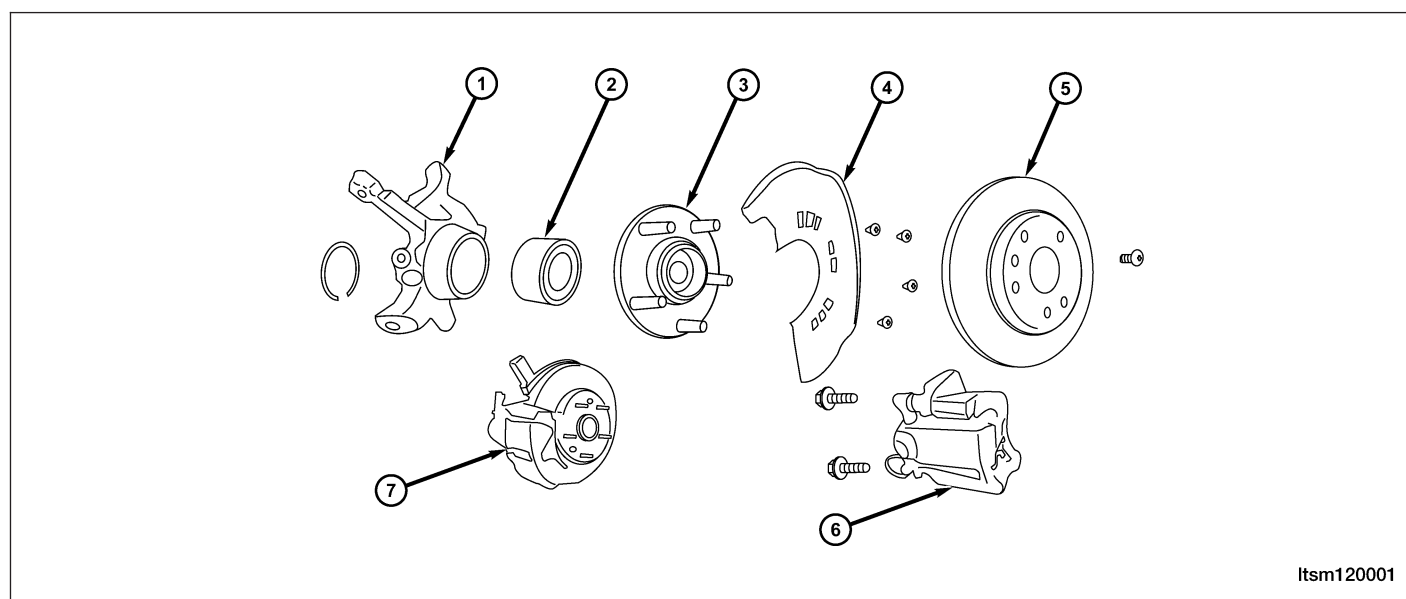
Description

Base Brakes

The base brake system consists of the following components:

- Brake pedal
- Power brake booster
- Master cylinder
- Brake tubes and hoses
- Disc brakes (front)
- Disc brakes (rear)
- Parking brake
- Parking brake shoes (rear)

Front Disc Brake



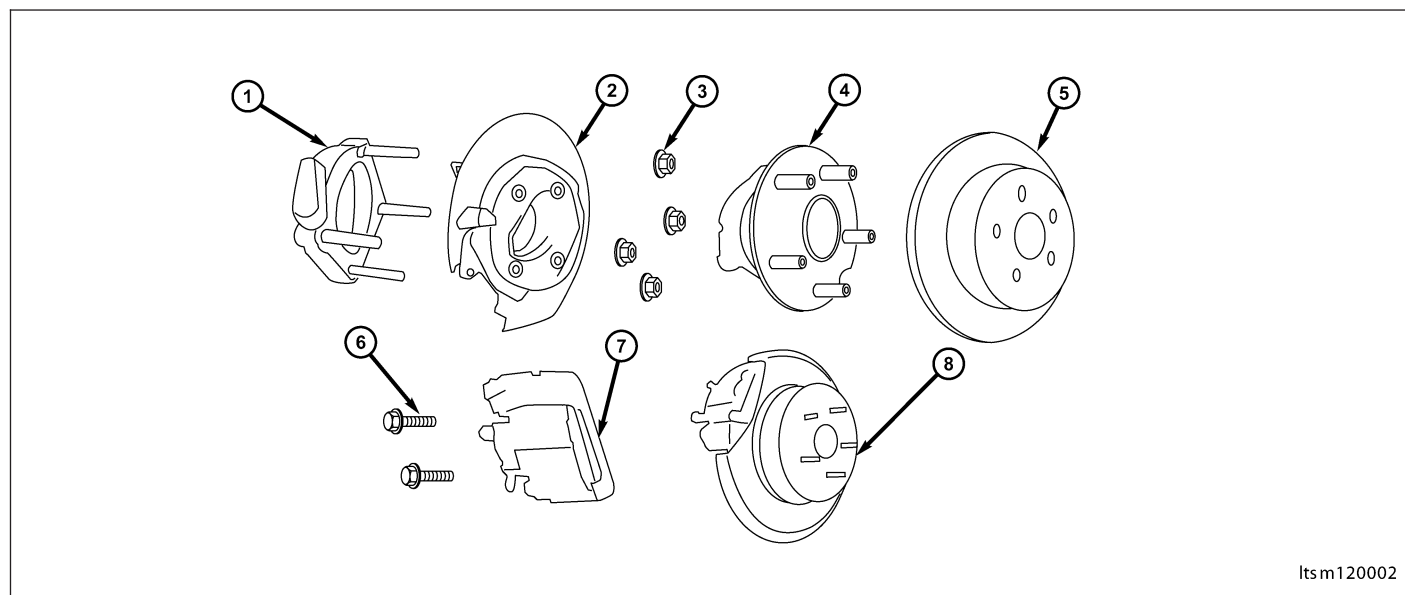
1 - Front Wheel Knuckle
2 - Knuckle Hub Bearing
3 - Front Wheel Hub Assembly
4 - Dust Board

5 - Front Brake Rotor
6 - Brake Caliper Assembly
7 - Disc Brake Assembly Of Front Knuckle

The front disc brake assembly consists of the following major components:

- Caliper
- Caliper adapter bracket
- Brake pads
- Rotor

Rear Disc Brake



Its m120002

1 - Joint Plate Assembly
2 - Rear Brake Assembly
3 - Lock Nut
4 - Rear Wheel Hub Bearing Unit

5 - Rear Brake Rotor
6 - Fixing Bolt
7 - Brake Caliper Assembly
8 - Disc Brake With Drum Brake Assembly

The rear disc brake assembly consists of the following major components:

- Caliper
- Caliper adapter bracket
- Brake pads
- Rotor
- Parking brake shoes

CAUTION:

- **Use DOT 4 brake fluid or equivalent from a tightly sealed container. Do not use petroleum-based fluids, which will cause seal damage in the brake system.**
- **Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash it off immediately with water.**
- **Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean system components. These fluids damage rubber cups and seals.**
- **During service procedures, grease or any other foreign material must be kept off the caliper assembly, brake pads, brake rotor and external surfaces of the hub.**
- **When handling the brake rotor and caliper, be careful to avoid damaging the brake rotor and caliper, and scratching or nicking the brake shoe lining.**

Operation

Applying the brake pedal uses lever action to push a rod into the brake booster, which through the use of vacuum, boosts the force of the rod and then transmits this force into the master cylinder. This produces hydraulic pressure in the master cylinder. On vehicles not equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the individual brake calipers or wheel cylinders. On vehicles equipped with ABS, the hydraulic pressure is transmitted by brake fluid through the brake tubes to the ABS hydraulic control unit (HCU), which then distributes that pressure to the individual brake calipers and wheel cylinders. The brake calipers use hydraulic pressure to apply the brake pads. The application of the brake pads or shoes will cause the rotation of the wheels to slow or stop depending on how much brake pressure is applied. The parking brakes carry out the same function except that they are mechanically actuated by a cable that connects only to the rear brakes.

GENERAL INFORMATION

Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
Dust Shield Bolts	6.5 - 8.5
Locating Screws (Brake Rotor)	6 - 12
Brake Flex Hose Fitting - Front Caliper	19
Brake Flex Hose Banjo Bolt - Rear Caliper	20
Brake Pedal/Booster Mounting Nuts	25
Brake Tube Nuts	10
Disc Brake Caliper Adapter Bracket (To Knuckle) - Front	63
Disc Brake Caliper Adapter Bracket (To Support) - Rear	63
Disc Brake Caliper Guide Pin Bolts - Front	31 - 38
Disc Brake Caliper Guide Pin Bolts - Rear	23
Disc Brake Caliper Bleeder Screw	9 - 11
Fluid Reservoir Mounting Screw	11
Master Cylinder Mounting Nuts	23
Parking Brake Lever Mounting Nuts	6 - 12
Rear Brake Backing Plate Bolts	20
Wheel Mounting Nuts	110

Rotor Specifications

BRAKE ROTOR	ROTOR THICKNESS	MINIMUM ROTOR THICKNESS	ROTOR DIAMETER	ROTOR RUNOUT
Front Rotor	25 mm	23 mm	265 mm	0.1 mm
Rear Rotor	9 mm	7 mm	303 mm	0.1 mm

Brake Pad/Lining Specifications

Front Brake

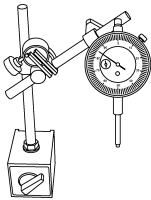
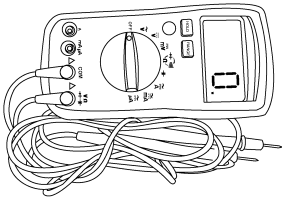
APPLICATION	SPECIFICATION (mm)
Brake Caliper Piston Diameter	57
Brake Rotor Diameter	265
Brake Rotor Thickness (New)	25
Min. Thickness Of Brake Rotor	23
Maximum Rotor Runout	0.1
Front Brake Pad Thickness (New)	17.8
Min. Thickness Of Front Brake Pad	7

GENERAL INFORMATION

Rear Brake

APPLICATION	SPECIFICATION (mm)
Brake Rotor Diameter	303
Brake Rotor Thickness (New)	9
Min. Thickness Of Brake Rotor	7
Rear Brake Pad Thickness (New)	15
Min. Thickness Of Rear Brake Pad	7
Thickness Of Parking Brake Lining	2.5
Min. Thickness Of Parking Brake Lining	1.5

Special Tools

Dial Indicator	 besm120026
Digital Multimeter Fluke 15B & 17B	 besm030002

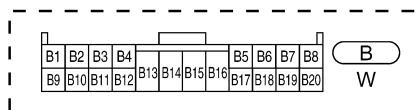
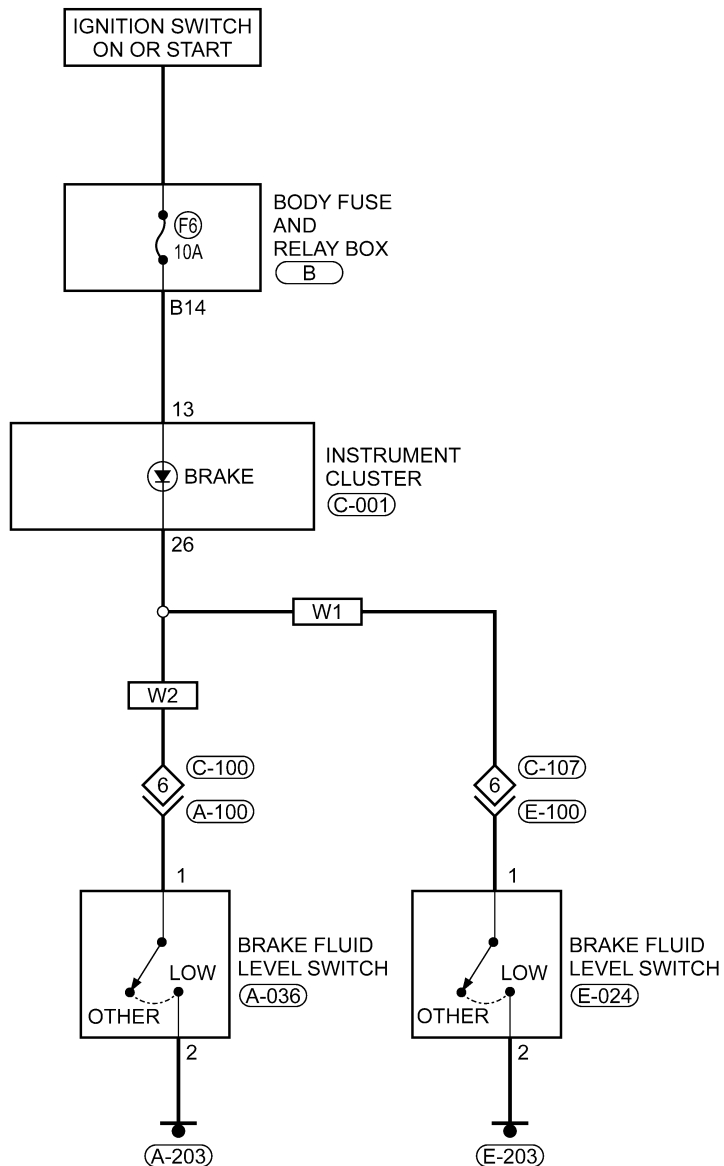
Electrical Schematics

Brake System (Page 1 of 1)

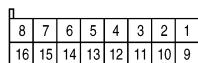
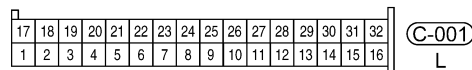
BASE BRAKE SYSTEM

W1 : WITH 1.6L - 1.8L ENGINE SYSTEM

W2 : WITH 2.0L - 2.4L ENGINE SYSTEM



BODY FUSE
AND
RELAY BOX



A-100, E-100
W W



A-036, E-024
B B

DIAGNOSIS & TESTING

Diagnostic Help

Brake diagnosis involves determining if the concern is related to a mechanical, hydraulic, electrical or vacuum operated component.

NOTE :

The brake reservoir fluid level will decrease in proportion to normal lining wear.

NOTE :

Brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.

Preliminary Brake Check:

- Check the condition of the tires and wheels. Damaged wheels and worn, damaged or under inflated tires can cause a pull, shudder, vibration and a condition similar to brake grab.
- If a complaint was based on noise while braking, check the suspension components. Jounce the front and the rear of vehicle and listen for anything that might be caused by a loose, worn or damaged suspension or steering component.
- Inspect the brake fluid level and condition.
 1. If the fluid level is abnormally low, look for any evidence of leaks at the calipers, brake lines, master cylinder and at the Antilock Brake System (ABS) Hydraulic Control Unit (HCU).
 2. If the fluid appears to be contaminated, drain a sample to examine.
- The system will have to be flushed if the fluid is separated into layers, or contains a substance other than brake fluid. The system seals, cups, hoses, master cylinder and HCU will also have to be replaced after flushing. Use clean brake fluid to flush the system.
- Check the parking brake operation. Verify free movement and full release of the cables and the lever. Also note if the vehicle was being operated with the parking brake partially applied.
- Check the brake pedal operation. Verify that the pedal does not bind and has adequate free play. If the pedal lacks free play, check the pedal and the power booster for looseness or for a binding condition. DO NOT road test the vehicle until the condition is located and corrected.
- Check the vacuum booster check valve and vacuum supply hose.
- If the preliminary checks appear to be OK, road test the vehicle.

Brake Noise

CONDITION	POSSIBLE CAUSES	CORRECTION
Disc Brake Chirp	• Excessive brake rotor runout. • Small particles	• Diagnose and correct as necessary.
Disc Brake Rattle Or Clunk	• Broken or missing spring clips. • Caliper guide pin bolts loose. • Missing abutment shims. • Small metal particles	• Replace brake pads. • Tighten guide pin bolts. • Replace missing abutment shims.
Disc Brake Squeak At Low Speed (While Applying Light Brake Pedal Effort)	• Brake shoe linings.	• Replace brake pads.
Scraping Or Whirring	• ABS wheel speed sensor hitting tone wheel.	• Inspect, correct or replace faulty component(s).

DIAGNOSIS & TESTING

Braking Concerns

CONDITION	POSSIBLE CAUSES	CORRECTION
Excessive Pedal Effort	- Obstruction of brake pedal. - Low power brake booster assist. - Glazed brake pads. - Brake pad lining transfer to brake rotor.	- Inspect, remove or move obstruction. - Refer to Power Brake Booster in this section. - Resurface or replace brake rotors as necessary. Replace brake pads. - Resurface or replace brake rotors as necessary. Replace brake pads.
Excessive Pedal Effort (Hard Pedal Unable To Lock-Up Wheels)	Power brake booster runout (vacuum assist).	Check booster vacuum hose and engine tune for adequate vacuum supply.
Excessive Pedal Travel (Vehicle Stops OK)	Air in brake lines.	Bleed brakes.
Pedal Pulsates/Surges During Braking	Disc brake rotor has excessive thickness variation.	Isolate condition as rear or front. Resurface or replace brake rotors as necessary.
Pedal Is Spongy	Air in brake lines.	Bleed brakes.
Vehicle Pulls To Right Or Left On Braking	- Frozen brake caliper piston. - Contaminated brake pad/shoe lining (most likely front lining). - Pinched brake lines. - Leaking piston seal. - Suspension problem.	- Replace frozen piston or caliper. Bleed brakes. - Inspect and clean, or replace pads/shoes. Repair source of contamination. - Replace pinched line. - Replace piston seal or brake caliper. - See the Suspension section.
Parking Brake - Excessive Handle Travel	Rear brakes out of adjustment.	Adjust rear parking brake shoes on vehicles with rear disc brakes.

ON-VEHICLE SERVICE

Brake Bleeding

Brake Bleeding Information

WARNING!

When bleeding the brake system, wear safety glasses. A clear bleed tube must be attached to the bleeder screws and submerged in a clear container filled partially with clean brake fluid. Direct the flow of brake fluid away from yourself and the painted surfaces of the vehicle. Brake fluid at high pressure may come out of the bleeder screws when opened.

CAUTION:

Before removing the master cylinder cap, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder reservoir. Use brake fluid or an equivalent from a fresh, tightly sealed container. Brake fluid must conform to DOT 4 specifications.

NOTE :

During the brake bleeding procedure, be sure the brake fluid level remains close to the "MAX" level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add brake fluid as required.

NOTE :

Do not pump the brake pedal at any time while having a bleeder screw open during the bleeding process. This will only increase the amount of air in the system and make additional bleeding necessary. Do not allow the master cylinder reservoir to run out of brake fluid while bleeding the system. An empty reservoir will allow additional air into the brake system. Check the fluid level frequently and add fluid as needed. The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

Brake Bleeding Procedure

The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system:

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

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Manual Brake Bleeding

NOTE :

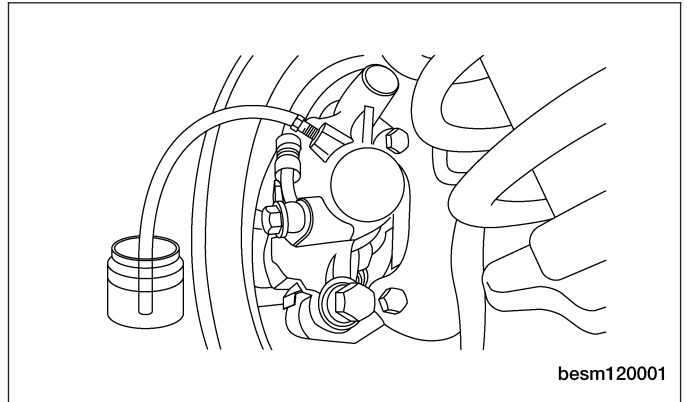
To bleed the brakes manually, the aid of a helper will be required.

Fill the brake master cylinder reservoir to the proper level with brake fluid.

NOTE :

Never allow the brake master cylinder to empty of brake fluid while bleeding the brake system.

Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose.



1. Turn the ignition switch off.
2. Have a helper pump the brake pedal three or four times and hold it in the down position.
3. With the pedal in the down position, open the bleeder screw at least one full turn.
4. Once the brake pedal has dropped, close the bleeder screw. After the bleeder screw is closed, release the brake pedal.
5. Repeat the above steps until all trapped air is removed from that wheel circuit (usually four or five times).
6. Bleed the remaining wheel circuits in the same manner until all air is removed from the brake system. Monitor the fluid level in the master cylinder reservoir to make sure it does not go dry.
7. Check and adjust brake fluid level to the "MAX" mark.
8. Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Re-bleed the brakes as necessary.
9. Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

Pressure Brake Bleeding

NOTE :

Follow pressure bleeder manufacturer's instructions for use of pressure bleeding equipment.

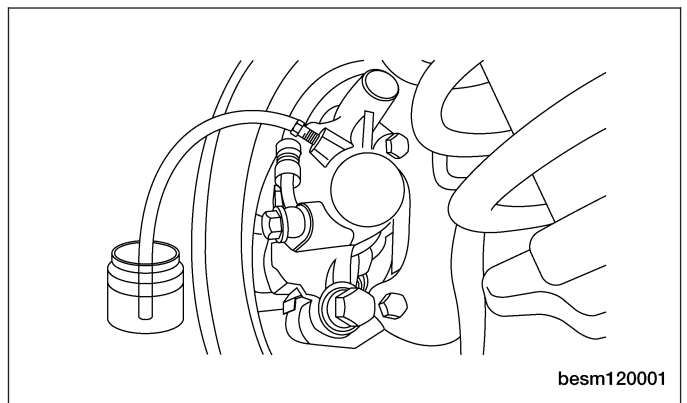
Fill the brake master cylinder reservoir to the proper level with brake fluid.

Attach the pressure bleeding equipment to the master cylinder.

NOTE :

Never allow the brake master cylinder to empty of brake fluid while bleeding the brake system.

Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose.



1. Turn the ignition switch off.
2. Open the bleeder screw at least one full turn or more to obtain a steady stream of brake fluid.
3. After approximately 120-240 ml of fluid has been bled through the brake circuit and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.
4. Repeat this procedure at all the remaining bleeder screws.
5. Check and adjust brake fluid level to the "MAX" mark on the reservoir.

6. Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Re-bleed the brakes as necessary.
7. Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

Master Cylinder - LHD

Description

The master cylinder body is an anodized aluminum casting. It is located at the left side of the engine room. It has a machined bore to accept the master cylinder pistons and also has threaded ports with seats for hydraulic brake tube connections. The master cylinder has the brake fluid reservoir mounted on top of it and supplies brake fluid to the master cylinder as required. On manual transaxle equipped vehicles, the brake fluid reservoir also feeds the clutch hydraulic circuit. The reservoir is made of clear plastic and it houses the brake fluid level switch.

Operation

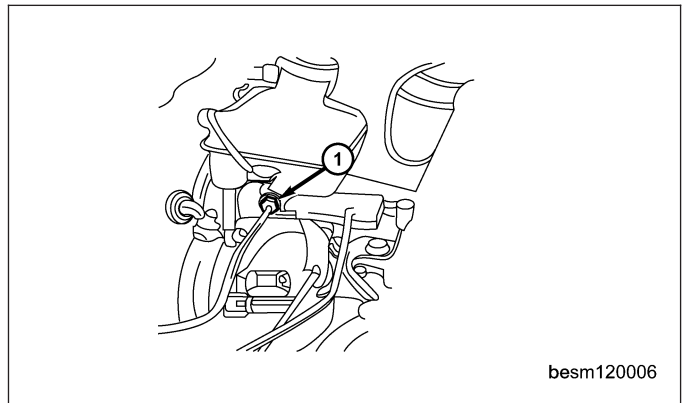
When the brake pedal is pressed, the master cylinder pistons apply brake pressure through the chassis brake tubes to each brake assembly. The brake fluid reservoir supplies the brake hydraulic system with the necessary fluid to operate properly.

Removal & Installation

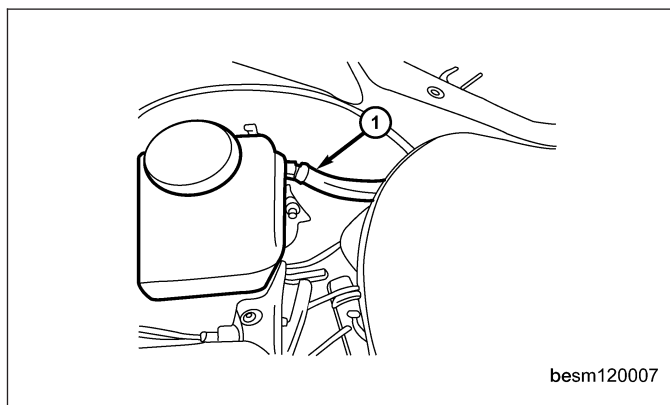
CAUTION:

The vacuum in the power brake booster must be pumped down before removing the master cylinder to avoid damaging the master cylinder and to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

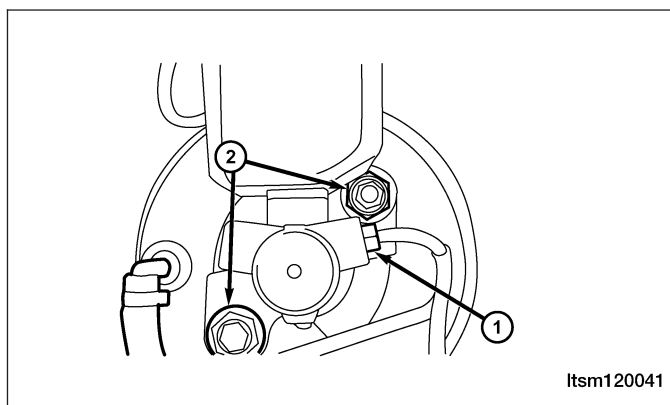
1. Turn the ignition switch off.
2. Siphon out as much brake fluid as possible from the master cylinder.
3. With the engine off, pump the brake pedal 4-5 strokes until the pedal feel is firm.
4. Disconnect the negative battery cable.
5. Disconnect the brake fluid level switch electrical connector in the master cylinder brake fluid reservoir.
6. Disconnect the brake tubes (1) at the master cylinder outlet ports. Install plugs at all of the open brake tube outlets on the master cylinder.
(Tighten: Brake tube nuts to 10 N·m)



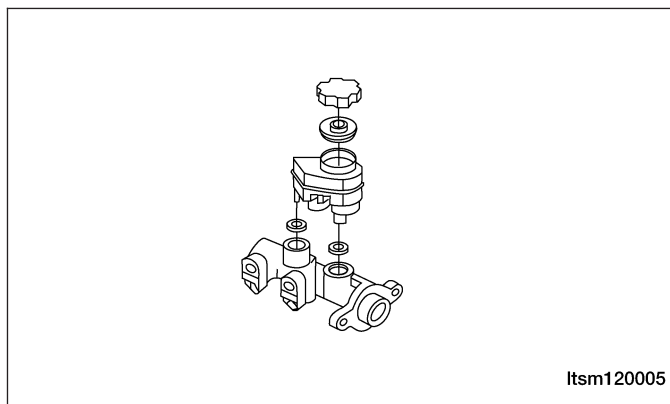
7. If equipped with a manual transaxle, remove the clamp (1) and slide the clutch actuator hose off the reservoir port.



8. Clean the area around where the master cylinder attaches to the power brake booster using a suitable brake cleaner such as Brake Parts Cleaner or an equivalent.
9. Disconnect the brake tubes (1) and remove the nuts (2) attaching the master cylinder to the power brake booster.
- (Tighten: Master cylinder mounting nuts to 23 N·m)



10. Slide the master cylinder straight out of the power brake booster.



11. Installation is in the reverse order of removal.

NOTE :

After installation, bleed the master cylinder or bleed the entire brake system as necessary.

Master Cylinder - RHD

Description

The master cylinder body is an anodized aluminum casting. It is located at the right side of the engine room. It has a machined bore to accept the master cylinder pistons and also has threaded ports with seats for hydraulic brake tube connections. The master cylinder has the brake fluid reservoir mounted on top of it and supplies brake fluid to the master cylinder as required. On manual transaxle equipped vehicles, the brake fluid reservoir also feeds the clutch hydraulic circuit. The reservoir is made of clear plastic and it houses the brake fluid level switch.

Operation

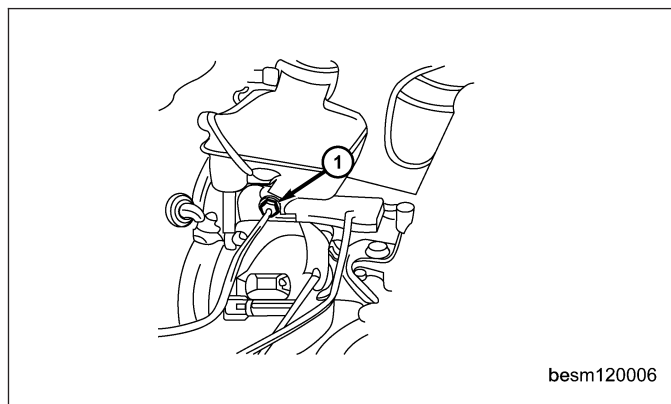
When the brake pedal is pressed, the master cylinder pistons apply brake pressure through the chassis brake tubes to each brake assembly. The brake fluid reservoir supplies the brake hydraulic system with the necessary fluid to operate properly.

Removal & Installation

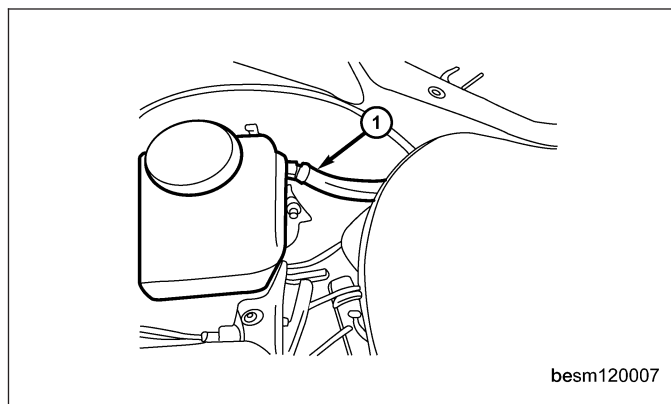
CAUTION:

The vacuum in the power brake booster must be pumped down before removing the master cylinder to avoid damaging the master cylinder and to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

1. Turn the ignition switch off.
2. Siphon out as much brake fluid as possible from the master cylinder.
3. With the engine off, pump the brake pedal 4-5 strokes until the pedal feel is firm.
4. Disconnect the negative battery cable.
5. Disconnect the brake fluid level switch electrical connector in the master cylinder brake fluid reservoir.
6. Disconnect the brake tubes (1) at the master cylinder outlet ports. Install plugs at all of the open brake tube outlets on the master cylinder.
(Tighten: Brake tube nuts to 10 N·m)

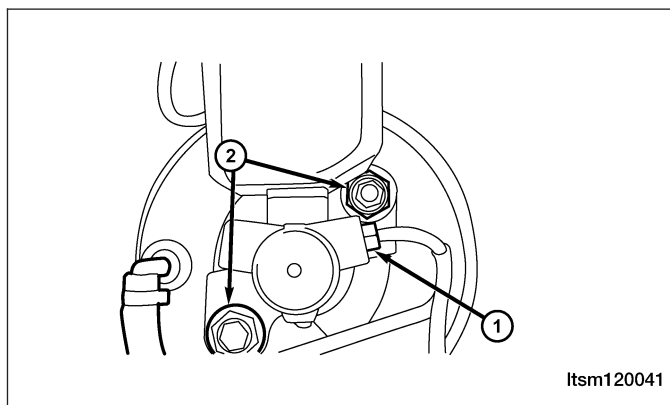


7. If equipped with a manual transaxle, remove the clamp (1) and slide the clutch actuator hose off the reservoir port.

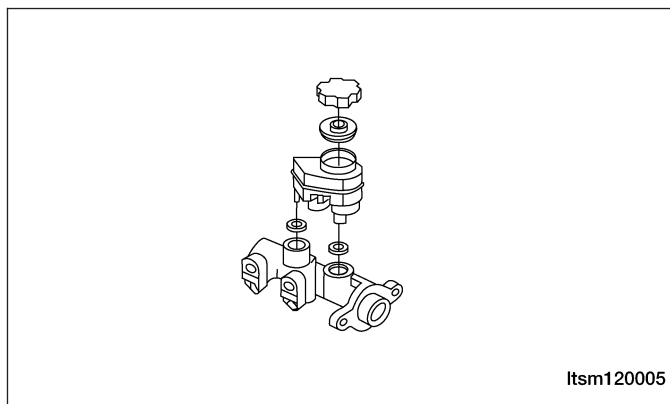


8. Clean the area around where the master cylinder attaches to the power brake booster using a suitable brake cleaner such as Brake Parts Cleaner or an equivalent.

9. Disconnect the brake tubes (1) and remove the nuts (2) attaching the master cylinder to the power brake booster.
(Tighten: Master cylinder mounting nuts to 23 N·m)



10. Slide the master cylinder straight out of the power brake booster.



11. Installation is in the reverse order of removal.

NOTE :

After installation, bleed the master cylinder or bleed the entire brake system as necessary.

Power Brake Booster - LHD

Description

The power brake booster is mounted in the engine compartment on the left side of the dash panel. The master cylinder is bolted to the front of the booster.

Operation

A vacuum line connects the check valve to engine source vacuum. The booster input rod extends through the dash panel and connects to the brake pedal.

Removal & Installation

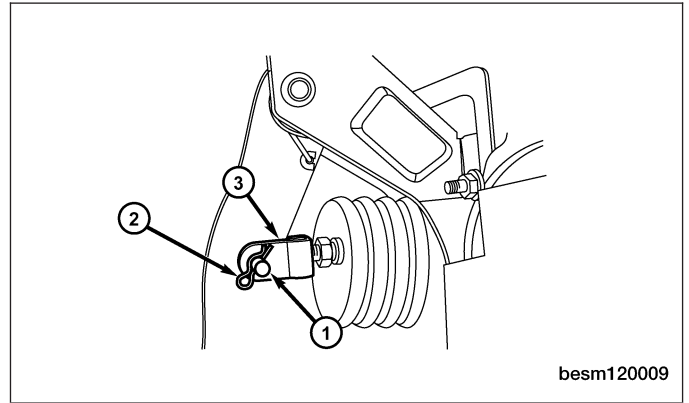
CAUTION:

The vacuum in the power brake booster must be pumped down before removing the master cylinder to avoid damaging the master cylinder and to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

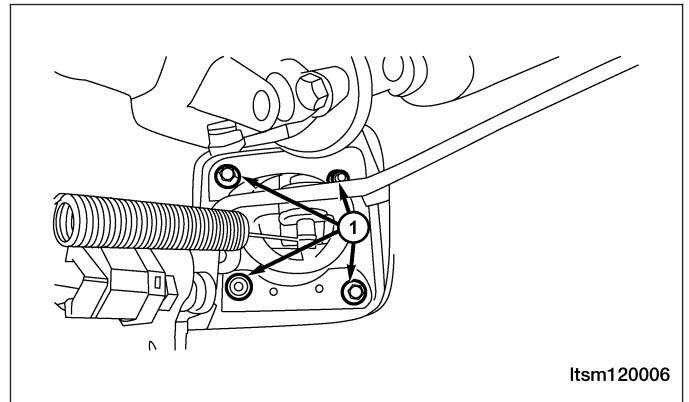
1. Remove the master cylinder (See Master Cylinder Removal & Installation in Section 12 Brakes).

ON-VEHICLE SERVICE

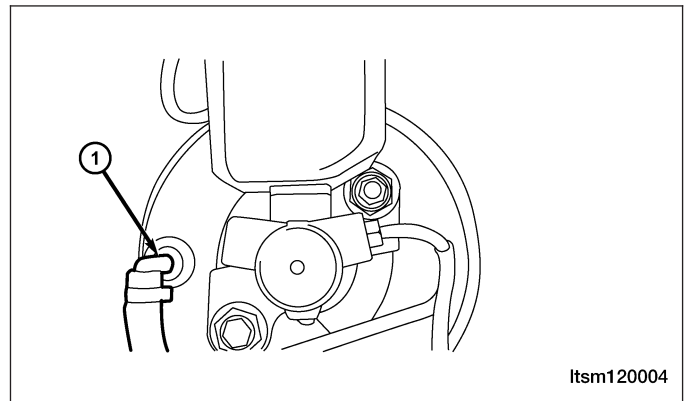
2. Remove the spring-type cotter pin (2) and clevis pin (1) from the brake booster rod (3).



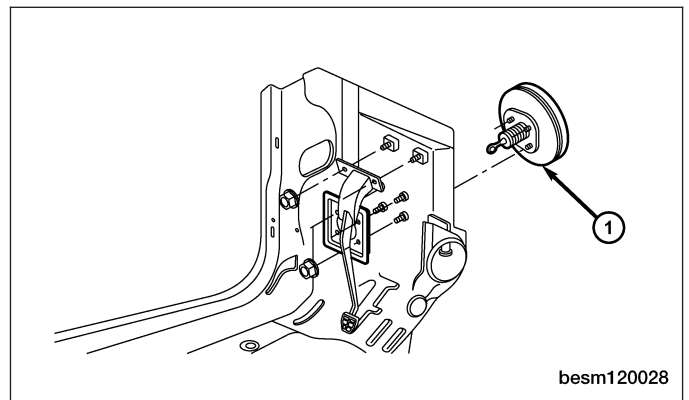
3. Remove the nuts and bolts (1) attaching the power brake booster to the brake pedal bracket.
(Tighten: Brake pedal/Power brake booster mounting nuts and bolts to 25 N·m)
4. Remove the brake pedal bracket.



5. Disconnect the vacuum hose (1) from the check valve on the power brake booster.



6. Slide the power brake booster (1) forward until its mounting studs clear the dash panel, then remove it through the engine compartment.
7. Installation is in the reverse order of removal.



Power Brake Booster - RHD

Description

The power brake booster is mounted in the engine compartment on the right side of the dash panel. The master cylinder is bolted to the front of the booster.

Operation

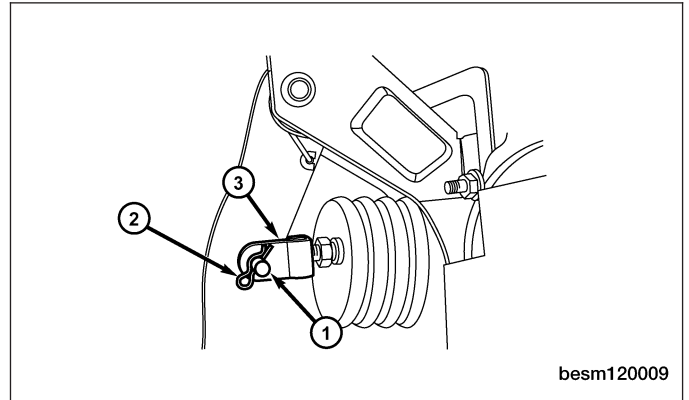
A vacuum line connects the check valve to engine source vacuum. The booster input rod extends through the dash panel and connects to the brake pedal.

Removal & Installation

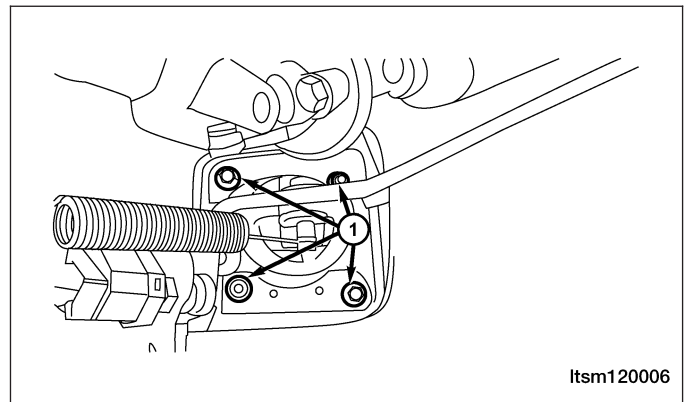
CAUTION:

The vacuum in the power brake booster must be pumped down before removing the master cylinder to avoid damaging the master cylinder and to prevent the booster from sucking in any contamination. This can be done by pumping the brake pedal while the engine is not running until a firm brake pedal is achieved.

1. Remove the master cylinder (See Master Cylinder Removal & Installation in Section 12 Brakes).
2. Remove the spring-type cotter pin (2) and clevis pin (1) from the brake booster rod (3).

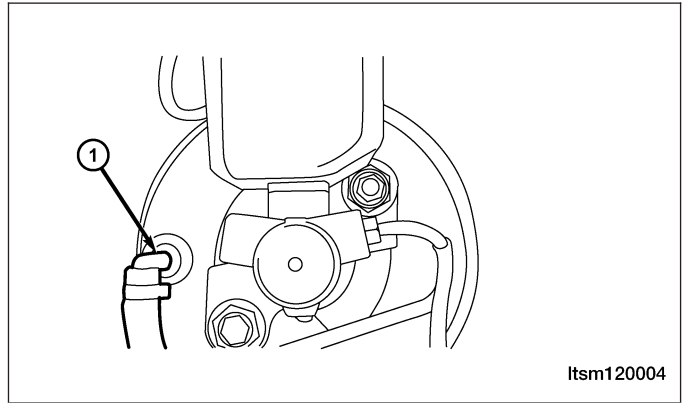


3. Remove the nuts and bolts (1) attaching the power brake booster to the brake pedal bracket. (Tighten: Brake pedal/Power brake booster mounting nuts and bolts to 25 N·m)
4. Remove the brake pedal bracket.



ON-VEHICLE SERVICE

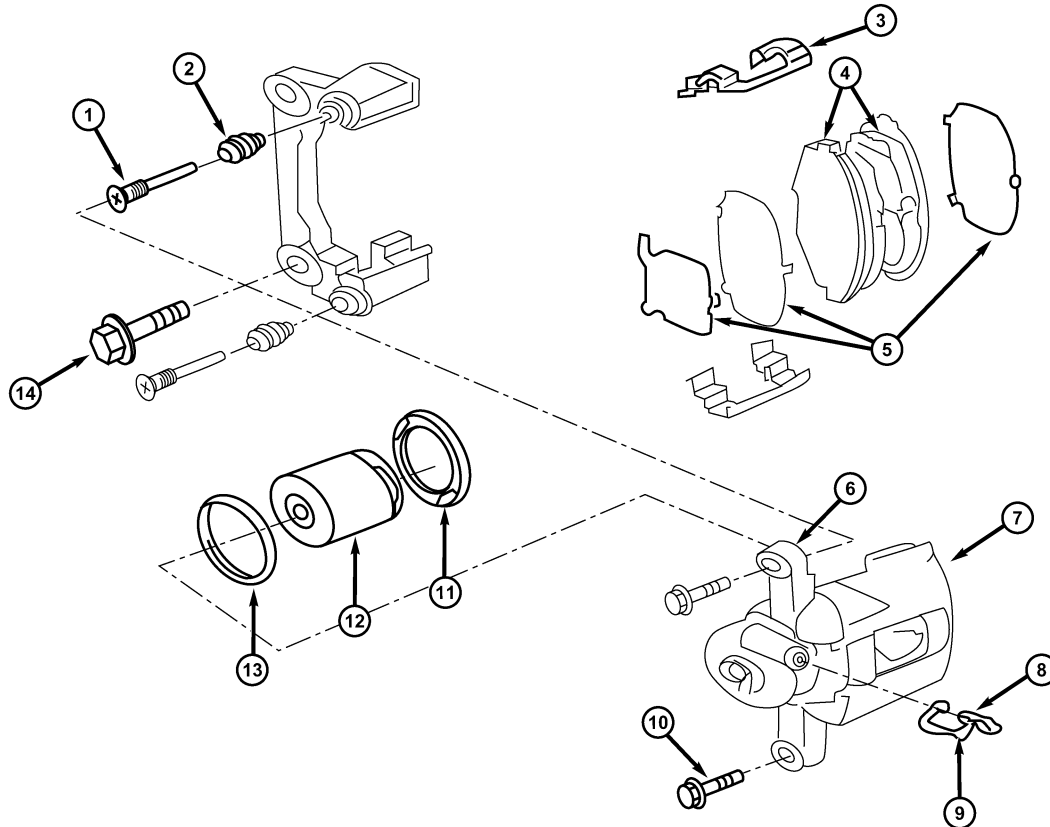
5. Disconnect the vacuum hose (1) from the check valve on the power brake booster.



6. Slide the power brake booster forward until its mounting studs clear the dash panel, then remove it through the engine compartment.
7. Installation is in the reverse order of removal.

Front Brake Caliper

Description



Itsm120007

1 - Locating Guide Rod	8 - Bleeding Screw
2 - Dust Cap	9 - Dust Cover
3 - Brake Gasket	10 - Brake Caliper Connecting Bolt
4 - Brake Lining Assembly	11 - Piston Dust Cap

5 - Lining Damper	12 - Piston
6 - Brake Caliper Bracket	13 - Piston Seal
7 - Brake Caliper Body	14 - Brake Caliper Bracket Bolt

The calipers are a single piston type. The calipers are free to slide laterally on the anchor, this allows continuous compensation for lining wear. The calipers are directly bolted to the wheel hub with mounting bolts. The brake rotor dust shield is mounted to the hub.

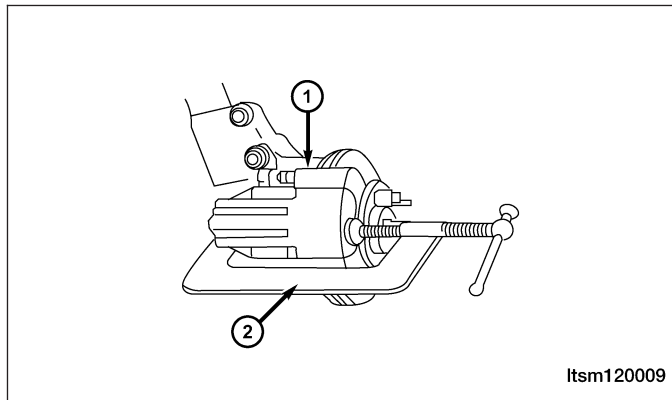
Operation

When the brakes are applied, fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bores will be equal. Fluid pressure applied to the pistons is transmitted directly to the inboard brake pad. This forces the pad

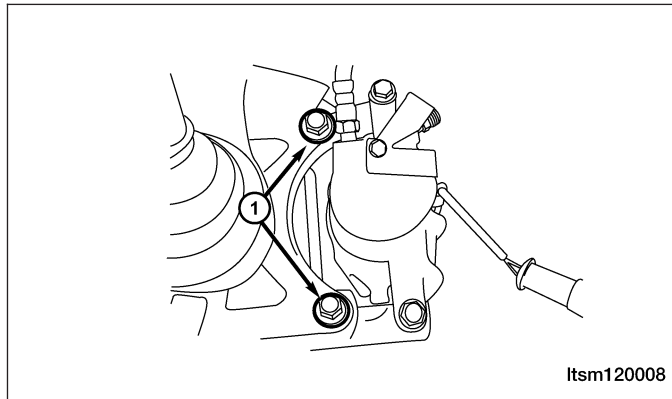
lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the slide pins. This action brings the outboard brake pad lining into contact with the outer surface of the disc brake rotor.

Removal & Installation

1. Using a brake pedal holding tool, depress the brake pedal past its first 25 mm of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir when the lines are opened.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)
4. Using a large C-clamp (2), push the caliper piston to an adequate depth to remove the brake caliper (1) from the brake disc.



5. Remove the front brake hose from the front brake caliper.
(Tighten: Front caliper brake hose to 19 N·m)
6. Remove the front caliper guide pin bolts (1).
(Tighten: Front caliper guide pin bolts to 23 N·m)



7. Slide the front brake caliper from the disc brake adapter bracket and remove.
8. Installation is in the reverse order of removal.

Installation Notes:

- Completely retract the caliper piston back into the bore of the caliper.
- After installation, bleed the caliper as necessary.

Rear Brake Caliper

Description

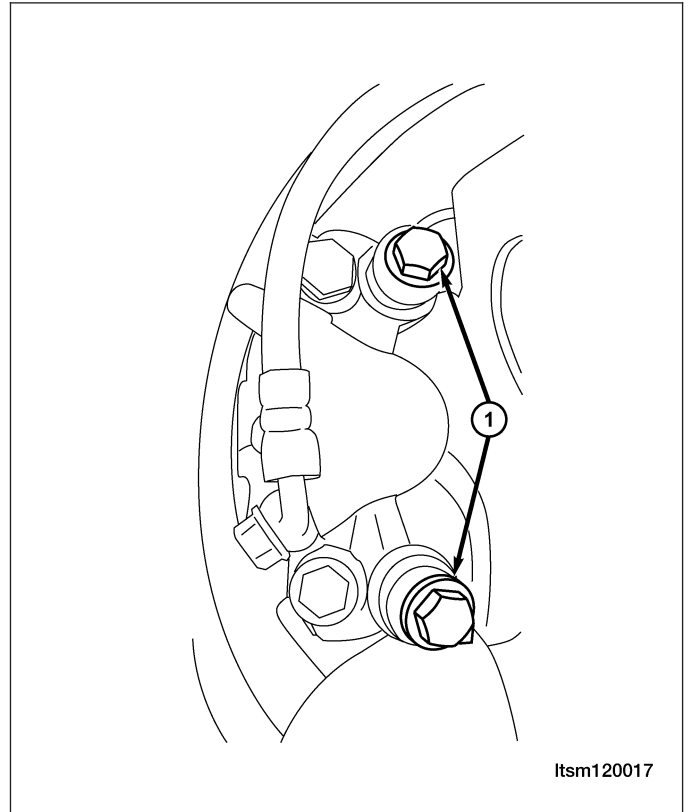
The rear disc brakes consist of fixed single piston style calipers and solid rotors. The rear caliper is mounted to the rear wheel hub. The calipers are directly bolted to the wheel hub with mounting bolts. The disc brake rotor dust shield is mounted to the hub. The brake rotor has a built in drum used for the parking brakes. The parking brake shoes are mounted to the wheel hub.

Operation

When the brakes are applied, fluid pressure is exerted against the caliper piston. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper piston and within the caliper bores will be equal. Fluid pressure applied to the pistons is transmitted directly to the inboard brake pad. This forces the pad lining against the inner surface of the brake rotor. At the same time, fluid pressure within the piston bore forces the caliper to slide inward on the slide pins. This action brings the outboard brake pad lining into contact with the outer surface of the disc brake rotor.

Removal & Installation

1. Using a brake pedal holding tool, depress the brake pedal past its first 25 mm of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir when the lines are opened.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)
4. Remove the banjo bolt connecting the brake hose to the rear brake caliper.
(Tighten: Rear caliper banjo bolt to 20 N·m)
5. Remove the rear caliper guide pin bolts.
(Tighten: Rear caliper guide pin bolts to 23 N·m)
6. Remove rear brake caliper adapter mounting bolts (1).
(Tighten: Rear brake caliper adapter mounting bolts to 63 N·m)
7. Slide the rear brake caliper from the disc brake adapter bracket and remove.



8. Installation is in the reverse order of removal.

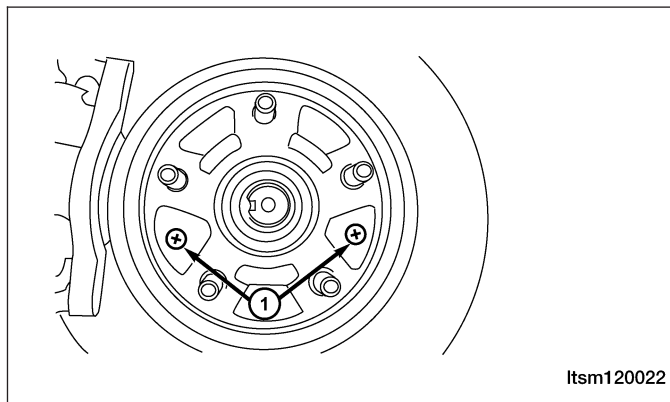
Installation Notes:

- Completely retract the caliper piston back into the bore of the caliper.
- After installation bleed the caliper as necessary.

Front Brake Rotor

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)
3. Remove the front caliper (See Front Caliper Removal & Installation in Section 12 Brakes).
4. Remove the front brake rotor locating screws (1).
(Tighten: Front brake rotor locating screws to 6-12 N·m)
5. Slide the front brake rotor off the hub and bearing.
6. Installation is in the reverse order of removal.



Inspection

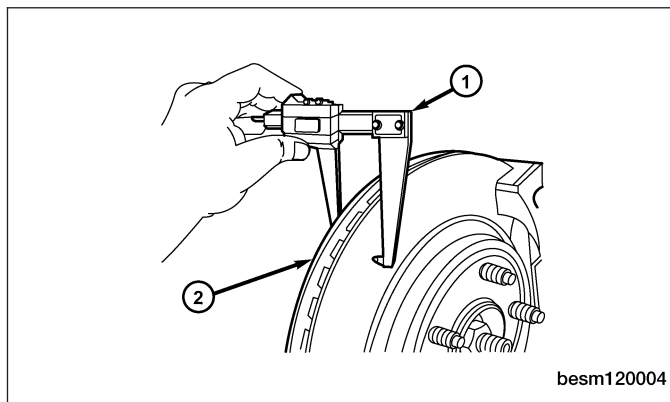
Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This increases guide pin sleeve wear due to the tendency of the caliper to follow the rotor wobble.

Braking Surface Inspection

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be resurfaced or replaced. Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake pads are installed, improper wear of the shoes will result. Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

Rotor Minimum Thickness

Measure the rotor thickness (1) at the center of the brake pad contact surface. Replace the rotor (2) if it is worn below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

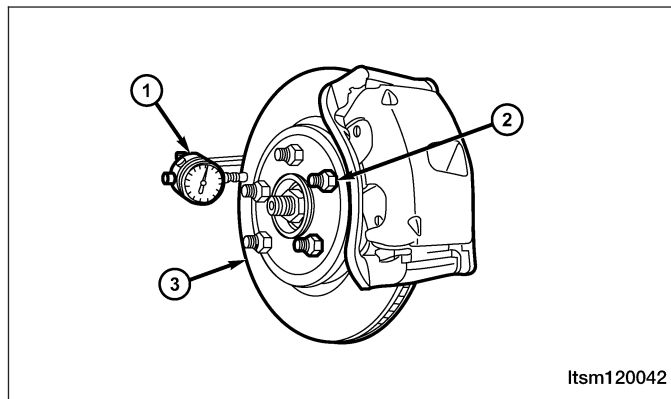
**12**

CAUTION:

Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Rotor Runout

1. Install standard wheel mounting nuts, flat side to rotor, on all the wheel studs (2). Progressively tighten the nuts in a crisscross pattern to 110 N·m.
2. Mount a dial indicator (1), with wheel, or equivalent, to the knuckle. Position the dial indicator wheel to contact the rotor braking surface approximately 10 mm from the outer edge of the rotor.
3. Slowly rotate the brake rotor (3) checking lateral runout, marking the low and high spots. Record these measurements.
4. Check and record the runout on the opposite side of the rotor in the same fashion, marking the low and high spots.
5. Compare runout measurement to specification.
6. If runout is in excess of specifications, check the lateral runout of the hub face.



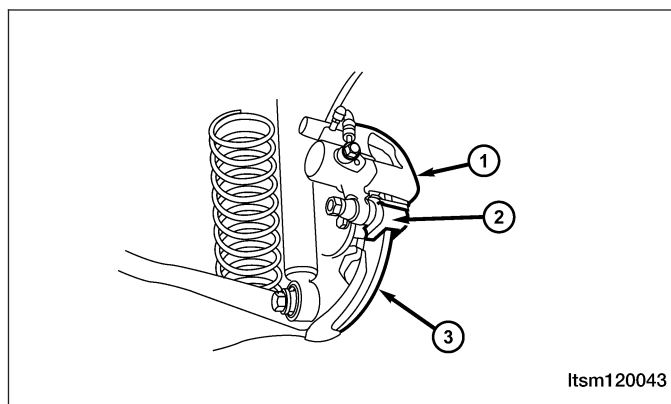
Itsm120042

BRAKE ROTOR	ROTOR THICKNESS	MINIMUM ROTOR THICKNESS	ROTOR DIAMETER	ROTOR RUNOUT
Front Rotor	25 mm	23 mm	265 mm	0.1 mm

Rear Brake Rotor

Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly. (Tighten: Wheel mounting nuts to 110 N·m)
3. Remove rear caliper (1) (See Rear Caliper Removal & Installation in Section 12 Brakes).
4. Slide the rear brake rotor (3) off the hub and bearing.
5. Installation is in the reverse order of removal.



Itsm120043

Inspection

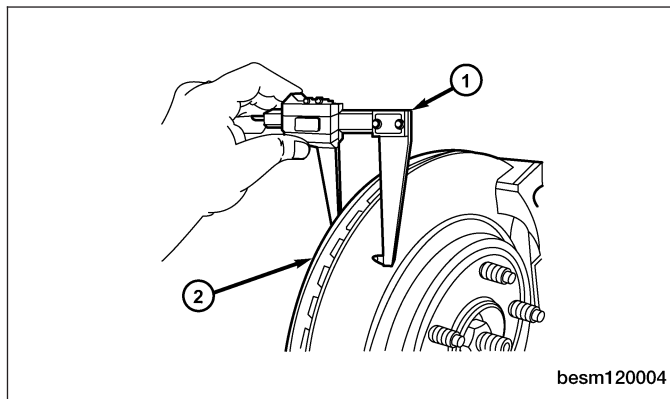
Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This increases guide pin sleeve wear due to the tendency of the caliper to follow the rotor wobble.

Braking Surface Inspection

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be resurfaced or replaced. Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake pads are installed, improper wear of the shoes will result. Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

Rotor Minimum Thickness

Measure the rotor thickness (1) at the center of the brake pad contact surface. Replace the rotor (2) if it is worn below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

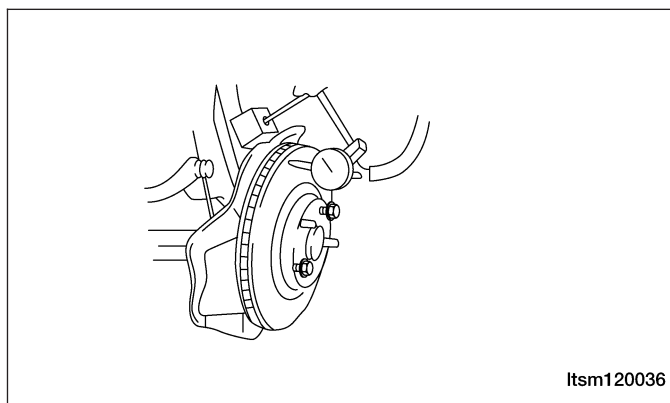


CAUTION:

Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Rotor Runout

1. Install standard wheel mounting nuts, flat side to rotor, on all the wheel studs. Progressively tighten the nuts in a crisscross pattern to 110 N·m.
2. Mount a dial indicator, with wheel, or equivalent, to the knuckle. Position the dial indicator wheel to contact the rotor braking surface approximately 10 mm from the outer edge of the rotor.
3. Slowly rotate the brake rotor checking lateral runout, marking the low and high spots. Record these measurements.
4. Check and record the runout on the opposite side of the rotor in the same fashion, marking the low and high spots.
5. Compare runout measurement to specification.
6. If runout is in excess of specifications, check the lateral runout of the hub face.



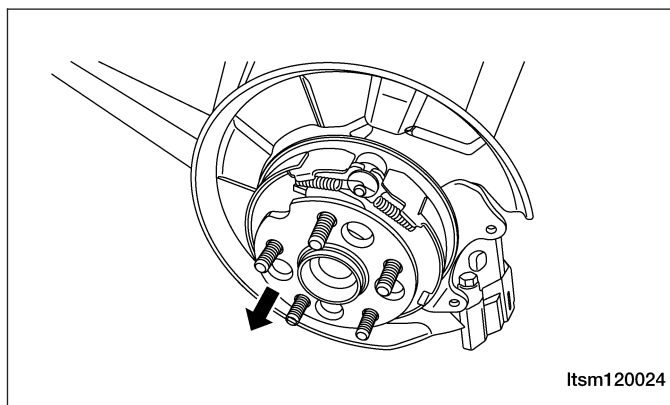
BRAKE ROTOR	ROTOR THICKNESS	MINIMUM ROTOR THICKNESS	ROTOR DIAMETER
Rear Rotor	9 mm	7 mm	303 mm

Rear Brake Backing Plate

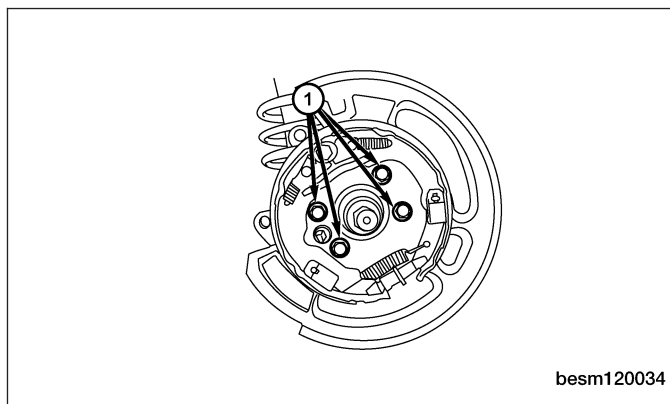
Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)

3. Remove the rear brake caliper (See Rear Brake Caliper Removal & Installation in Section 12 Brake).
4. Remove the rear brake rotor (See Rear Brake Rotor Removal & Installation in Section 12 Brake).
5. Remove the rear hub and bearing (See Rear Hub And Bearing Removal & Installation in Section 09 Driveline & Axle).



6. Remove the four bolts (1) that mount the rear brake backing plate to the trailing link.
(Tighten: Rear brake backing plate bolts to 20 N·m)
7. Remove the rear brake backing plate assembly.



8. Installation is in the reverse order of removal.

Front Brake Pads

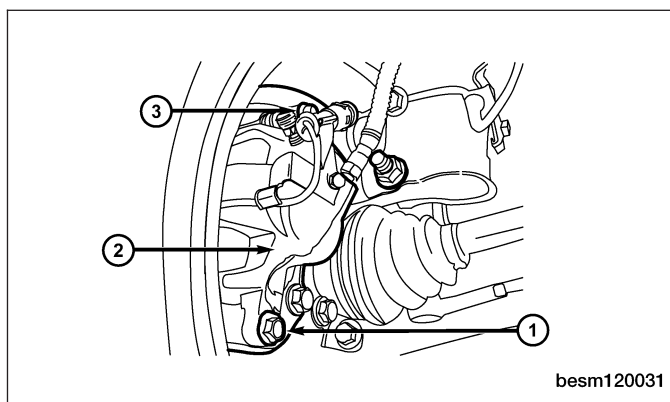
Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)

NOTE :

In some cases, it may be necessary to retract the caliper piston in its bore a small amount in order to provide sufficient clearance between the pads and the rotor.

3. Remove the front caliper guide pin bolts (1) and (3).
(Tighten: Front caliper guide pin bolts to 23 N·m)
4. Remove the disc brake caliper (2) from the disc brake adapter bracket and hang it out of the way using wire. Use care not to over extend the brake hose when doing this.



5. Remove the inboard brake pad from the caliper adapter bracket.
6. Remove the outboard brake pad from the caliper by prying the brake pad retaining clip over the raised area on the caliper. Slide the brake pad off of the brake caliper.
7. Installation is in the reverse order of removal.

Installation Notes:

- Before installing brake pads, completely retract the caliper piston back into the bore of the caliper.

- After installation and before moving the vehicle, pump the brake pedal several times to set the pads to the brake rotor.
- Check and adjust the brake fluid level in the reservoir as necessary.
- Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.
- After installation and before moving the vehicle, pump the brake pedal several times to set the pads to the brake rotor.

Inspection

Visually inspect brake pads for uneven lining wear. Also inspect for excessive lining deterioration. Check the clearance between the tips of the wear indicators (if equipped) on the pads and the brake rotors. If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the disc brake pads from the vehicle. Measure the brake pad minimum thickness. Brake pads must be replaced when usable material on a brake pad lining measured at its thinnest point measures one millimeter or less. Replace both disc brake pads (inboard and outboard) at each caliper. It is also necessary to replace the pads on the opposite side of the vehicle as well as the pads failing inspection to maintain proper braking characteristics. If the brake pad assemblies do not require replacement, be sure to reinstall the brake pads in the original position from which they were removed.

Rear Brake Pads

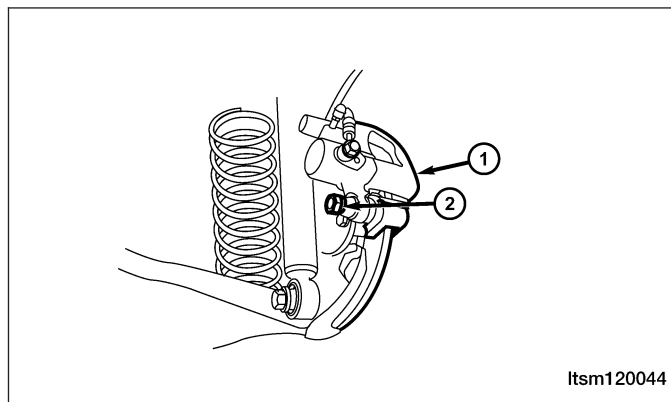
Removal & Installation

1. Raise and support the vehicle.
2. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)

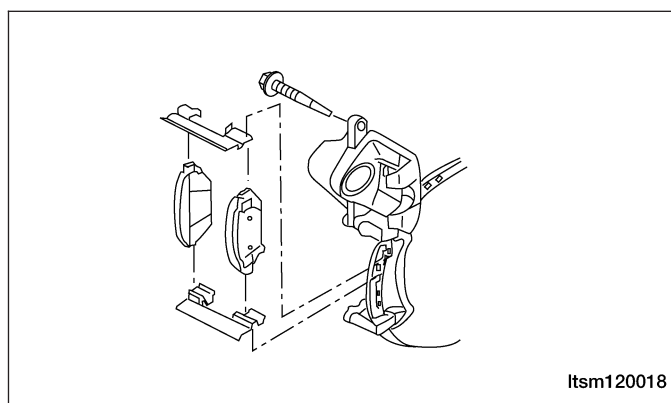
NOTE :

In some cases, it may be necessary to retract the caliper piston in its bore a small amount in order to provide sufficient clearance between the pads and the rotor.

3. Remove the lower rear caliper guide pin bolt (2).
(Tighten: Rear caliper guide pin bolt to 23 N·m)
CAUTION: When moving rear brake caliper upward, use extreme care not to damage or overextend the flex hose.
4. Rotate the caliper (1) upward hinging off the upper guide pin bolt. Rotate the caliper upward just enough to allow brake pad removal.



5. Slide the rear brake pads off of the brake caliper adapter.



Inspection

Visually inspect brake pads for uneven lining wear. Also inspect for excessive lining deterioration. Check the clearance between the tips of the wear indicators (if equipped) on the pads and the brake rotors. If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the disc brake pads from the vehicle. Measure the brake pad minimum thickness. Brake pads must be replaced when usable material on a brake pad lining measured at its thinnest point measures one millimeter or less. Replace both disc brake pads (inboard and outboard) at each caliper. It is also necessary to replace the pads on the opposite side of the vehicle as well as the pads failing inspection to maintain proper braking characteristics. If the brake pad assemblies do not require replacement, be sure to reinstall the brake pads in the original position from which they were removed.

UNIT REPAIR

Front Brake Caliper

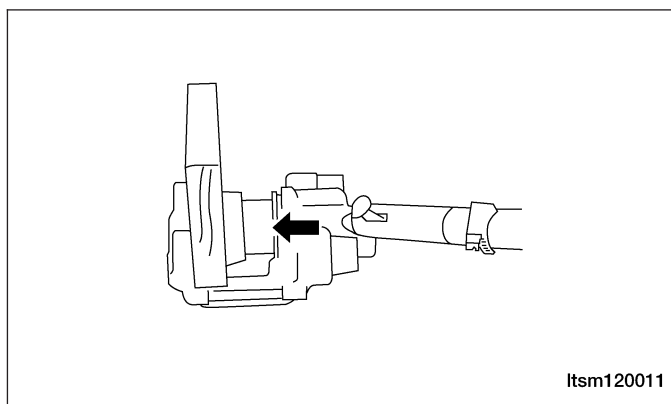
Disassemble

Before disassembling the brake caliper, clean and inspect it.

WARNING!

- Under no condition should high pressure air ever be used to remove a piston from a caliper bore. Personal injury could result from such a practice.
- Do not place face or hands near caliper and piston if using compressed air pressure to remove piston. Do not use high pressure.

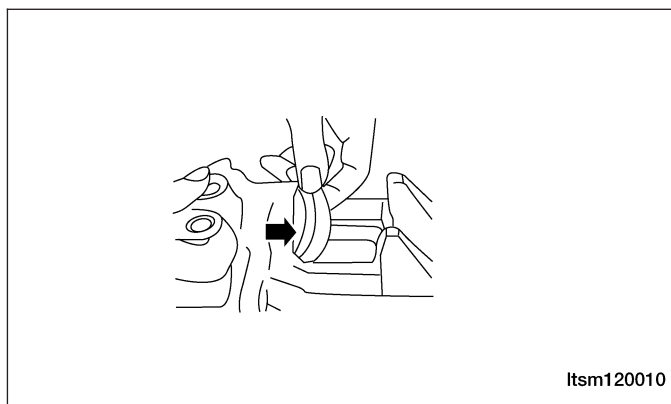
1. Place a wooden block in the caliper.
2. If necessary, apply low pressure compressed air to the caliper fluid inlet in short spurts to force the piston out.
3. Remove the piston from the caliper.



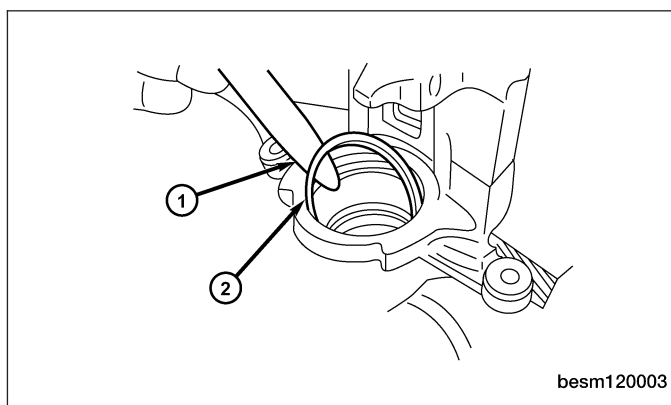
4. Remove the dust boot from the piston and discard it.

CAUTION:

Do not use a screwdriver or other metal tool for seal removal. Using such tools can scratch the bore or leave burrs on the seal groove edges.

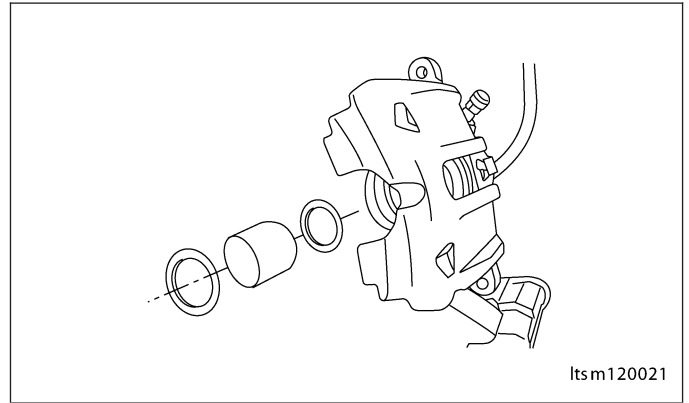


5. Using a soft tool such as a plastic trim stick (1), work the piston seal (2) out of its groove in caliper piston bore. Discard the used seal.



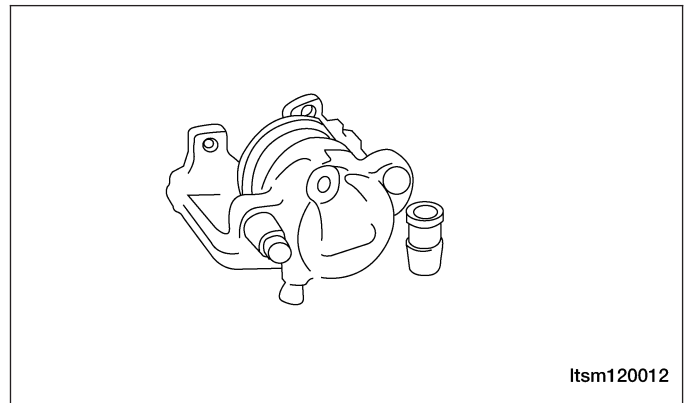
UNIT REPAIR

6. Clean the piston bore and drilled passage ways with alcohol or a suitable solvent. Wipe it dry using only a lint-free cloth.



Inspection

1. Inspect both the piston and bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth.
2. Remove deposits on the piston using a soft brass wire brush or a rough shop towel. Do not clean piston with a polishing or emery cloth because this will damage the chrome-plated surface. Replace the piston if the chrome plated surface is damaged. If the piston is jammed or if the cylinder bores are scored or rusted, replace the complete brake caliper. Remove small, light rust spots in the cylinder bore with a polishing cloth.
3. Inspect the caliper guide sleeves for smooth operation. Repair and grease caliper sleeves as necessary.



Assemble

NOTE :

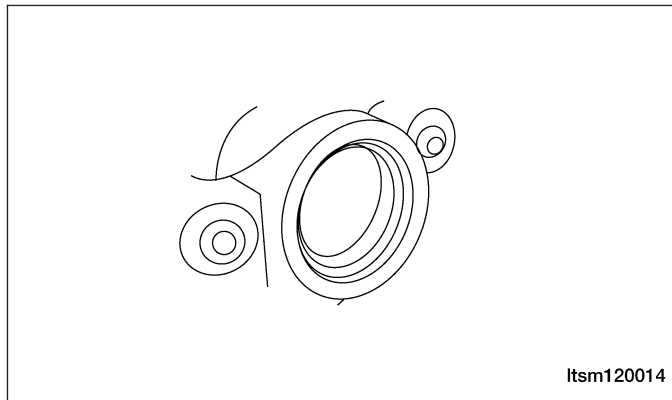
- Always have clean hands when assembling a brake caliper.
- Always use fresh, clean brake fluid when assembling a brake caliper.
- Never use an old piston seal.
- Bleed the brakes as necessary.

Perform the following procedure to assemble the brake caliper:

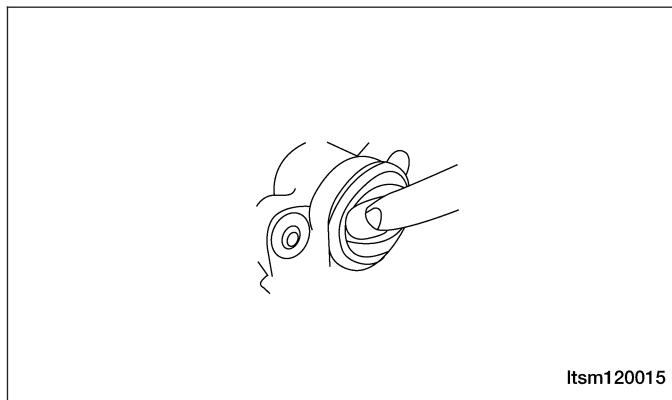
1. Lubricate the caliper piston, piston seals and piston bore with clean brake fluid.
2. Install the new piston seal into the seal groove.

NOTE :

Verify seal is fully seated into seal groove and not twisted.



3. Install the new dust boot on the caliper piston and seat the dust boot lip into the piston groove.
4. Stretch the dust boot rearward to straighten the boot folds, then move the boot forward until the fold snaps into place.

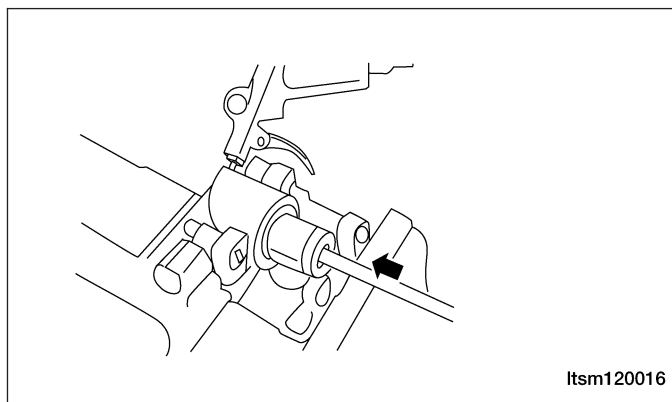


5. Install the piston into the caliper bore and press the piston down to the bottom of the caliper bore by hand or with the handle of a hammer.

CAUTION:

When assembling, the force applied to the piston to seat it in the bore must be applied uniformly to avoid cocking and binding of the piston.

6. Seat the dust boot in caliper.
7. Install the new caliper bleed screw.
8. Install the caliper (See Front Brake Caliper Removal & Installation in Section 12 Brakes).



Rear Brake Caliper

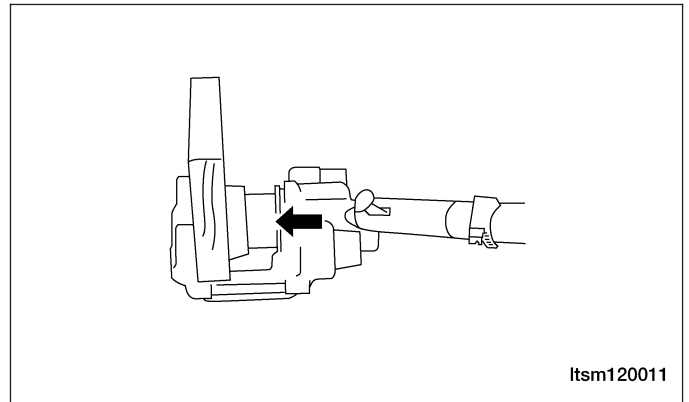
Disassemble

Before disassembling the brake caliper, clean and inspect it.

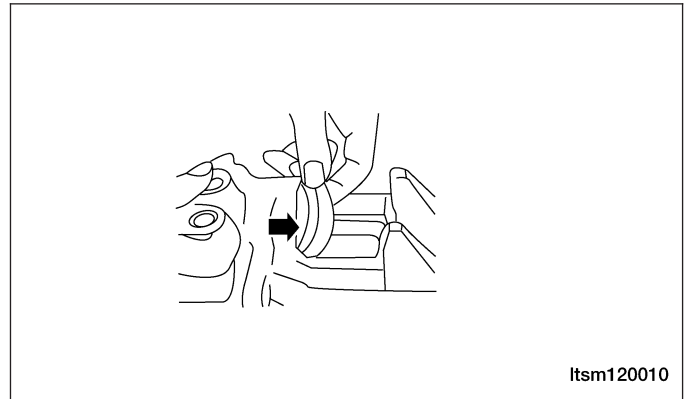
WARNING!

- Under no condition should high pressure air ever be used to remove a piston from a caliper bore. Personal injury could result from such a practice.
- Do not place face or hands near caliper and piston if using compressed air pressure to remove piston. Do not use high pressure.

1. Place a wooden block in the caliper.
2. If necessary, apply low pressure compressed air to the caliper fluid inlet in short spurts to force the piston out.
3. Remove the piston from the caliper.



4. Remove the dust boot from the piston and discard it.

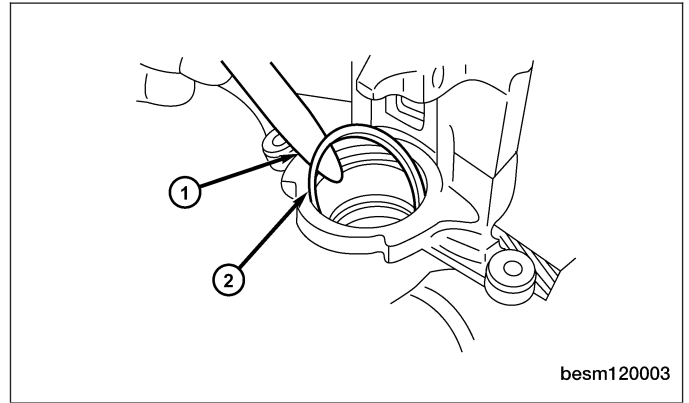


CAUTION:

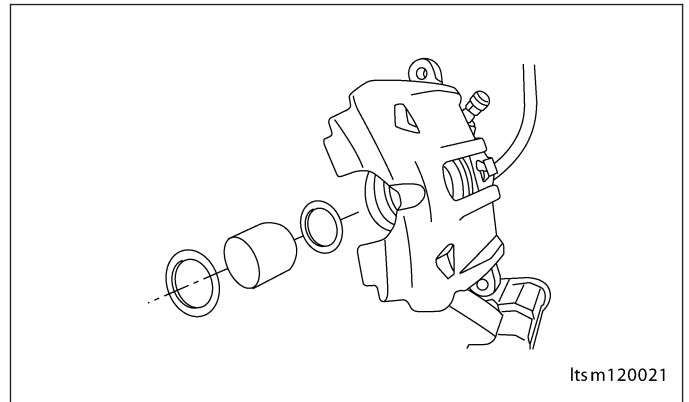
Do not use a screwdriver or other metal tool for seal removal. Using such tools can scratch the bore or leave burrs on the seal groove edges.

UNIT REPAIR

5. Using a soft tool such as a plastic trim stick (1), work the piston seal (2) out of its groove in caliper piston bore. Discard the used seal.

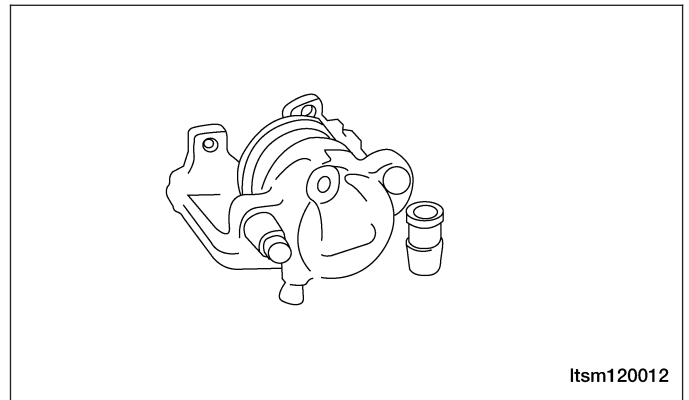


6. Clean the piston bore and drilled passage ways with alcohol or a suitable solvent. Wipe it dry using only a lint-free cloth.



Inspection

1. Inspect both the piston and bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth.
2. Remove deposits on the piston using a soft brass wire brush or a rough shop towel. Do not clean piston with a polishing or emery cloth because this will damage the chrome-plated surface. Replace the piston if the chrome plated surface is damaged. If the piston is jammed or if the cylinder bores are scored or rusted, replace the complete brake caliper. Remove small, light rust spots in the cylinder bore with a polishing cloth. Remove heavy rust spots in front of the groove for the piston seal using fine-grit emery paper (grit size 380 to 500).
3. Inspect the caliper seal rings. Repair the seal rings as necessary.



Assemble

NOTE :

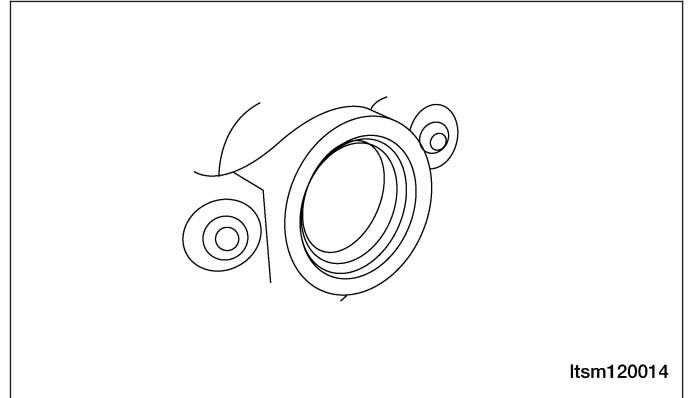
- Always have clean hands when assembling a brake caliper.
- Always use fresh, clean brake fluid when assembling a brake caliper.
- Never use an old piston seal.
- Bleed the brakes as necessary.

Perform the following procedure to assemble the brake caliper:

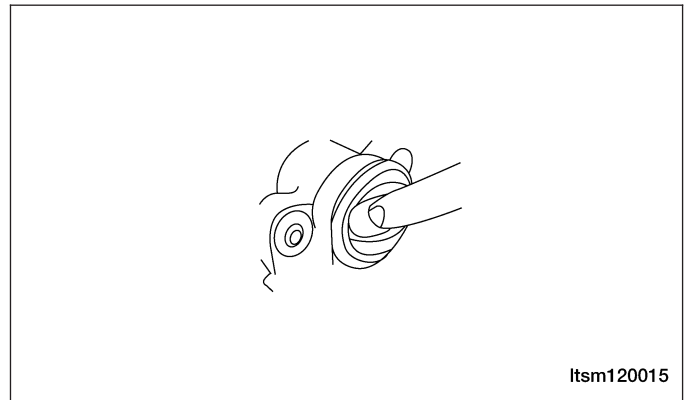
1. Lubricate the caliper piston, piston seals and piston bore with clean brake fluid.
2. Install the new piston seal into the seal groove.

NOTE :

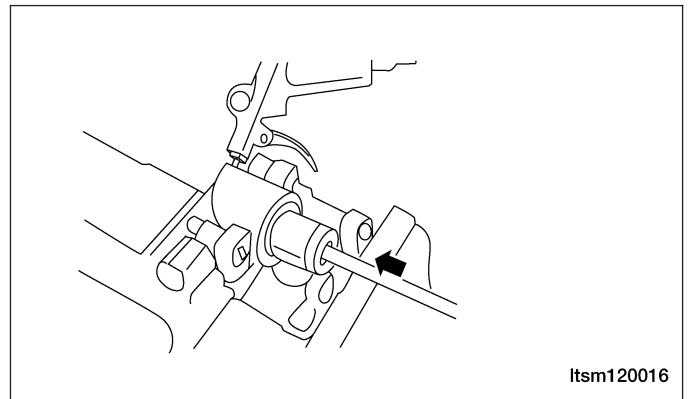
Verify seal is fully seated into seal groove and not twisted.



3. Install the new dust boot on the caliper piston and seat the dust boot lip into the piston groove.
4. Stretch the dust boot rearward to straighten the boot folds, then move the boot forward until the fold snaps into place.



5. Install the piston into the caliper bore and press the piston down to the bottom of the caliper bore by hand or with the handle of a hammer.



CAUTION:

When assembling, the force applied to the piston to seat it in the bore must be applied uniformly to avoid cocking and binding of the piston.

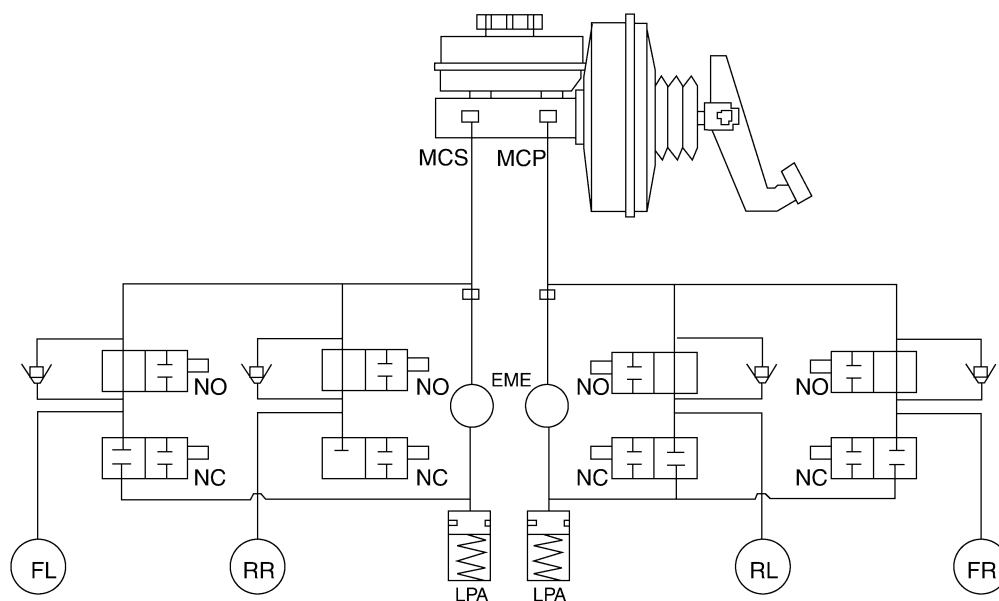
6. Seat the dust boot in caliper.
7. Install the new caliper bleed screw.
8. Install the caliper (See Front Brake Caliper Removal & Installation in Section 12 Brakes).

ANTILOCK BRAKES

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GENERAL INFORMATION

Description



ltsm120040

This Antilock Brake System (ABS) uses components of the base brake system, but also features the following components:

- Hydraulic Control Unit and Antilock Brake System Module (ABS module)
- Wheel Speed Sensors (wheel speed sensor) - Four sensors (one sensor at each wheel making it a four-channel system)

The purpose of the ABS is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.

Operation

ABS Braking

- ABS operation is available at all vehicle speeds above 20 km/h. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation. The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors at each wheel and received at the ABS Module.
- There are a few performance characteristics of the ABS that may at first seem abnormal, but in fact are normal. These characteristics are described below.
 - If the electrical system malfunctions, the Fail-Safe function is activated, the ABS becomes inoperative and the ABS warning lamp turns on.
 - During ABS operation, the brake pedal may vibrate lightly and a mechanical noise may be heard. This is normal.
 - Stopping distance may be longer than that of vehicles without ABS when vehicle drives on rough, gravel, or snow-covered (fresh, deep snow) roads.

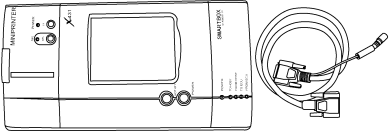
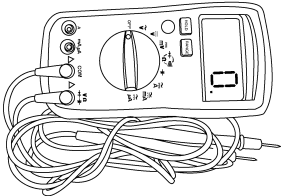
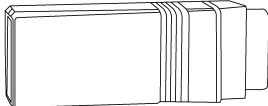
Specifications

Torque Specifications

DESCRIPTION	TORQUE (N·m)
ABS Mounting Bolt (To Bracket)	10
ABS Mounting Bracket Screws (To Frame)	20
ABS Mounting Bracket Screw And Nut (To Frame)	20
ABS Wheel Speed Sensor Head Mounting Screw - Rear	10
Brake Tube Nuts	10
Wheel Mounting Nuts	110

GENERAL INFORMATION

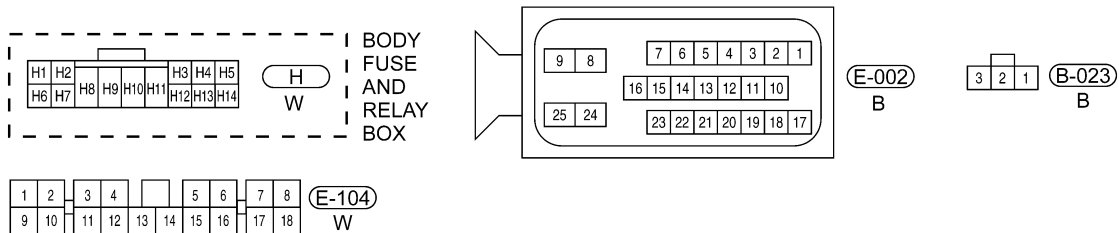
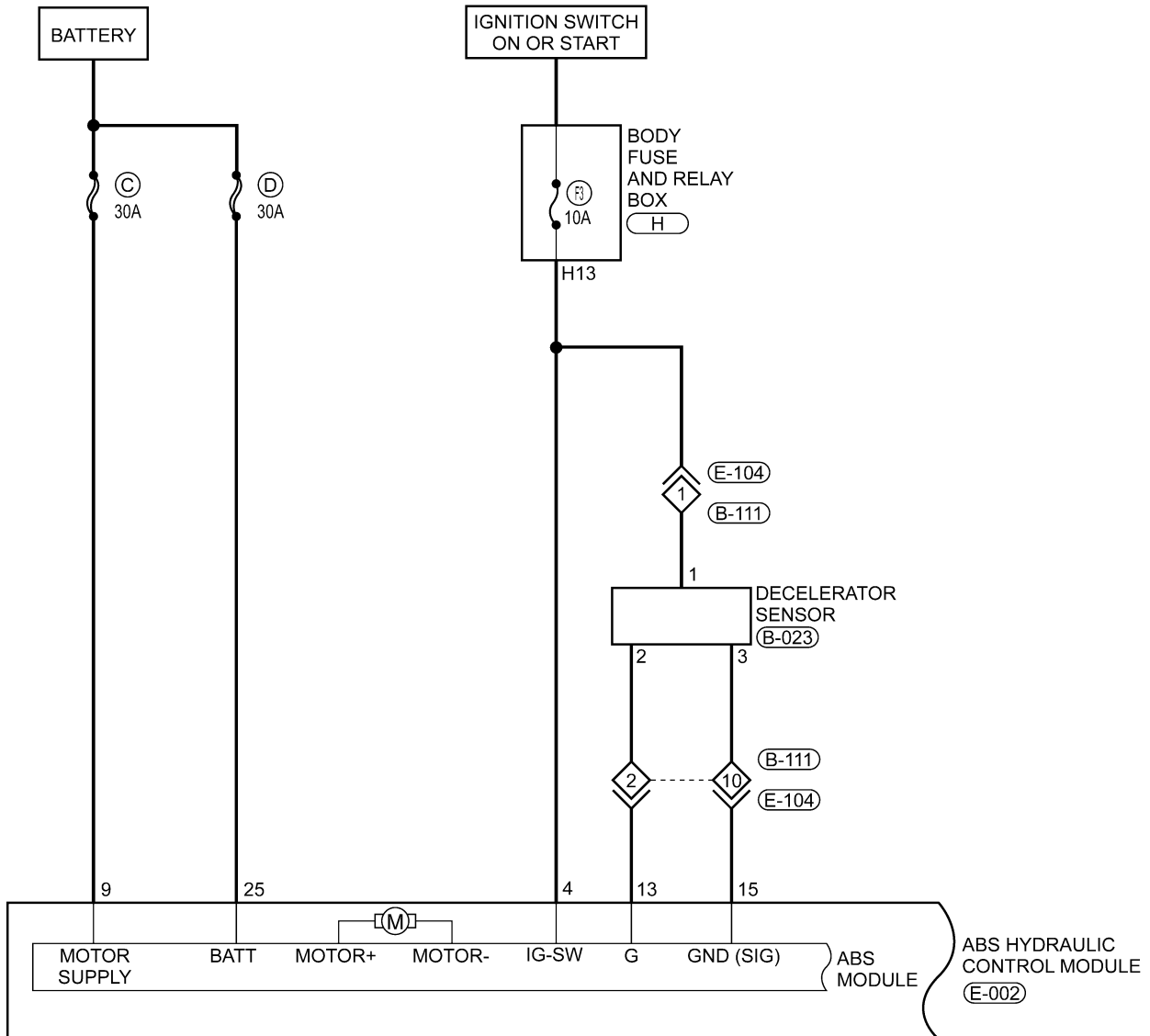
Special Tools

Diagnostic Scan Tool X-431	 Diagram of a Diagnostic Scan Tool X-431, showing the device and its associated cables. besm030001
Digital Multimeter Fluke 15B & 17B	 Diagram of a Digital Multimeter, showing the device and its associated cables. besm030002
CAN-BUS II Diagnostic Connector	 Diagram of a CAN-BUS II Diagnostic Connector, showing the connector and its associated cables. besm120036

Electrical Schematics

Antilock Brake System - 1.6L / 1.8L (Page 1 of 3)

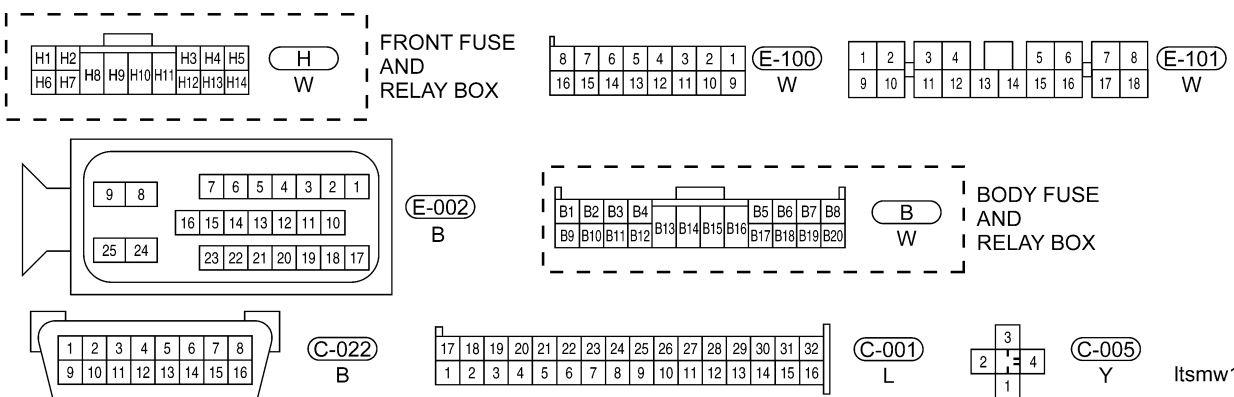
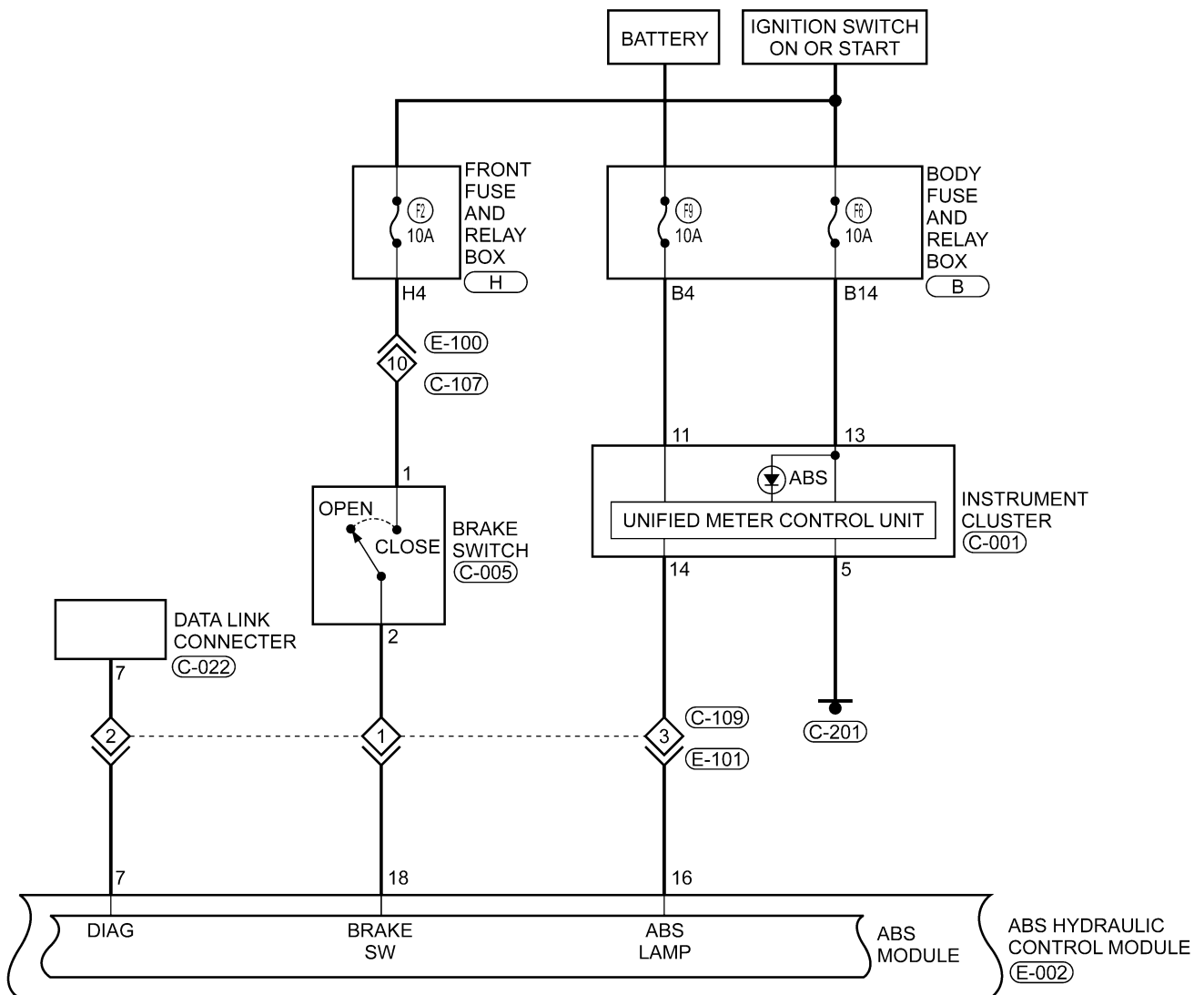
BRAKE CONTROL SYSTEM - WITH 1.6L-1.8L



Itsmw120019t

GENERAL INFORMATION

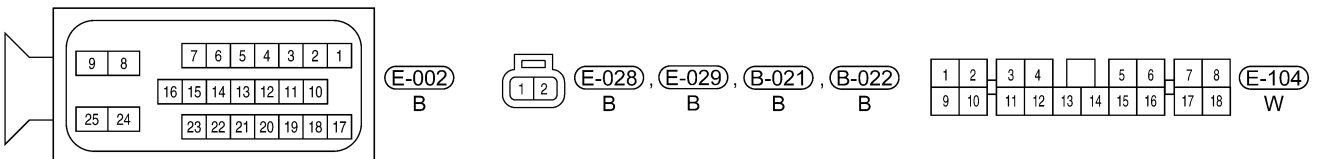
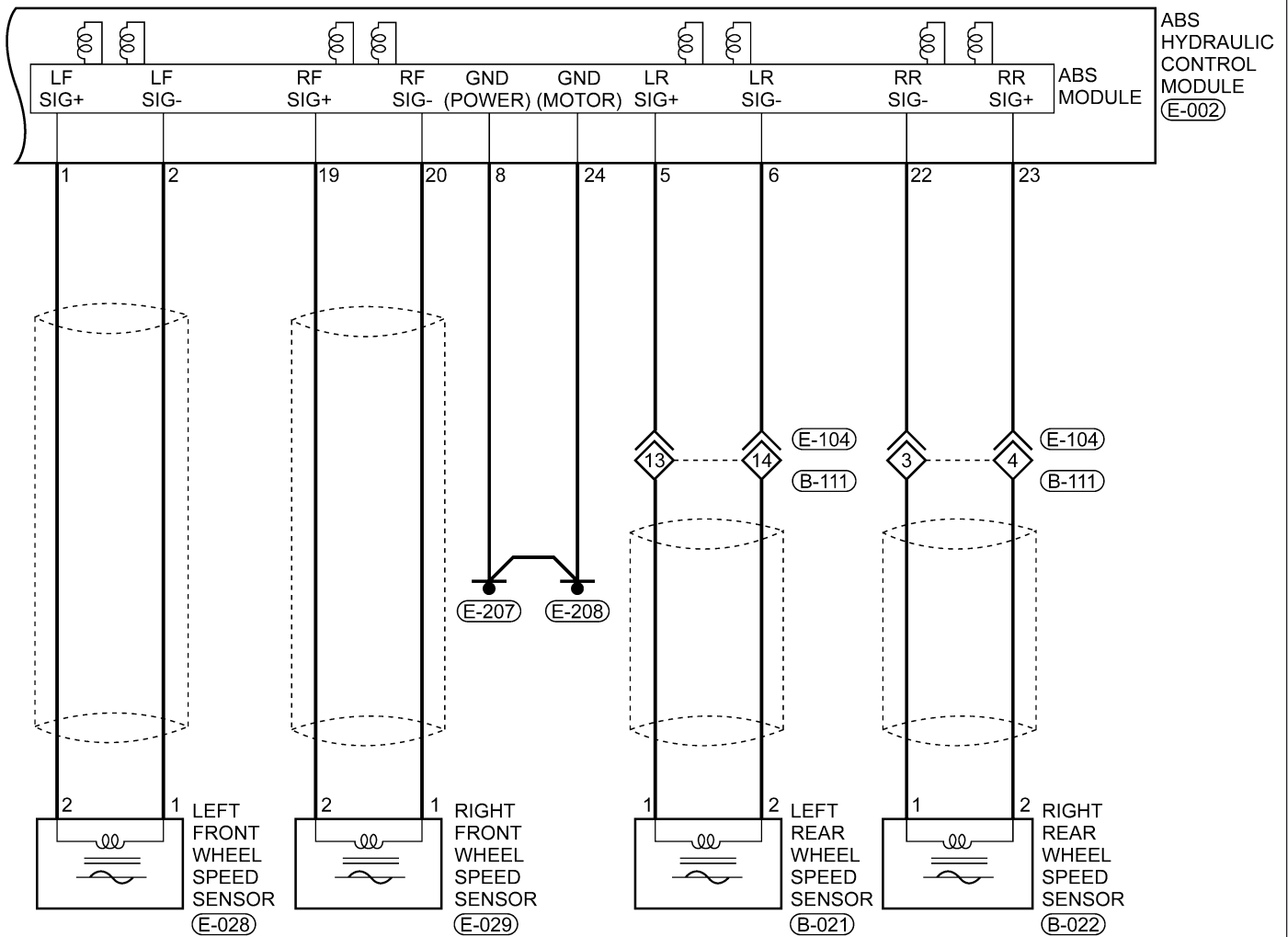
Antilock Brake System - 1.6L / 1.8L (Page 2 of 3)



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GENERAL INFORMATION

Antilock Brake System - 1.6L / 1.8L (Page 3 of 3)



ltsmw120021t

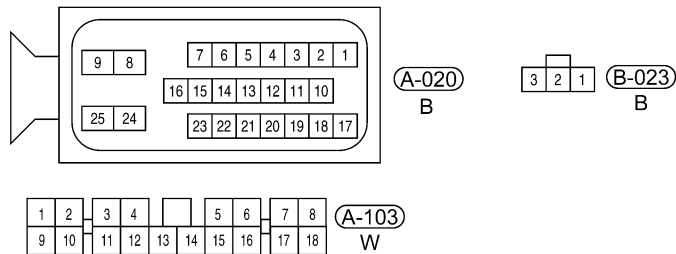
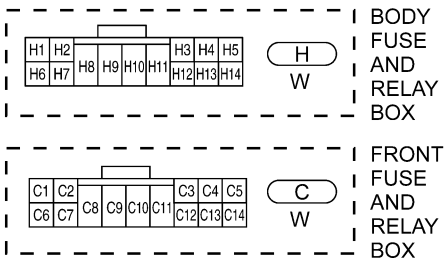
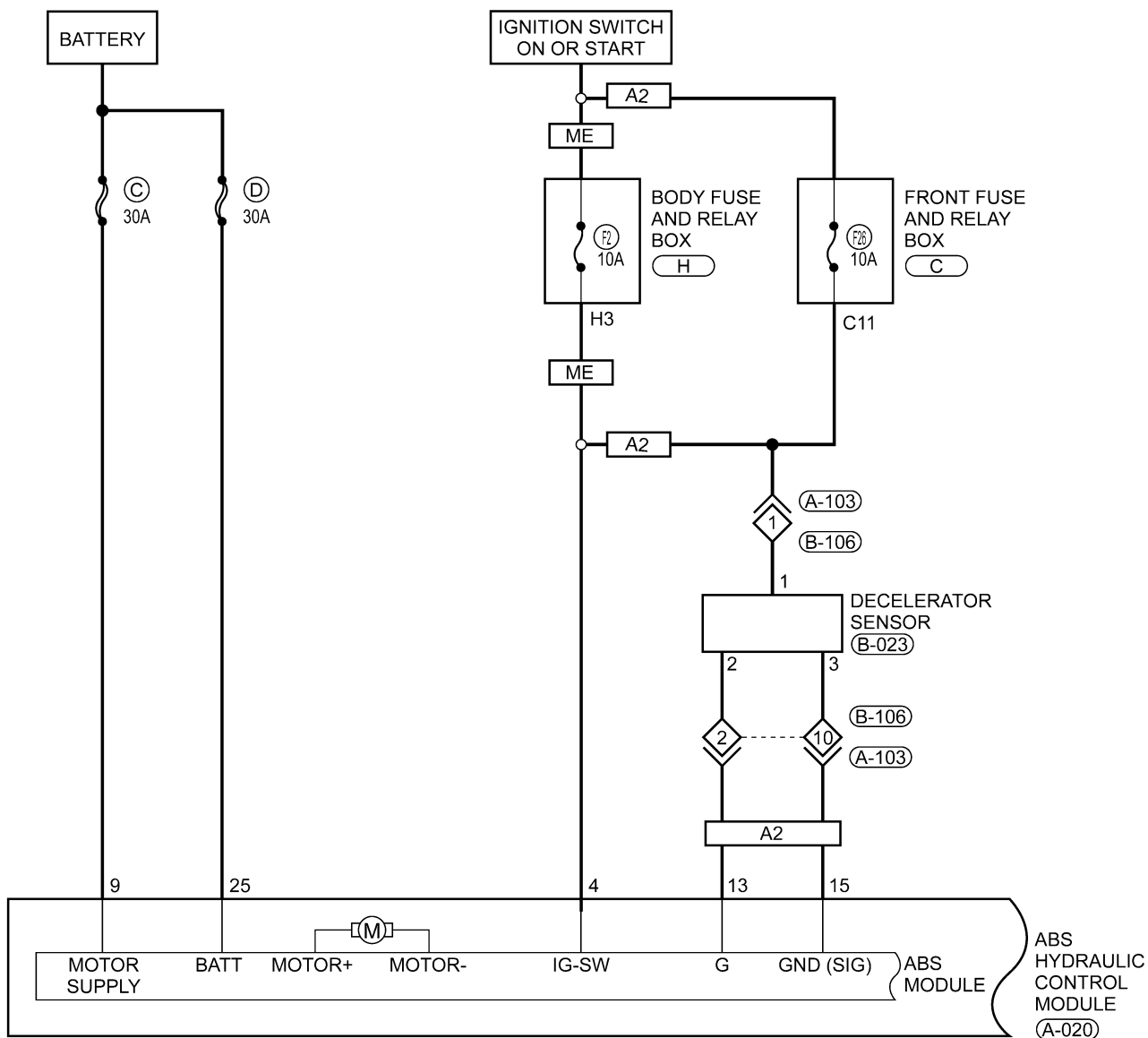
GENERAL INFORMATION

Antilock Brake System - 2.0L / 2.4L (Page 1 of 3)

BRAKE CONTROL SYSTEM - WITH 2.0L-2.4L

A2 : WITH ACTECO 2.0L ENGINE SYSTEM

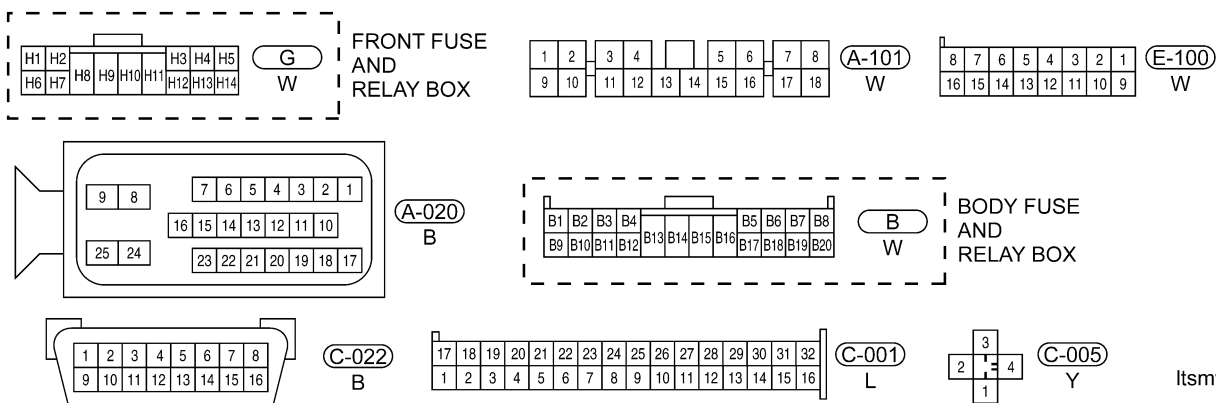
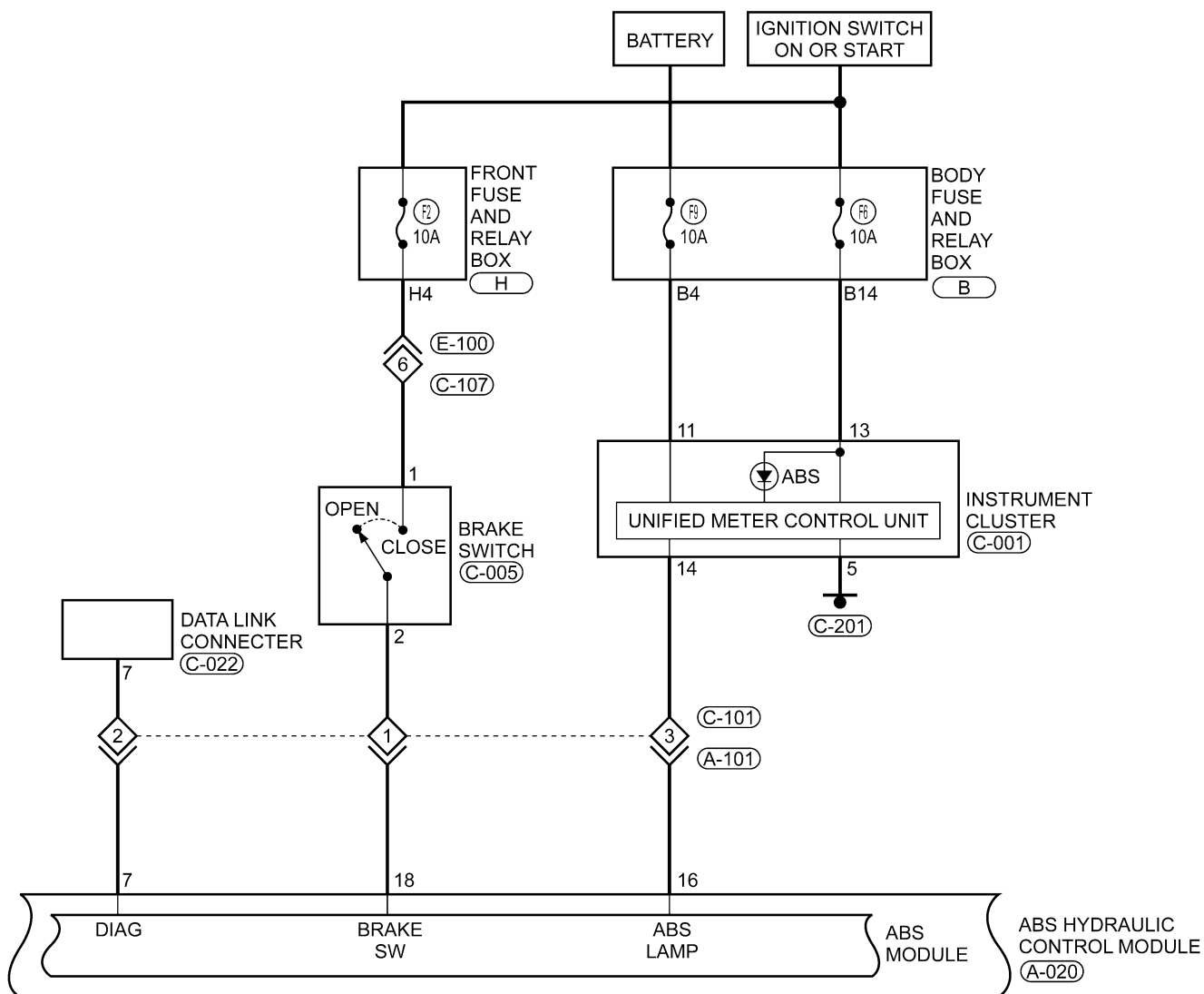
ME : WITH MITSUBISHI 2.4L ENGINE SYSTEM



Itsnmw120022t

GENERAL INFORMATION

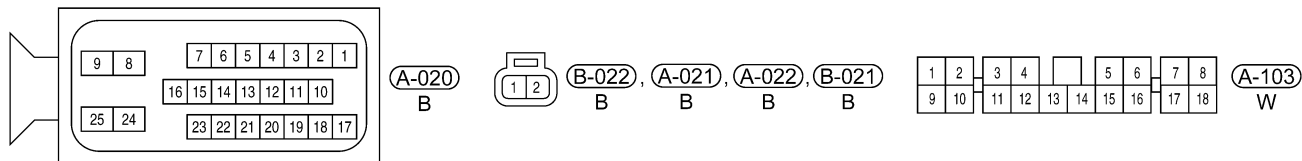
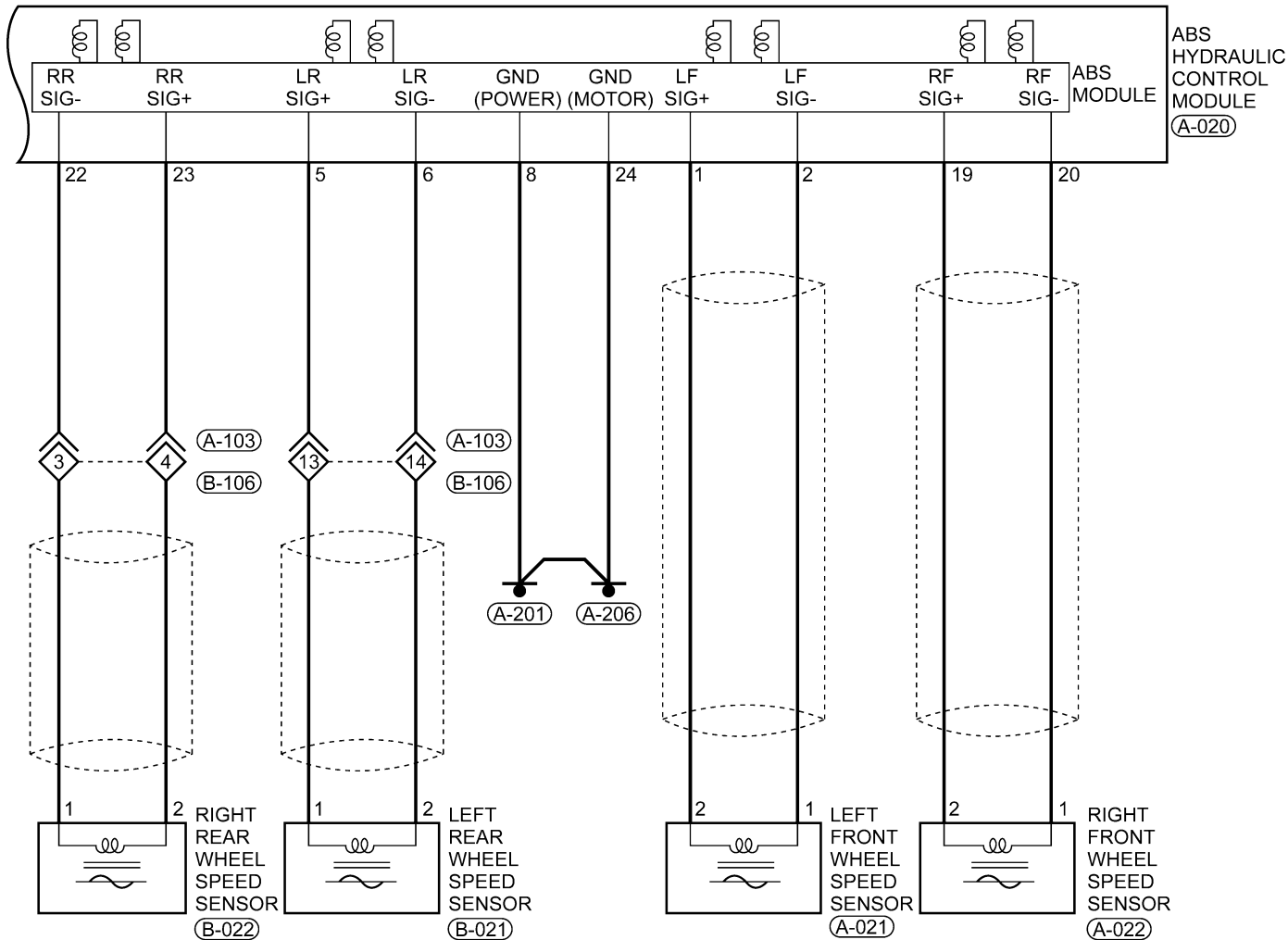
Antilock Brake System - 2.0L / 2.4L (Page 2 of 3)



ltsmw120023t

GENERAL INFORMATION

Antilock Brake System - 2.0L / 2.4L (Page 3 of 3)



ltsmw120024t

GENERAL INFORMATION

Antilock Brake System (ABS) Module Connector Pin-Out Table

ABS Hydraulic Control Module Connector Pin-Out Table

PIN	CIRCUIT IDENTIFICATION	PIN	CIRCUIT IDENTIFICATION
1	Front Wheel Speed Sensor LH +	14	-
2	Front Wheel Speed Sensor LH -	15	Decelerator Sensor (GND)
3	-	16	ABS Lamp
4	Ignition Switch	17	-
5	Rear Wheel Speed Sensor LH +	18	Brake Switch
6	Rear Wheel Speed Sensor LH -	19	Front Wheel Speed Sensor RH +
7	Diagnostic Link K	20	Front Wheel Speed Sensor RH -
8	GND (Power)	21	-
9	Continuous Supply Voltage (Motor)	22	Rear Wheel Speed Sensor RH +
10	-	23	Rear Wheel Speed Sensor RH -
11	-	24	GND (Motor)
12	-	25	Continuous Supply Voltage
13	Decelerator Sensor (G)	-	-

DIAGNOSIS & TESTING

Diagnostic Help

Diagnostic Help

1. The X-431 scan tool connects to the Data Link Connector (DLC) and communicates with the vehicle electronic modules through the vehicle data circuits.
2. Confirm that the malfunction is current and carry-out the diagnostic tests and repair procedures.
3. If the Diagnostic Trouble Code (DTC) cannot be deleted, it is a current fault.
4. Use a digital multimeter to perform voltage readings on electronic systems.
5. Refer to any Technical Bulletins that may apply to the failure.
6. Visually inspect the related electrical wiring harness.
7. Perform a voltage drop test on the related circuits between the suspected component and the ABS module.
8. Inspect and clean all ECM, ABS, engine, and chassis grounds that are related to the most current DTC.
9. If numerous trouble codes were set, use an electrical schematic and look for any common ground circuits or voltage supply circuits that may apply to the DTC.
10. For any wheel speed sensor DTCs, inspect for dirt/metal debris.
11. Use the scan tool to perform a System Test if one applies to the failed component.

Intermittent DTC Troubleshooting

If the failure is intermittent perform the following:

- Check for loose connectors.
- Look for any chafed, pierced, pinched, or partially broken wires.
- Monitor the scan tool data relative to this circuit.
- Wiggle the related electrical wiring harness and connectors while looking for an interrupted signal on the affected circuit.
- If possible, try to duplicate the conditions under which the DTC set.
- Look for the data to change or for the DTC to reset during the wiggle test.
- Look for broken, bent, pushed out or corroded terminals.
- Inspect the sensor and mounting area for any condition that would result in an incorrect signal, such as damage, foreign material.
- A data recorder, and/or oscilloscope should be used to help diagnose intermittent conditions.
- Remove the ABS module from the troubled vehicle and install in a new vehicle and test. If the DTC cannot be deleted, the ABS module is malfunctioning. If the DTC can be deleted, return the ABS module to the original vehicle.

Ground Inspection

Ground connections are very important to the proper operation of electrical and electronic circuits. Ground connections are often exposed to moisture, dirt and other corrosive elements. The corrosion (rust) can become an unwanted resistance. This added resistance can alter the way a circuit works.

Electronically controlled circuits are very sensitive to proper grounding. A loose or corroded ground can drastically affect an electronically controlled circuit. A poor or corroded ground can affect the circuit. Perform the following when inspecting a ground connection:

1. Remove the ground bolt or screw.
2. Inspect all mating surface for tarnish, dirt, rust, etc.
3. Clean as required to assure good contact.
4. Reinstall bolt or screw securely.
5. Inspect for "add-on" accessories which may be interfering with the ground circuit.
6. If several wires are crimped into one ground eyelet terminal, check for proper crimps. Make sure all of the wires are clean, securely fastened and providing a good ground path. If multiple wires are crimped to one eyelet, make sure no excess wire insulation has been crimped creating a bad ground.

Diagnostic Tools

- Diagnostic Scan Tool X-431
- Digital Multimeter
- Jumper Wire

Diagnostic Trouble Code (DTC) List

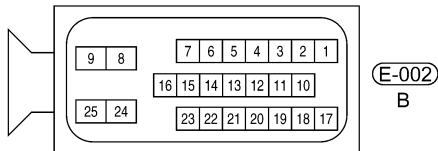
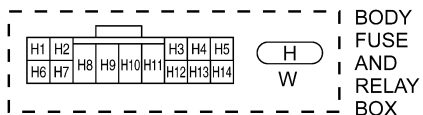
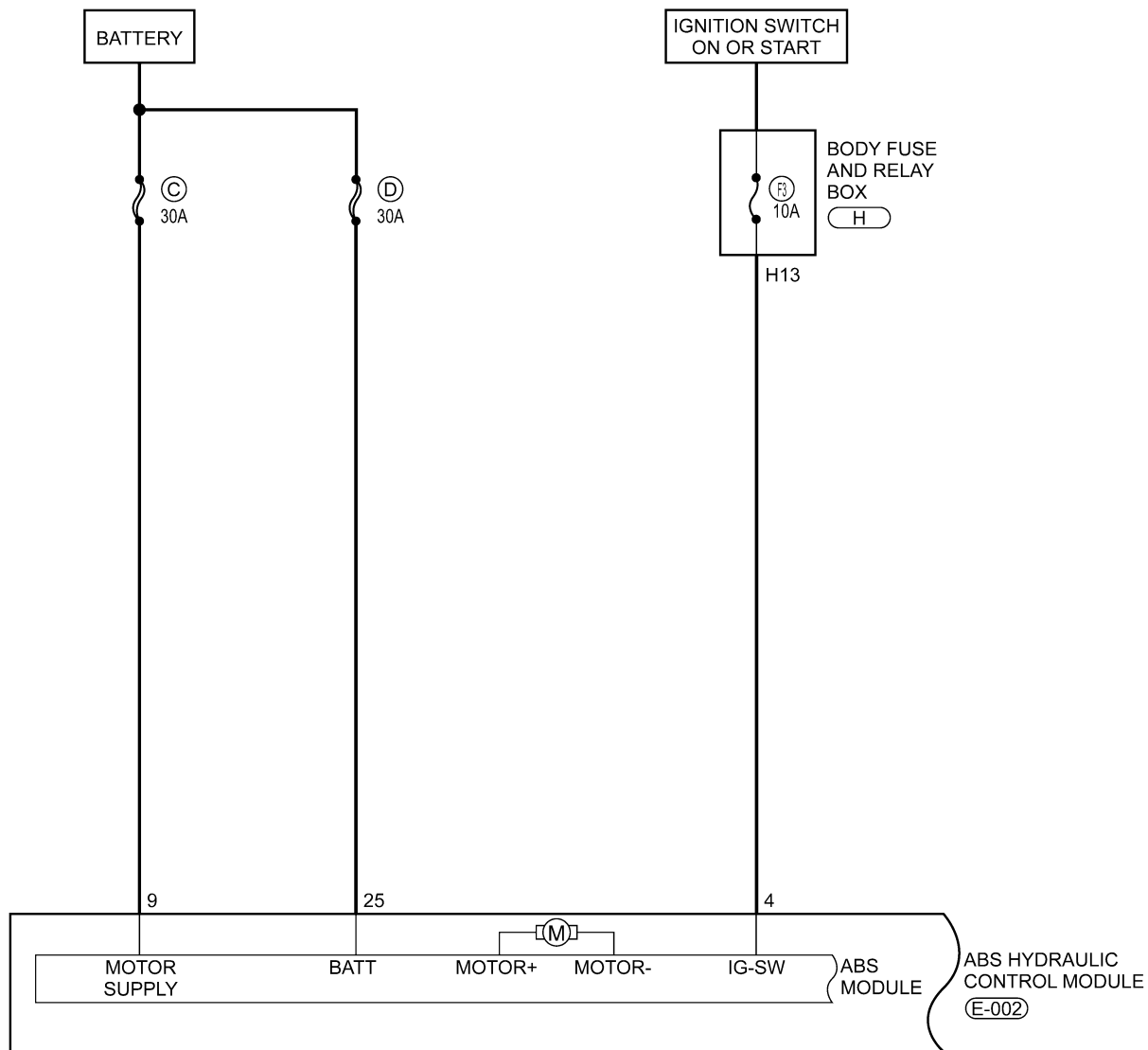
Antilock Brake System DTC List

DTC NUMBER	DTC DEFINITION
C1101	Battery Voltage High (>18 Volt)
C1102	Battery Voltage Low (<18 Volt)
C1200	Left Front Wheel Speed Sensor Circuit Open or Short to Ground
C1201	Range/Performance: Speed Jump Or Damaged Exciter
C1202	No Signal: Air-Gap Error Or Wrong Exciter
C1203	Right Front Wheel Speed Sensor Circuit Open or Short to Ground
C1204	Range/Performance: Speed Jump Or Damaged Exciter
C1205	No Signal: Air-Gap Error Or Wrong Exciter
C1206	Left Rear Wheel Speed Sensor Circuit Open or Short to Ground
C1207	Range/Performance: Speed Jump Or Damaged Exciter
C1208	No Signal: Air-Gap Error Or Wrong Exciter
C1209	Right Rear Wheel Speed Sensor Circuit Open or Short to Ground
C1210	Range/Performance: Speed Jump Or Damaged Exciter
C1211	No Signal: Air-Gap Error Or Wrong Exciter
C1275	G Sensor Open Or Short To Ground
C1274	G Sensor Signal Fixed Signal
C1604	ECU Hardware: ECU Internal Or Valve Failure
C2112	Valve Relay: Valve Relay Or Fuse Failure
C2402	Motor - Electrical: Open Or Short To Battery, Motor Relay, Fuse Or Motor Lock Fail

Diagnostic Trouble Code (DTC) Tests

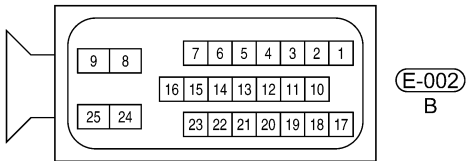
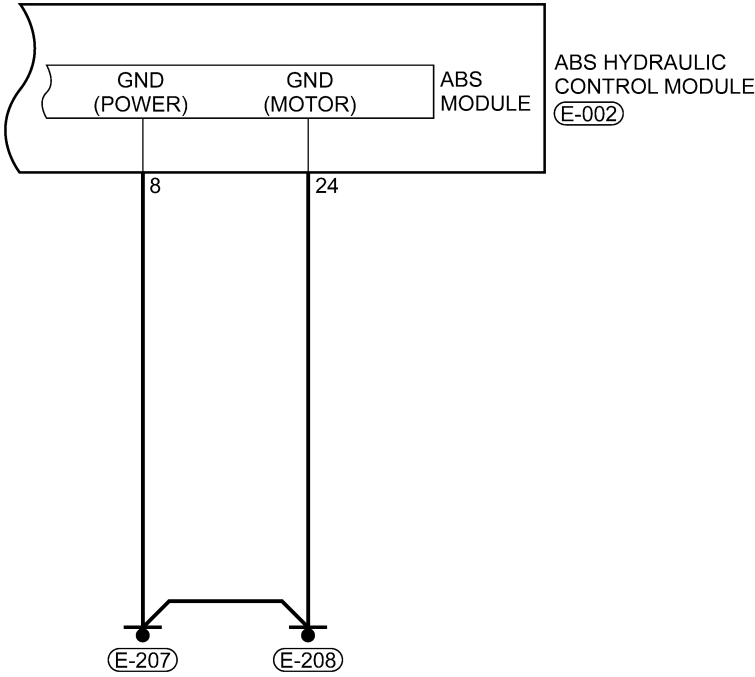
C1101 - Battery Voltage High, C1102 - Battery Voltage Low

BRC - 1.6L - 1.8L - PWR - 01



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BRC - 1.6L - 1.8L - PWR - 02

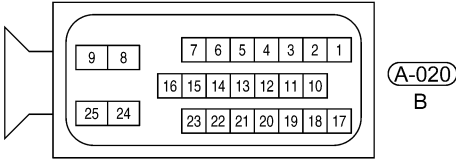
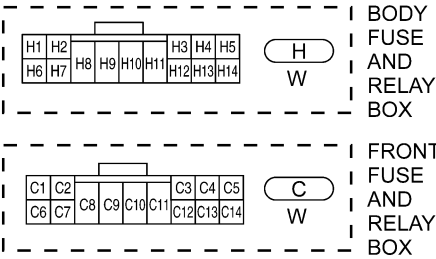
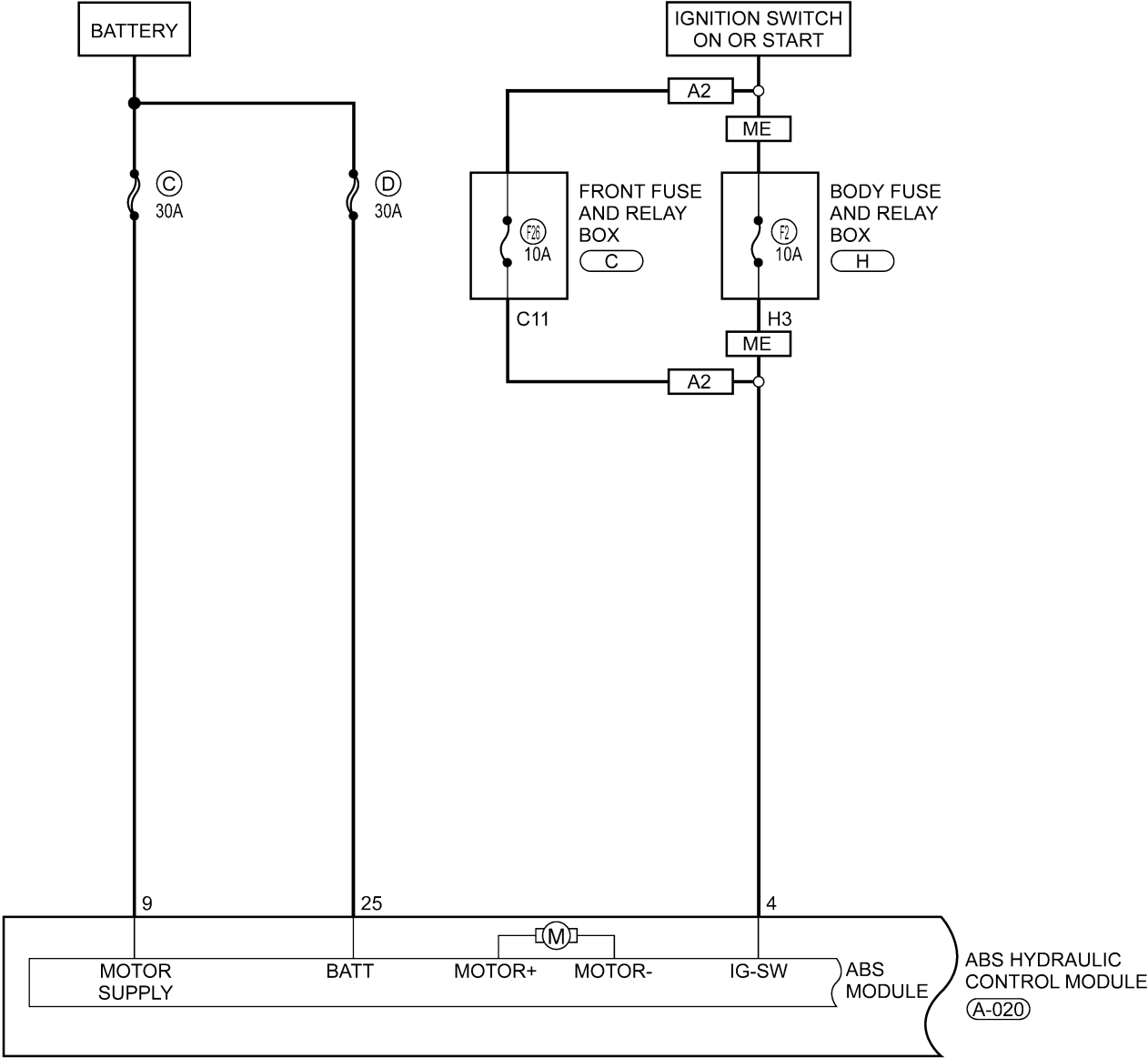


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DIAGNOSIS & TESTING

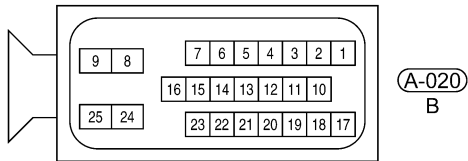
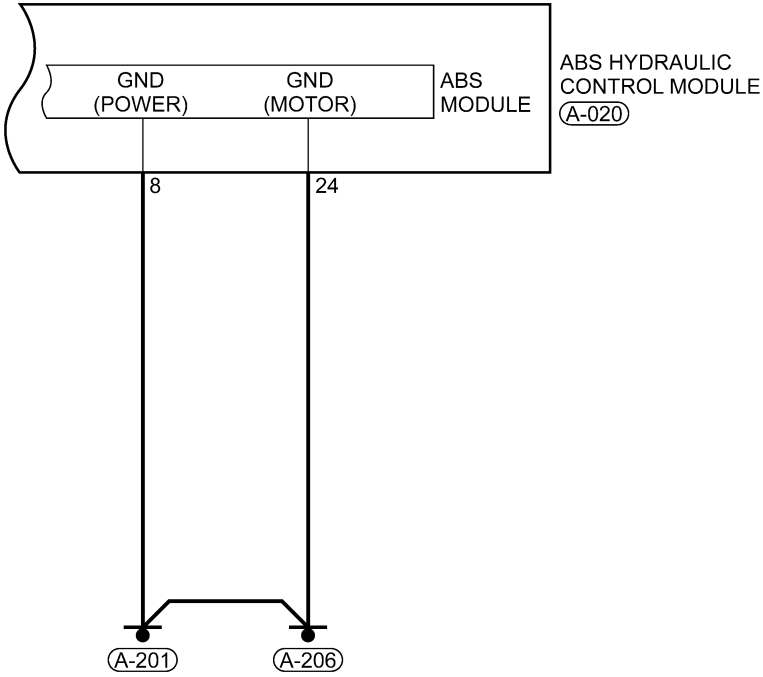
BRC - 2.0L - 2.4L - PWR - 01

A2 : WITH ACTECO 2.0L ENGINE SYSTEM
ME : WITH MITSUBISHI 2.4L ENGINE SYSTEM



Itsmw120002t

BRC - 2.0L - 2.4L - PWR - 02



ltsmw120003t

DIAGNOSIS & TESTING

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSES
C1101	Battery Voltage High (Above 18 V)	Ignition switch: ON	ABS module detected that the battery voltage is excessively high.	• Charging system • ABS module
C1102	Battery Voltage Low (Below 9.5 V)		ABS module detected that the battery voltage is excessively low.	• Battery • Harness is shorted • Charging system • ABS module

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Start the engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Turn ignition switch ON then select view DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK GROUND CONNECTIONS

- Turn ignition switch off.
- Loosen and retighten ground screws on the body (See Ground Inspection in Section 12 Brakes).
- The ground connections E-207 and E-208 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness With 1.6L & 1.8L Engine in Section 16 Wiring).
- The ground connections A-201 and A-206 mounting position (See Vehicle Wiring Harness Layout - Engine Room Harness With 2.0L & 2.4L Engine in Section 16 Wiring).

Are the ground connections OK?

Yes >> Go to the next step.

No >> Repair or replace the ground connections.

2. CHECK ABS MODULE ELECTRICAL CONNECTOR

- Disconnect the ABS module electrical connector.
- Inspect the electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.

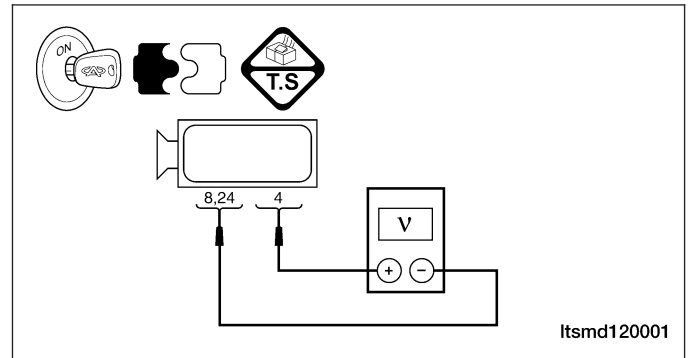
3. CHECK ABS MODULE POWER SUPPLY

- Turn ignition switch on
- Check ABS module power supply between terminal 4 and terminal 8, 24 in the ABS module electrical connector A-020 or E-002 terminal side.

Is the voltage between 9.4 - 17 V?

Yes >> Replace the ABS module.

No >> If the voltage is less than 9.4 V, go to step 4.
If the voltage is more than 17 V, go to step 7.



4. CHECK SYSTEM VOLTAGE

- Connect ABS module connector.
- Start the engine, raise the speed over 1000 RPM.
- Measure the charging voltage at the battery positive and negative terminals.

Is the voltage less than 9.4 V?

Yes >> Replace the AC generator.

No >> Go to the next step.

5. CHECK THE BATTERY

- Start the engine, raise the engine speed to over 1000 RPM for a few minutes.
- Turn ignition switch off.
- Measure the voltage drop at the battery positive and negative terminals while cranking the engine.
- Battery voltage should be more than approximately 9.4 V.

Is the check result normal?

Yes >> Go to step 6.

No >> Charge or replace the battery.

6. CHECK ABS MODULE POWER SUPPLY CIRCUIT

- Measure the continuity between the ABS module terminal 4 and the battery positive terminal.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Check fuse.
Check the harness.
Check all related components.

7. CHECK SYSTEM VOLTAGE

- Maintain engine speed to over 1000 RPM.
- Measure the charging voltage at the battery positive and negative terminals.

Is the voltage more than 17 V?

Yes >> Replace the AC generator.

No >> Go to the next step.

8. CHECK DTC

- With the X-431 scan tool, read ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

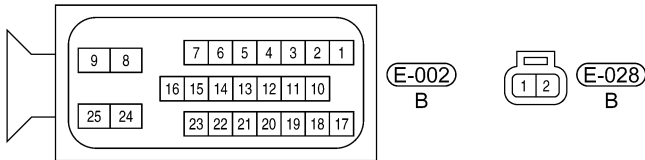
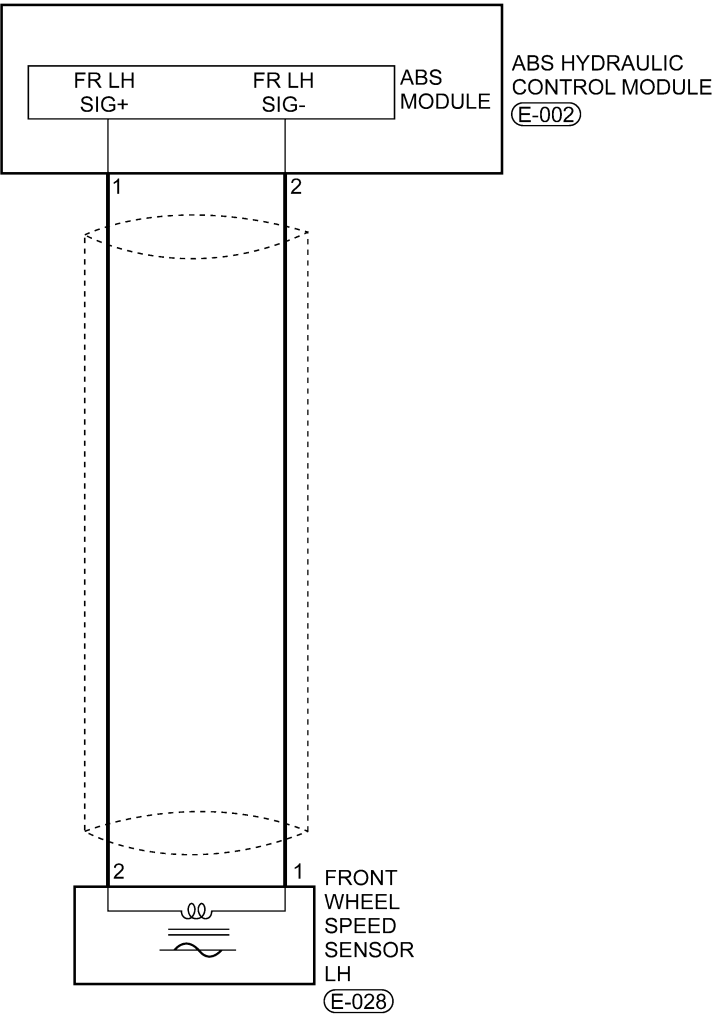
Is DTC C1101 or C1102 still present?

Yes >> Replace the ABS module.

No >> The system is now operating properly.
Erase all codes and test drive the vehicle to verify the repair is complete.

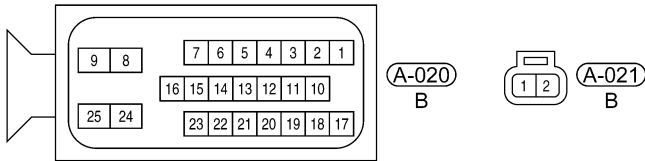
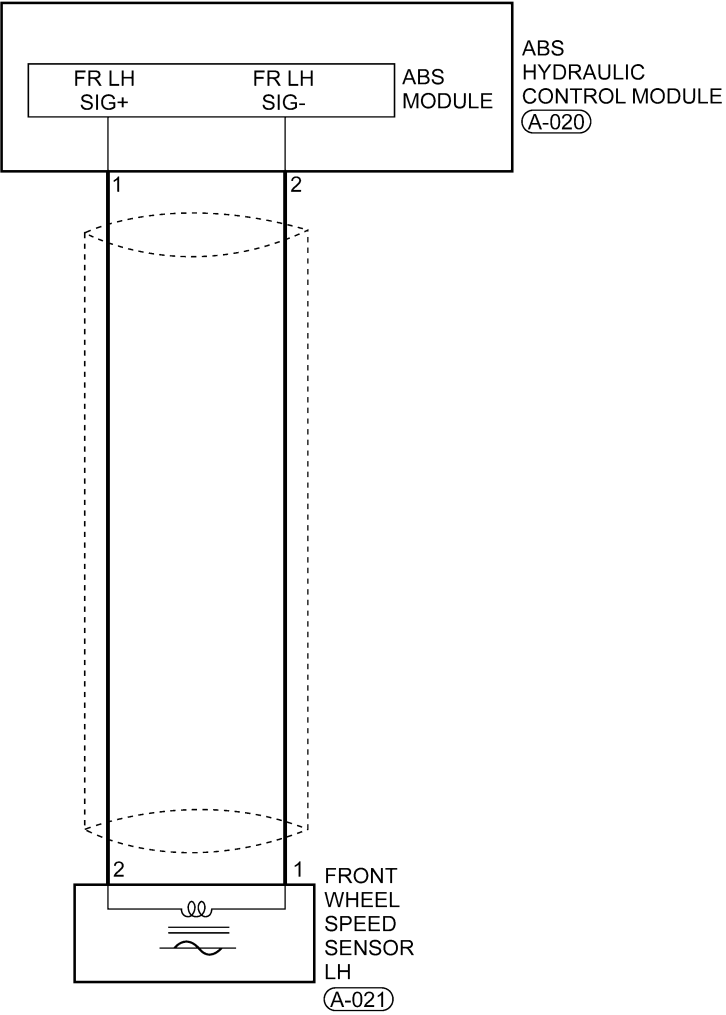
C1200 - Left Front Wheel Speed Sensor Circuit Open or Shorted

BRC - 1.6L - 1.8L - FLS - 01



DIAGNOSIS & TESTING

BRC - 2.0L - 2.4L - FLS - 01



ltsmw120004t

DIAGNOSIS & TESTING

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
C1200	Left front wheel speed sensor circuit open or shorted	• Ignition switch: ON • Vehicle: Running	ABS module detected that the Left Front wheel speed sensor input signal to ABS module is open or shorted.	• Left Front wheel speed sensor • Harness is open or shorted • ABS module

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Cycle the ignition switch from off to on.
- Start the engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Start the engine. With the scan tool connected to the DLC, drive the vehicle over 40 km/h (25 mph).

NOTE :

Vehicle must be driven above 40 km/h (25 mph) for fault setting conditions to be met.

- With the scan tool select: View ABS Data Stream and DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).
- Erase all codes and test drive the vehicle to verify the repair is complete.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK ABS MODULE DTC

- With the scan tool select: View ABS Data Stream.
- With an assistant driving the vehicle, check the following data stream list items while driving the vehicle over 40 km/h (25 mph).
 - Left Front Wheel Speed
 - Right Front Wheel Speed
 - Left Rear Wheel Speed
 - Right Rear Wheel Speed
- With the scan tool, read active DTCs in the ABS module.

Is DTC C1200 present and the Left Front Wheel Speed signal abnormal?

Yes >> Go to the next step.

No >> The condition that caused this DTC to set is currently not present (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

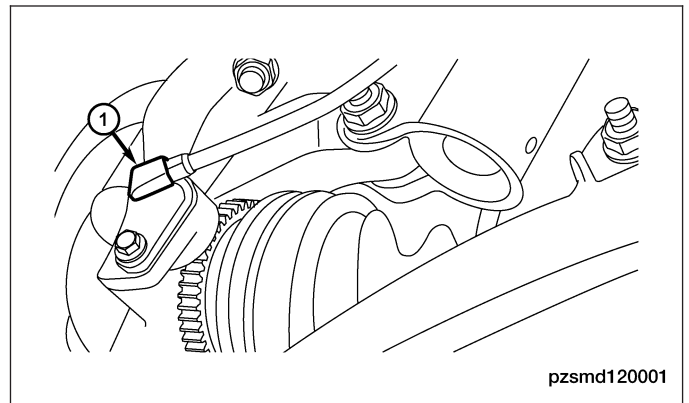
2. CHECK LEFT FRONT WHEEL SPEED SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the wheel speed sensor (1) electrical connector.
- Inspect the wheel speed sensor electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



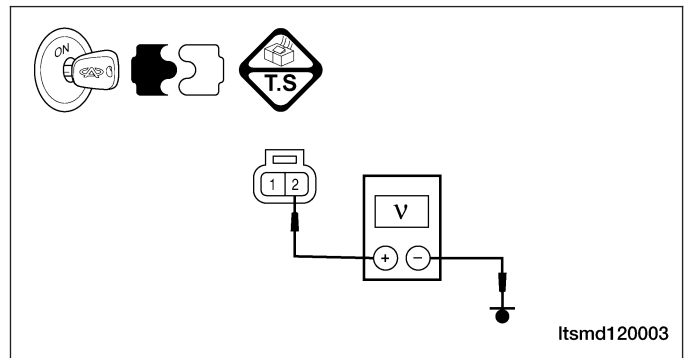
3. CHECK LEFT FRONT WHEEL SPEED SENSOR REFERENCE SIGNAL CIRCUIT

- Turn ignition switch on.
- Measure the sensor reference voltage between terminal 2 of the wheel speed sensor connector, terminal side and ground.
- Voltage should exist (2.0 - 4.0 V).

Is the proper voltage present?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open, short to ground or short to battery in connector or harness.



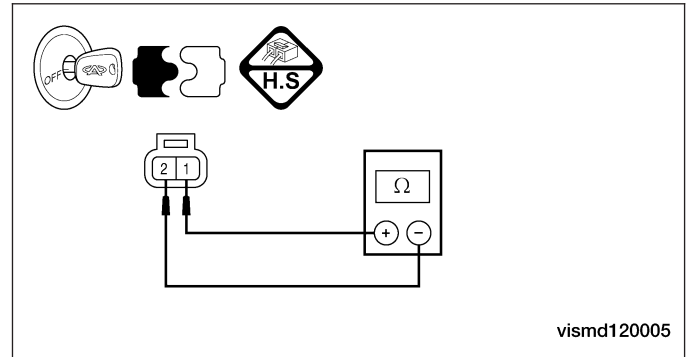
4. CHECK LEFT FRONT WHEEL SPEED SENSOR RESISTANCE

- Check the wheel speed sensor resistance between the sensor terminals 1 and 2, component side.

Is the sensor resistance 700 - 1500 ohms?

Yes >> Go to the next step.

No >> Replace the Left Front wheel speed sensor.



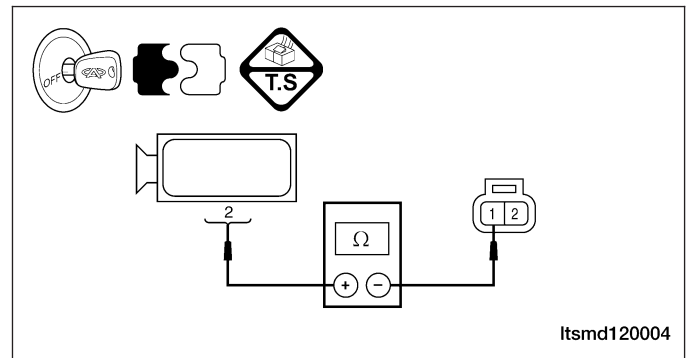
5. CHECK LEFT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Disconnect the ABS module electrical connector.
- For 1.6L/1.8L engine: Check the continuity between terminal 2 of the ABS module connector E-002, and terminal 1 of the Left Front wheel speed sensor connector E-028, terminal side.
- For 2.0L/2.4L engine: Check the continuity between terminal 2 of the ABS module connector A-020, and terminal 1 of the Left Front wheel speed sensor connector B-021, terminal side.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open.



6. CHECK LEFT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

- Check the continuity between terminal 1 of the Left Front wheel speed sensor connector, terminal side and ground.
- Continuity should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to ground.

7. CHECK LEFT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Check the voltage between terminal 1 of the Left Front wheel speed sensor connector, terminal side and ground.
- Voltage should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to battery.

8. CHECK DTC

- With the X-431 scan tool, read the ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

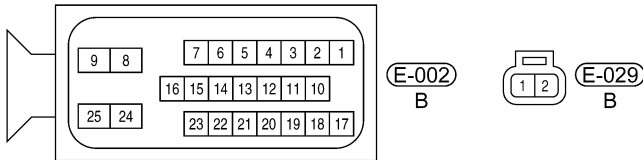
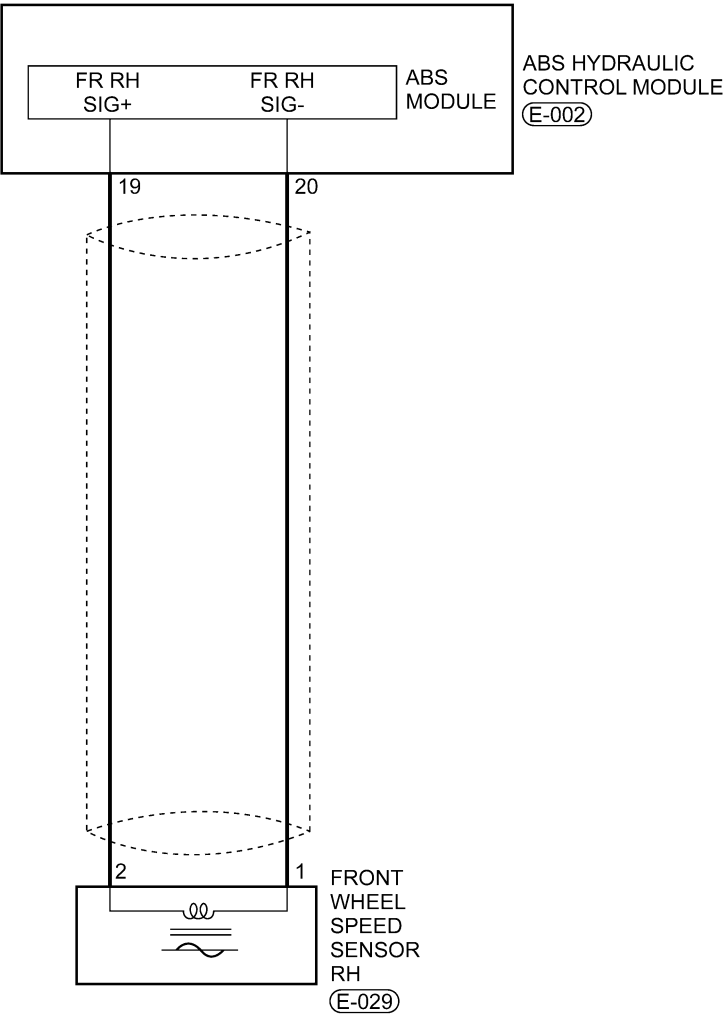
Is DTC C1200 present?

Yes >> Replace the ABS module (See ABS Module Removal & Installation in Section 12 Brakes).

No >> The system is now operating properly.
Erase all codes and test drive the vehicle to verify the repair is complete.

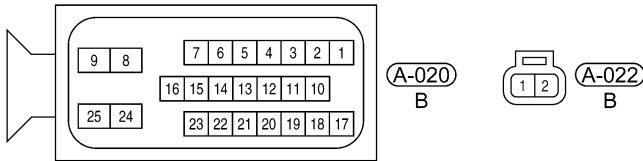
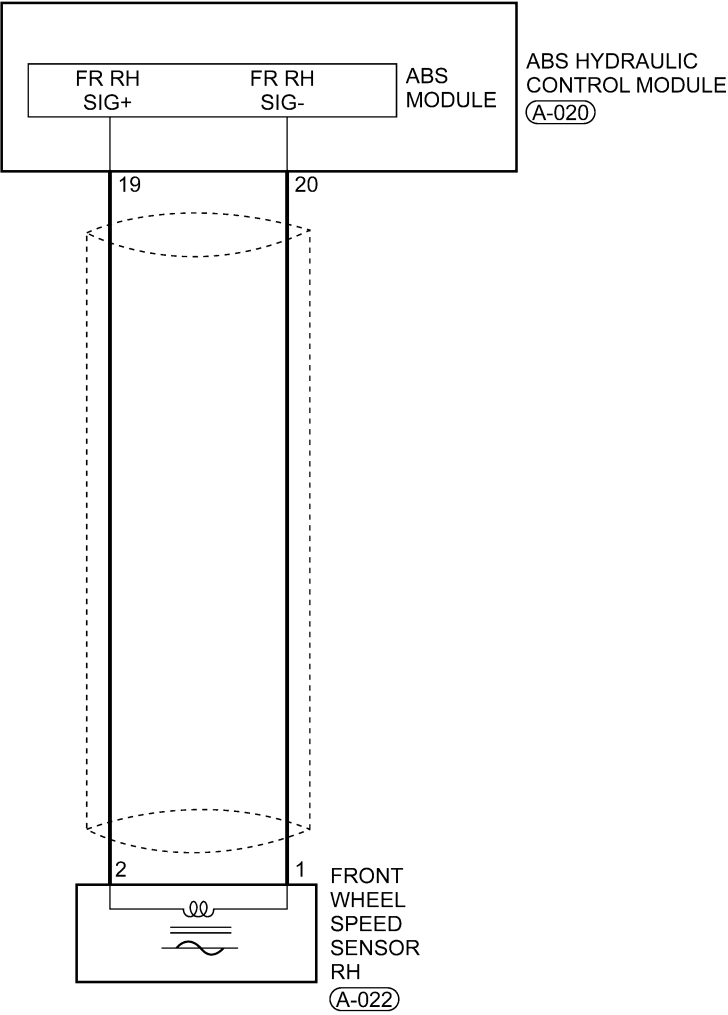
C1203 - Right Front Wheel Speed Sensor Circuit Open or Shorted

BRC - 1.6L - 1.8L - FRS - 01



DIAGNOSIS & TESTING

BRC - 2.0L - 2.4L - FRS - 01



ltsmw120005t

DIAGNOSIS & TESTING

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
C1203	Right front wheel speed sensor circuit open or shorted	• Ignition switch: ON • Vehicle: Running	ABS module detected that the Right Front wheel speed sensor input signal to ABS module is open or shorted.	• Right Front wheel speed sensor • Harness is open or shorted • ABS module

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Cycle the ignition switch from off to on.
- Start the engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Start the engine. With the scan tool connected to the DLC, drive the vehicle over 40 km/h (25 mph).

NOTE :

Vehicle must be driven above 40 km/h (25 mph) for fault setting conditions to be met.

- With the scan tool select: View ABS Data Stream and DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).
- Erase all codes and test drive the vehicle to verify the repair is complete.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK ABS MODULE DTC

- With the scan tool select: View ABS Data Stream.
- With an assistant driving the vehicle, check the following data stream list items while driving the vehicle over 40 km/h (25 mph).
 - Left Front Wheel Speed
 - Right Front Wheel Speed
 - Left Rear Wheel Speed
 - Right Rear Wheel Speed
- With the scan tool, read active DTCs in the ABS module.

Is DTC C1203 present and the Right Front Wheel Speed signal abnormal?

Yes >> Go to the next step.

No >> The condition that caused this DTC to set is currently not present (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

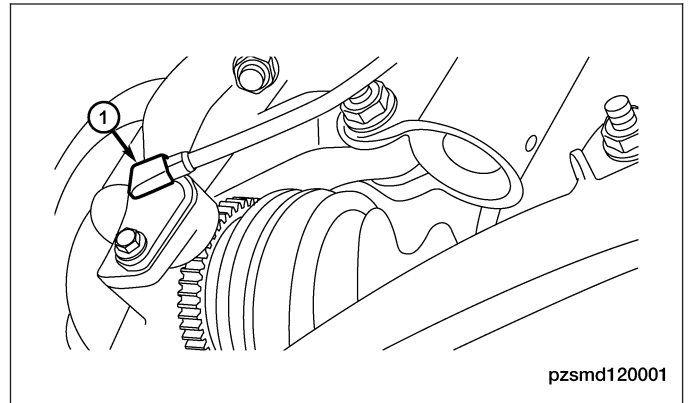
2. CHECK RIGHT FRONT WHEEL SPEED SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the wheel speed sensor (1) electrical connector.
- Inspect the wheel speed sensor electrical connector for damage.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.



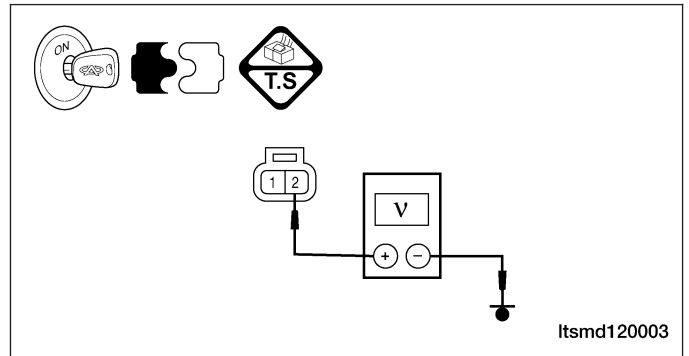
3. CHECK RIGHT FRONT WHEEL SPEED SENSOR REFERENCE SIGNAL CIRCUIT

- Turn ignition switch on.
- Measure the sensor reference voltage between terminal 2 of the wheel speed sensor connector, terminal side and ground.
- Voltage should exist (2.0 - 4.0 V).

Is the proper voltage present?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open, short to ground or short to battery in connector or harness.



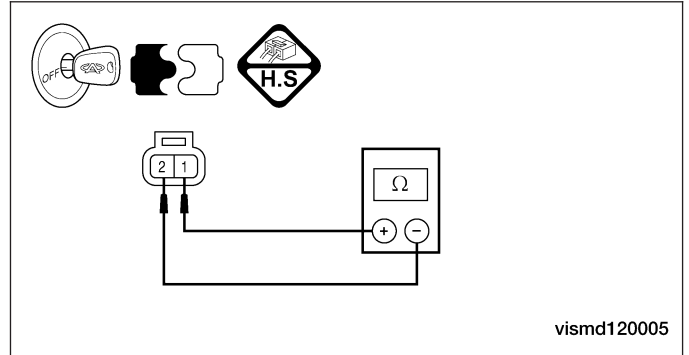
4. CHECK RIGHT FRONT WHEEL SPEED SENSOR RESISTANCE

- Check the wheel speed sensor resistance between the sensor terminals 1 and 2, component side.

Is the sensor resistance 700 - 1500 ohms?

Yes >> Go to the next step.

No >> Replace the Right Front wheel speed sensor.



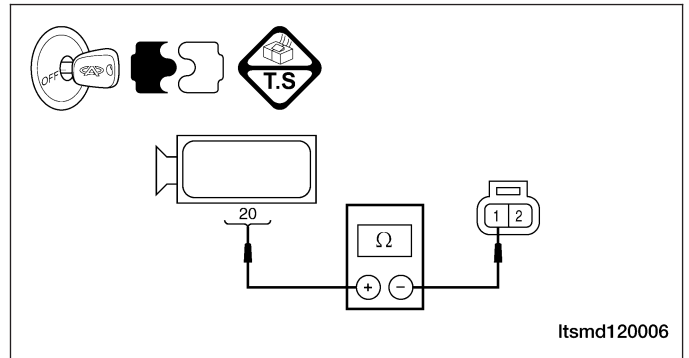
5. CHECK RIGHT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Disconnect the ABS module electrical connector.
- For 1.6L/1.8L engine: Check the continuity between terminal 20 of the ABS module connector E-002, and terminal 1 of the Right Front wheel speed sensor connector E-029, terminal side.
- For 2.0L/2.4L engine: Check the continuity between terminal 20 of the ABS module connector A-020, and terminal 1 of the Right Front wheel speed sensor connector A-022, terminal side.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open.



6. CHECK RIGHT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

- Check the continuity between terminal 1 of the Right Front wheel speed sensor connector, terminal side and ground.
- Continuity should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to ground.

7. CHECK RIGHT FRONT WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Check the voltage between terminal 1 of the Right Front wheel speed sensor connector, terminal side and ground.
- Voltage should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to battery.

8. CHECK DTC

- With the X-431 scan tool, read the ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

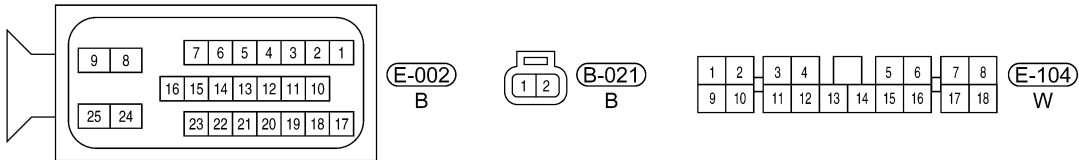
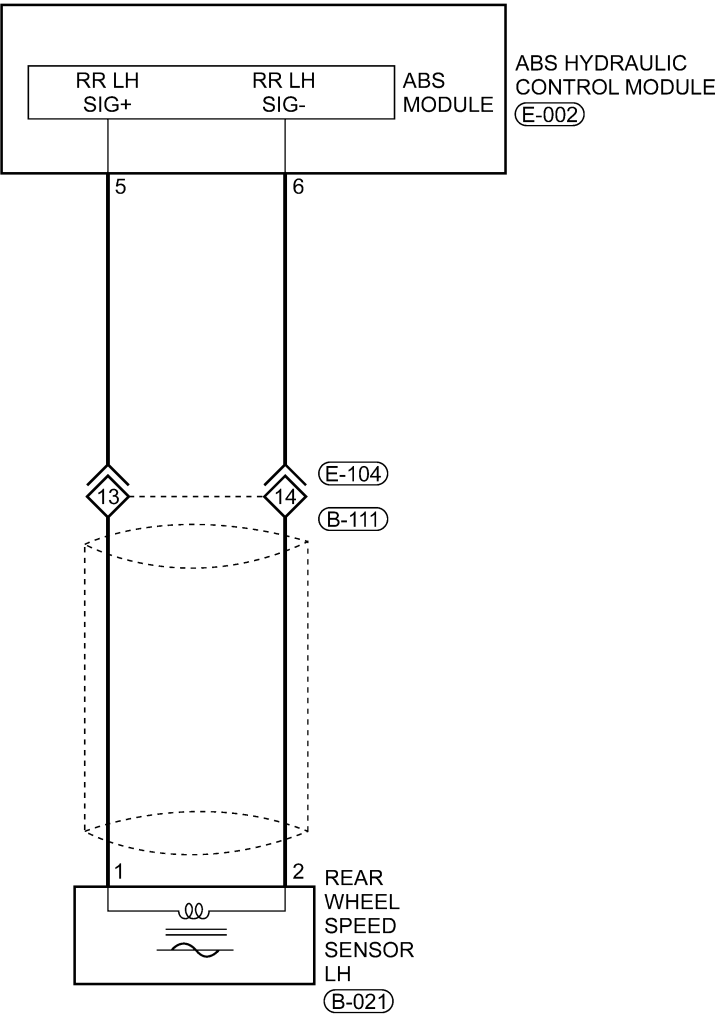
Is DTC C1203 present?

Yes >> Replace the ABS module (See ABS Module Removal & Installation in Section 12 Brakes).

No >> The system is now operating properly.
Erase all codes and test drive the vehicle to verify the repair is complete.

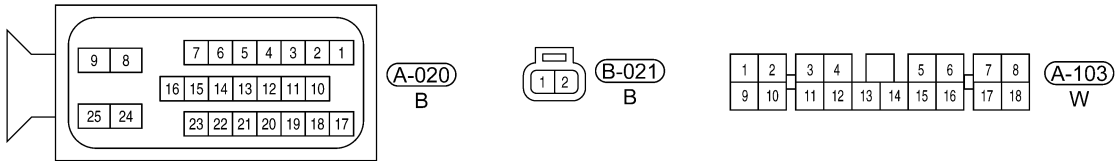
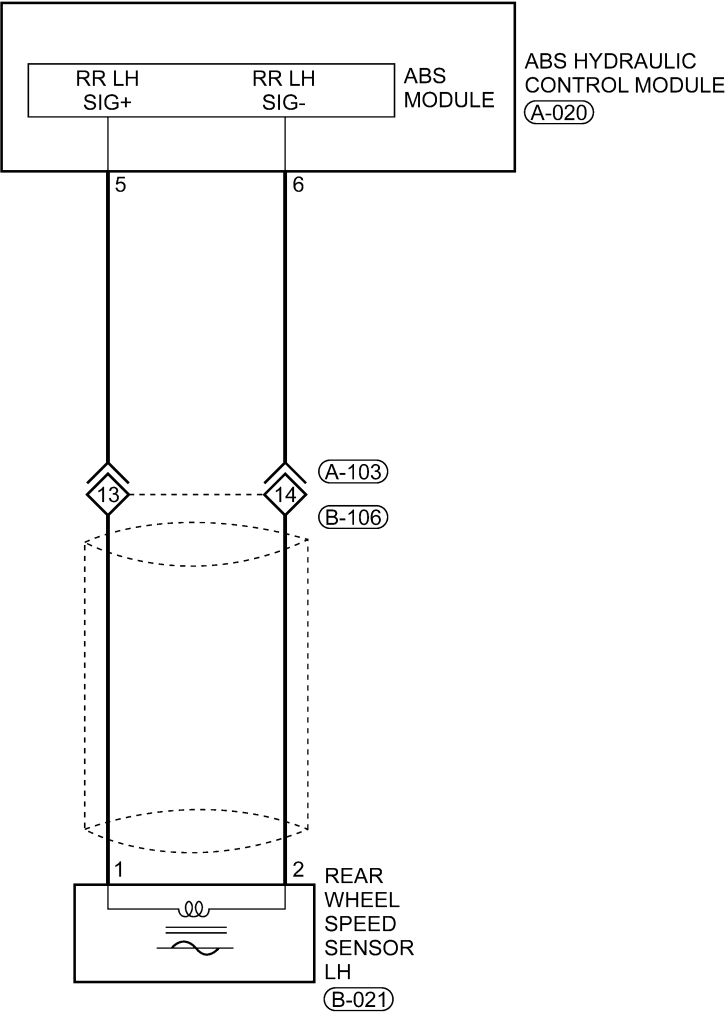
C1206 - Left Rear Wheel Speed Sensor Circuit Open or Shorted

BRC - 1.6L - 1.8L - RLS - 01



DIAGNOSIS & TESTING

BRC - 2.0L - 2.4L - RLS - 01



ltsmw120006t

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
C1206	Left rear wheel speed sensor circuit open or shorted	• Ignition switch: ON • Vehicle: Running	ABS module detected that the Left Rear wheel speed sensor input signal to ABS module is open or shorted.	• Left Rear wheel speed sensor • Harness is open or shorted • ABS module

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Cycle the ignition switch from off to on.
- Start the engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Start the engine. With the scan tool connected to the DLC, drive the vehicle over 40 km/h (25 mph).

NOTE :

Vehicle must be driven above 40 km/h (25 mph) for fault setting conditions to be met.

- With the scan tool select: View ABS Data Stream and DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).
- Erase all codes and test drive the vehicle to verify the repair is complete.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK ABS MODULE DTC

- With the scan tool select: View ABS Data Stream.
- With an assistant driving the vehicle, check the following data stream list items while driving the vehicle over 40 km/h (25 mph).
 - Left Front Wheel Speed
 - Right Front Wheel Speed
 - Left Rear Wheel Speed
 - Right Rear Wheel Speed
- With the scan tool, read active DTCs in the ABS module.

Is DTC C1206 present and the Left Rear Wheel Speed signal abnormal?

Yes >> Go to the next step.

No >> The condition that caused this DTC to set is currently not present (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

2. CHECK LEFT REAR WHEEL SPEED SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the wheel speed sensor (1) electrical connector.
- Inspect the wheel speed sensor electrical connector.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.

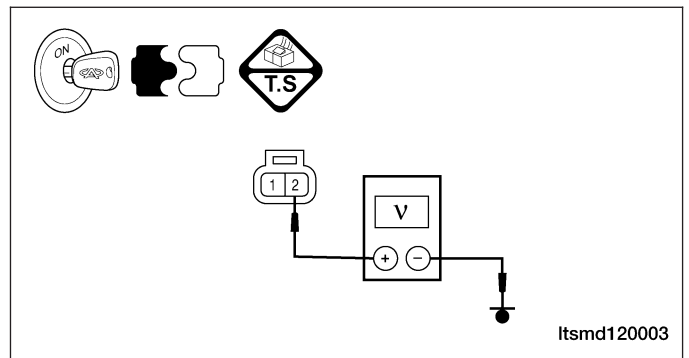
3. CHECK LEFT REAR WHEEL SPEED SENSOR REFERENCE SIGNAL CIRCUIT

- Turn ignition switch on.
- Measure the sensor reference voltage between terminal 2 of the wheel speed sensor connector, terminal side and ground.
- Voltage should exist (2.0 - 4.0 V).

Is the proper voltage present?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open, short to ground or short to battery in connector or harness.



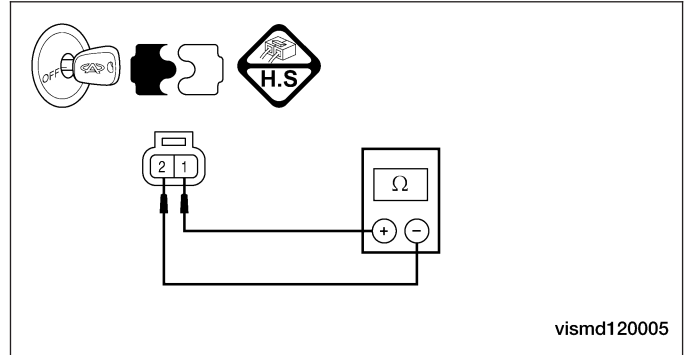
4. CHECK LEFT REAR WHEEL SPEED SENSOR RESISTANCE

- Check the wheel speed sensor resistance between the sensor terminals 1 and 2, component side.

Is the sensor resistance 700 - 1500 ohms?

Yes >> Go to the next step.

No >> Replace the Left Rear wheel speed sensor.



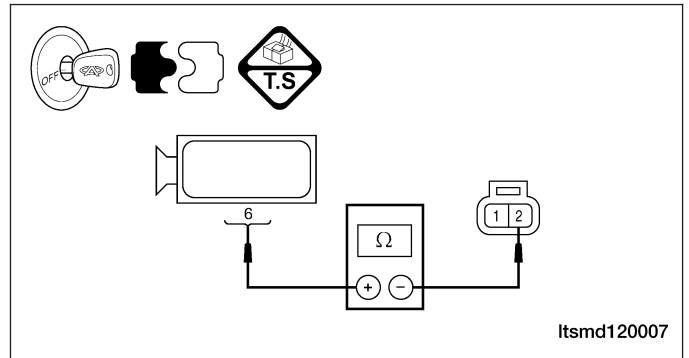
5. CHECK LEFT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Disconnect the ABS module electrical connector.
- For 1.6L/1.8L engine: Check the continuity between terminal 6 of the ABS module connector E-002, and terminal 2 of the Left Rear wheel speed sensor connector B-021, terminal side.
- For 2.0L/2.4L engine: Check the continuity between terminal 6 of the ABS module connector A-020, and terminal 2 of the Left Rear wheel speed sensor connector B-021, terminal side.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open.



6. CHECK LEFT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

- Check the continuity between terminal 2 of the Left Rear wheel speed sensor connector, terminal side and ground.
- Continuity should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to ground.

7. CHECK LEFT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Check the voltage between terminal 2 of the Left Rear wheel speed sensor connector, terminal side and ground.
- Voltage should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to battery.

8. CHECK DTC

- With the X-431 scan tool, read the ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

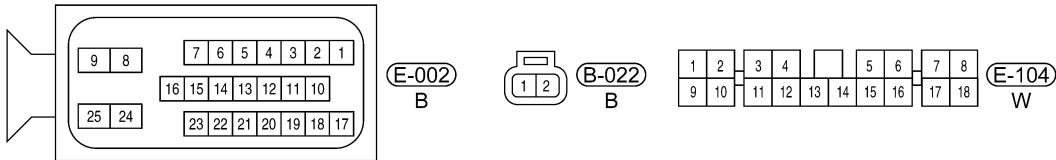
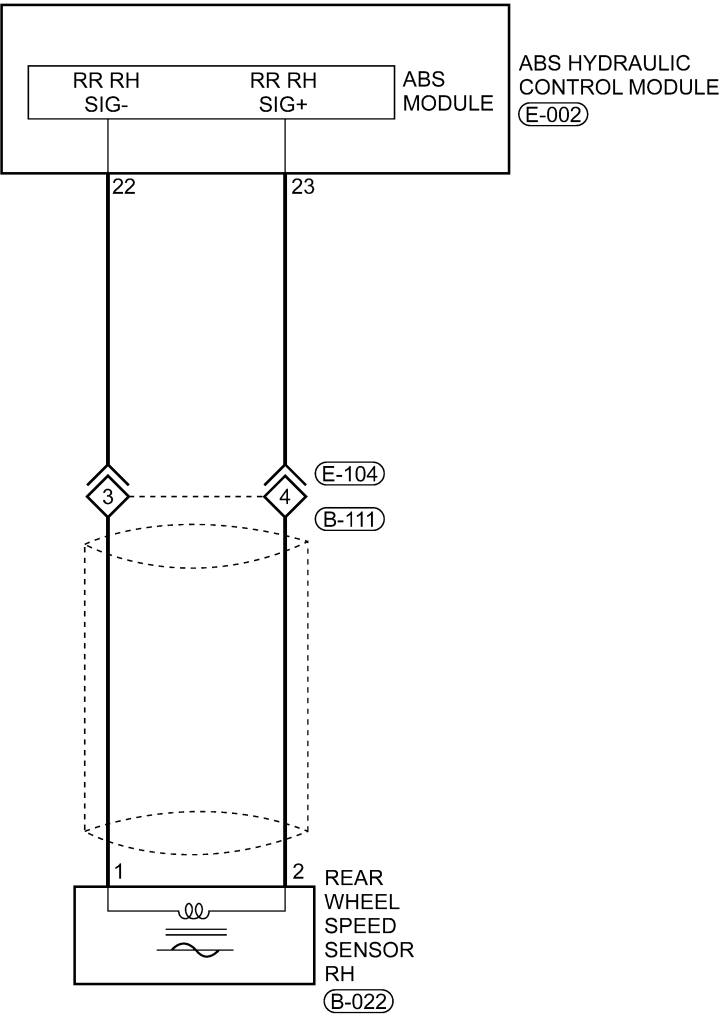
Is DTC C1206 present?

Yes >> Replace the ABS module (See ABS Module Removal & Installation in Section 12 Brakes).

No >> The system is now operating properly.
Erase all codes and test drive the vehicle to verify the repair is complete.

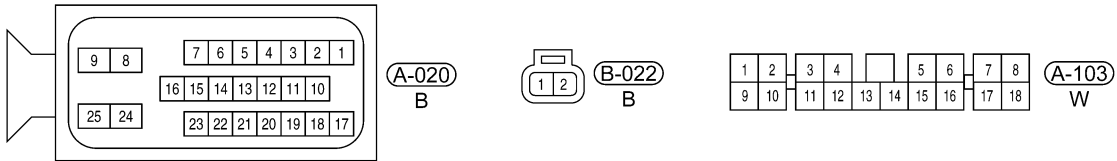
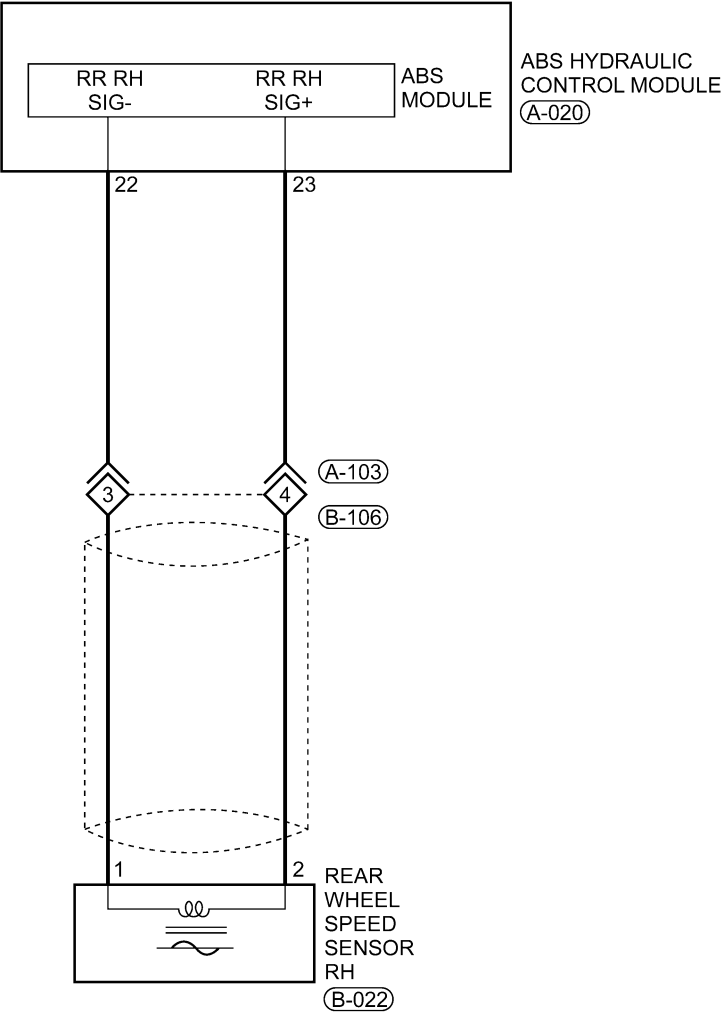
C1209 - Right Rear Wheel Speed Sensor Circuit Open or Shorted

BRC - 1.6L - 1.8L - RRS - 01



DIAGNOSIS & TESTING

BRC - 2.0L - 2.4L - RRS - 01



ltsmw120007t

DIAGNOSIS & TESTING

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	DTC SET CONDITION	POSSIBLE CAUSE
C1209	Right rear wheel speed sensor circuit open or shorted	• Ignition switch: ON • Vehicle: Running	ABS module detected that the Right Rear wheel speed sensor input signal to ABS module is open or shorted.	• Right Rear wheel speed sensor • Harness is open or shorted • ABS module

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Cycle the ignition switch from off to on.
- Start the engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Start the engine. With the scan tool connected to the DLC, drive the vehicle over 40 km/h (25 mph).

NOTE :

Vehicle must be driven above 40 km/h (25 mph) for fault setting conditions to be met.

- With the scan tool select: View ABS Data Stream and DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).
- Erase all codes and test drive the vehicle to verify the repair is complete.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK ABS MODULE DTC

- With the scan tool select: View ABS Data Stream.
- With an assistant driving the vehicle, check the following data stream list items while driving the vehicle over 40 km/h (25 mph).
 - Left Front Wheel Speed
 - Right Front Wheel Speed
 - Left Rear Wheel Speed
 - Right Rear Wheel Speed
- With the scan tool, read active DTCs in the ABS module.

Is DTC C1209 present and the Right Rear Wheel Speed signal abnormal?

Yes >> Go to the next step.

No >> The condition that caused this DTC to set is currently not present (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

2. CHECK RIGHT REAR WHEEL SPEED SENSOR ELECTRICAL CONNECTOR

- Turn ignition switch off.
- Disconnect the wheel speed sensor (1) electrical connector.
- Inspect the wheel speed sensor electrical connector.

Is the electrical connector OK?

Yes >> Go to the next step.

No >> Repair or replace the electrical connector as necessary.

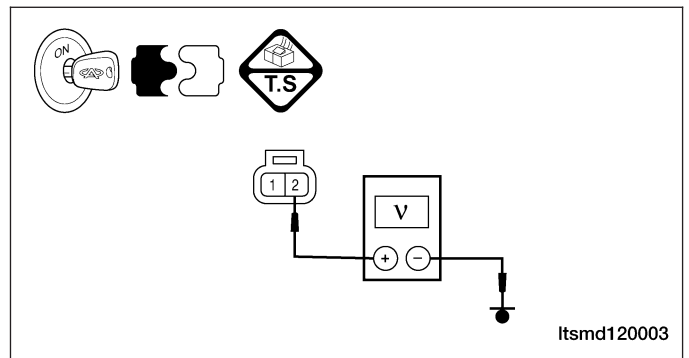
3. CHECK RIGHT REAR WHEEL SPEED SENSOR REFERENCE SIGNAL CIRCUIT

- Turn ignition switch on.
- Measure the sensor reference voltage between terminal 2 of the wheel speed sensor connector, terminal side and ground.
- Voltage should exist (2.0 - 4.0 V).

Is the proper voltage present?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open, short to ground or short to battery in connector or harness.



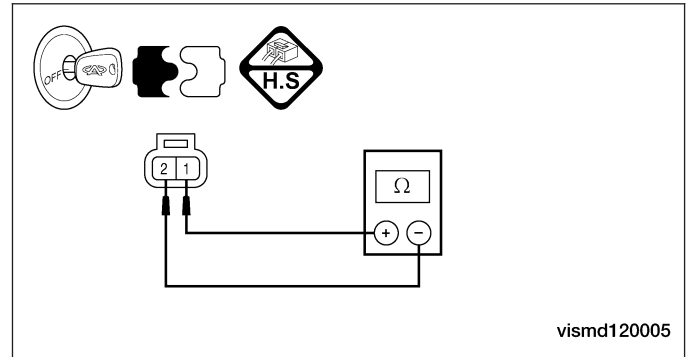
4. CHECK RIGHT REAR WHEEL SPEED SENSOR RESISTANCE

- Check the wheel speed sensor resistance between the sensor terminals 1 and 2, component side.

Is the sensor resistance 700 - 1500 ohms?

Yes >> Go to the next step.

No >> Replace the Right Rear wheel speed sensor.



5. CHECK RIGHT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR AN OPEN

- Turn ignition switch off.
- Disconnect the ABS module electrical connector.
- For 1.6L/1.8L engine: Check the continuity between terminal 22 of the ABS module connector E-002, and terminal 1 of the Right Rear wheel speed sensor connector B-022, terminal side.
- For 2.0L/2.4L engine: Check the continuity between terminal 22 of the ABS module connector A-020, and terminal 1 of the Right Rear wheel speed sensor connector B-022, terminal side.
- Continuity should exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for an open.

6. CHECK RIGHT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO GROUND

- Check the continuity between terminal 1 of the Right Rear wheel speed sensor connector, terminal side and ground.
- Continuity should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to ground.

7. CHECK RIGHT REAR WHEEL SPEED SENSOR GROUND CIRCUIT FOR A SHORT TO VOLTAGE

- Check the voltage between terminal 1 of the Right Rear wheel speed sensor connector, terminal side and ground.
- Voltage should not exist.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair or replace the circuit for a short to battery.

8. CHECK DTC

- With the X-431 scan tool, read the ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

Is DTC C1209 present?

Yes >> Replace the ABS module (See ABS Module Removal & Installation in Section 12 Brakes).

No >> The system is now operating properly.
Erase all codes and test drive the vehicle to verify the repair is complete.

C1604 - ECU Defect, Internal Errors or Solenoid Fault

On Board Diagnostic Logic

- Self-diagnosis detection logic.

DTC NO.	DTC DEFINITION	DTC DETECTION CONDITION	POSSIBLE CAUSE
C1604	ECU defect, internal errors or solenoid fault	ECM detected an internal failure or solenoid failure.	ABS module or solenoid

DTC Confirmation Procedure:

Before performing the following procedure, confirm that battery voltage is more than 12 V.

- Turn ignition switch off.
- Connect the X-431 scan tool to the Data Link Connector (DLC) - use the most current software available.
- Turn ignition switch on.
- With the scan tool, record and erase stored DTCs in the ABS module.
- Cycle the ignition switch.
- Start engine and warm it to normal operating temperature.
- Turn ignition switch off and wait for a few seconds.
- Start the engine. With the scan tool connected to the DLC, drive the vehicle over 40 km/h (25 mph).
- With the scan tool select: View ABS Data Stream and DTC.
- If the DTC is detected, the DTC condition is current. Go to Diagnostic Procedure - Step 1.
- If the DTC is not detected, the DTC condition is intermittent (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).
- Erase all codes and test drive the vehicle to verify the repair is complete.

NOTE :

While performing electrical diagnosis & testing, always refer to the electrical schematics for specific circuit and component information.

Diagnostic Procedure

1. CHECK DTC

- Perform DTC confirmation procedure.

Is DTC C1604 present?

Yes >> Go to the next step.

No >> The condition that caused this DTC to set is currently not present (See Diagnostic Help and Intermittent DTC Troubleshooting in Section 12 Brakes for more information).

2. CHECK ABS MODULE POWER SUPPLY AND GROUND CIRCUIT

- Check the ABS module voltage supply circuit and ground circuit for an open, high resistance or short circuit.

Is the check result normal?

Yes >> Go to the next step.

No >> Repair circuit for an open or short in harness and connectors.

3. CHECK DTC

- With the X-431 scan tool, read ABS module DTCs.
- Refer to "DTC Confirmation Procedure".

Is DTC C1604 still present?

Yes >> Replace the ABS module (See ABS Module Removal & Installation in Section 12 Brakes).

No >> The system is now operating properly.
Reassemble the vehicle and road test to verify the customers complaint is repaired.

ON-VEHICLE SERVICE

Antilock Brake System (ABS) Bleeding Procedure

ABS Bleeding Information

WARNING!

When bleeding the brake system, wear safety glasses. A clear bleed tube must be attached to the bleeder screws and submerged in a clear container filled partially. Direct the flow of brake fluid away from yourself and the painted surfaces of the vehicle. Brake fluid at high pressure may come out of the bleeder screws when opened.

CAUTION:

Before removing the master cylinder cap, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder reservoir. Use brake fluid or an equivalent from a fresh, tightly sealed container. Brake fluid must conform to DOT 4 specifications.

NOTE :

During the brake bleeding procedure, be sure the brake fluid level remains close to the "MAX" level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add brake fluid as required.

NOTE :

Do not pump the brake pedal at any time while having a bleeder screw open during the bleeding process. This will only increase the amount of air in the system and make additional bleeding necessary. Do not allow the master cylinder reservoir to run out of brake fluid while bleeding the system. An empty reservoir will allow additional air into the brake system. Check the fluid level frequently and add fluid as needed. The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

ABS Bleeding Instructions

When bleeding the ABS system, the following bleeding sequence must be followed to ensure complete and adequate bleeding:

1. Make sure all hydraulic fluid lines are installed and properly torqued.
2. Connect the X-431 scan tool to the diagnostics connector.
3. Using the scan tool, check to make sure the ABS module does not have any fault codes stored. If it does, clear them.
4. Bleed the base brake system (See Manual Brake Bleeding in Section 12 Brake).

NOTE :

Pressure bleeding is recommended to bleed the base brake system to ensure all air is removed from the brake system.

5. Using the scan tool, access "ABS bleeding" function. Follow the instructions displayed. When finished, disconnect the scan tool and proceed.
6. Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.
7. Fill the master cylinder fluid reservoir to the "MAX" level.
8. Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

Antilock Brake System (ABS) Hydraulic Control Module

Removal & Installation

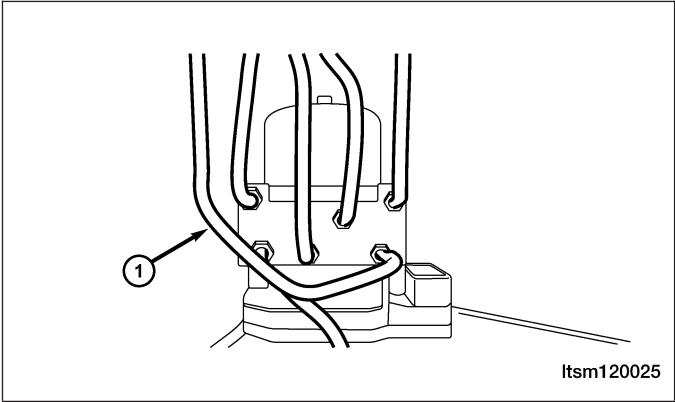
NOTE :

The following special tools are required to perform the repair procedure:

- Diagnostic Scan Tool X-431

NOTE :

The ABS hydraulic control module is comprised of the Hydraulic Control Unit (HCU) and the Electronic Control Unit (ECU). These are serviced as a complete unit and cannot be serviced separately.

1. Disconnect the negative battery cable.
 2. Turn the ignition switch off.
 3. Using a brake pedal holding tool, depress the brake pedal past its first 25 mm of travel and hold it in this position. This will isolate the master cylinder from the brake hydraulic system and will not allow the brake fluid to drain out of the master cylinder reservoir while the lines are disconnected.
 4. Remove the brake tubes (1) at the hydraulic control unit.
(Tighten: Brake tube nuts to 10 N·m)
 5. Disconnect the ABS hydraulic control module electrical connector.
 6. Remove the mounting bolts attaching the HCU mounting bracket to vehicle.
(Tighten: ABS mounting bracket bolts to 20 N·m)
- 
- Diagram illustrating the removal of brake tubes (1) from the ABS hydraulic control module. The diagram shows the module with several brake tubes connected to it. One tube is labeled with a circled '1' and an arrow pointing to it, indicating the point of disconnection. The module is mounted on a bracket, and the diagram shows the internal components and the connection points for the brake tubes.
- Itsm120025
7. Position the brake tubes as necessary without bending them.
 8. Remove the ABS HCU from vehicle.
 9. Remove the ABS mounting bolts and mounting bracket as necessary.
(Tighten: ABS mounting bolts to 10 N·m)
 10. Installation is in the reverse order of removal.

Installation Notes:

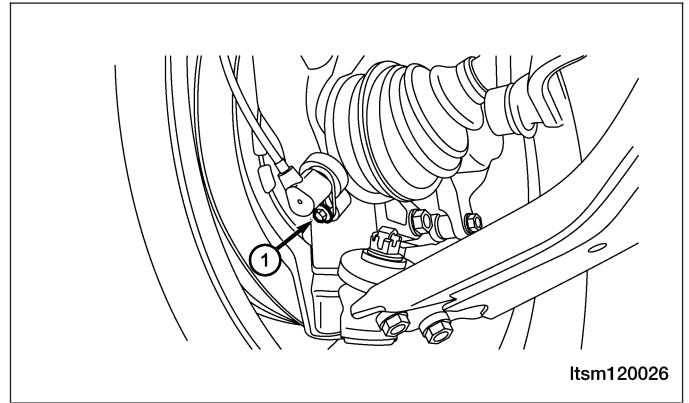
- After installation, connect the X-431 scan tool to initialize the ABS hydraulic control module and bleed the brake system (See Antilock Brake System (ABS) Bleeding Procedure in Section 12 Brakes).

Front Wheel Speed Sensor

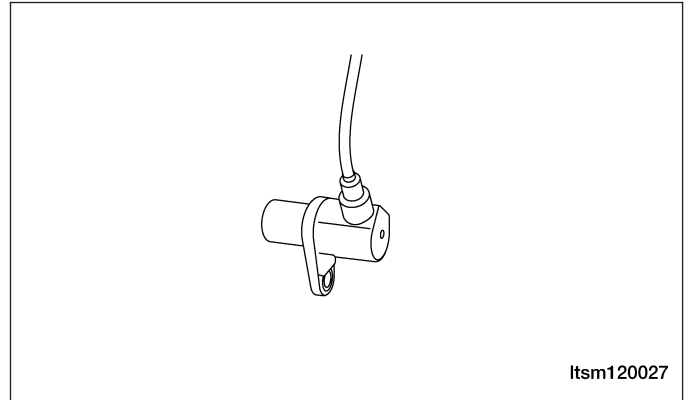
Removal & Installation

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)
4. Disconnect the wheel speed sensor electrical connector.

5. Remove the wheel speed sensor mounting bolt (1).
(Tighten: Wheel speed sensor mounting bolt to 10 N·m)



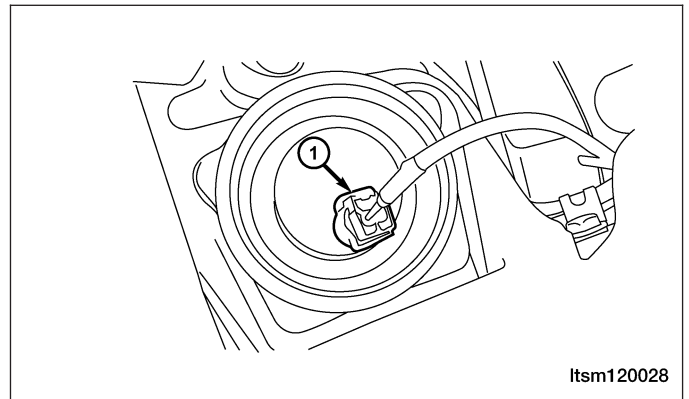
6. Remove the front wheel speed sensor.



Rear Wheel Speed Sensor

Removal & Installation

1. Disconnect the negative battery cable.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the tire and wheel assembly.
(Tighten: Wheel mounting nuts to 110 N·m)
4. Disconnect the rear wheel speed sensor electrical connector (1).



5. Remove the rear hub and bearing assembly (See Rear Hub and Bearing Removal & Installation in Section 09 Driveline & Axle).
6. Remove the rear wheel speed sensor with the rear hub and bearing.
NOTE: The rear wheel speed sensor is integrated into the rear hub and bearing assembly and a one piece sealed unit.

PARKING BRAKE

GENERAL INFORMATION	12-83	ON-VEHICLE SERVICE	12-87
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GENERAL INFORMATION

Description

The parking brakes consist of the following components:

- Hand-operated parking brake lever
- Parking brake cables (one each side)
- Parking brake controls

Operation

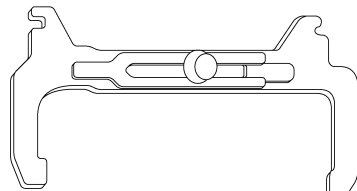
All vehicles are equipped with a center-mounted, hand-operated parking brake lever mounted between the front seats. A tensioner is built into the equalizer mounted on the end of the lever's output cable. There is an individual parking brake cable for each rear wheel that joins a parking brake cable equalizer, attached to the parking brake lever, to the rear parking brakes. The parking brake cables are made of flexible steel cable.

Specifications

Torque Specifications

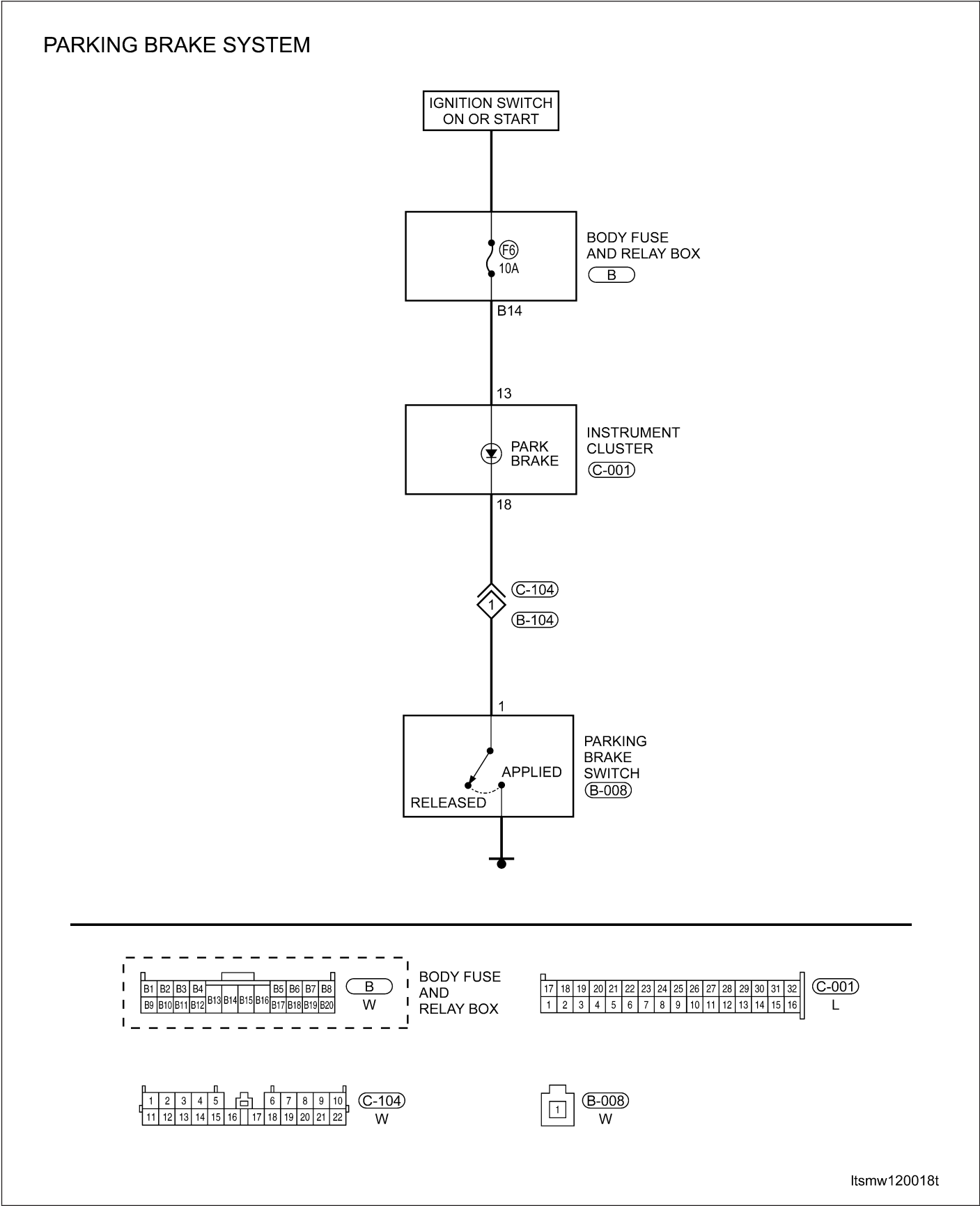
DESCRIPTION	TORQUE (N·m)
Parking Brake Cable Routing Clamp Bolt	12
Parking Brake Cable Bracket Bolts	12
Parking Brake Lever Nuts	30
Wheel Mounting Nuts	110

Special Tools

Brake Measuring Gauge J21177-A	 besm120025
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Electrical Schematics

Parking Brake System (Page 1 of 1)



DIAGNOSIS & TESTING

Parking Brake Warning Light

The parking brake switch is incorporated in the circuit for the red warning lamp in the dash. The switch will cause the lamp to illuminate only when the parking brakes are applied. If the lamp remains on after parking brake release, the switch or circuit is faulty.

Parking Brake Operation

The leading cause of improper parking brake operation, is excessive clearance between the parking brake shoes and the shoe braking surface. Excessive clearance is a result of lining and/or drum wear, drum surface machined oversize.

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/won't hold), can be traced to a parking brake component.

Inspect the following when diagnosing a parking brake problem:

- Brake shoe wear
- Drum surface (in rear rotor) machined oversize
- Front cable not secured to lever
- Rear cable not attached to actuator
- Rear cable seized
- Parking brake lever not seated
- Parking brake lever bind

Parking Brake Adjustment

Adjust the parking brake only if the parking brake lever can be pulled up more than 3 notches without having an adequate solid braking effect.

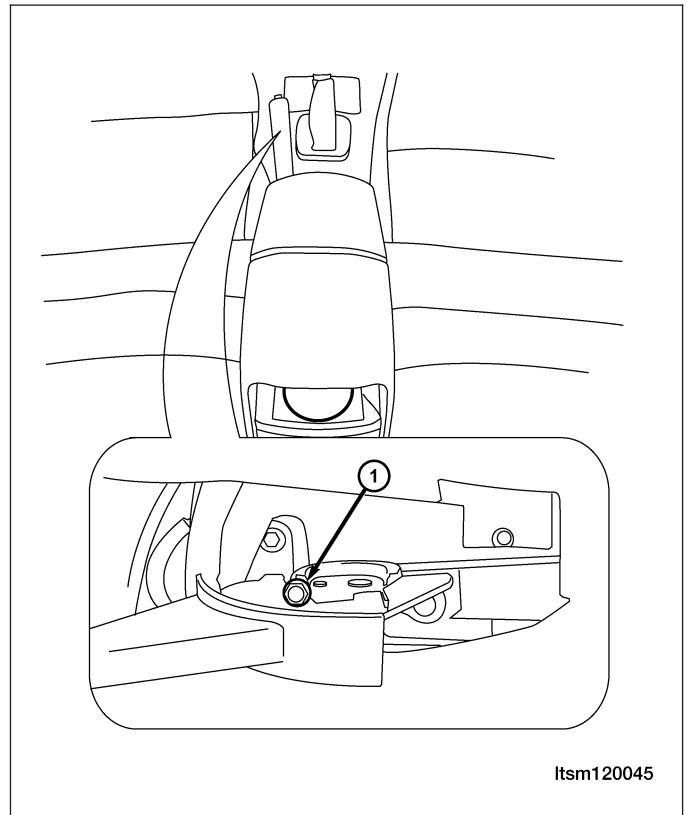
NOTE :

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), could be the result of worn brake shoes, improper brake shoe adjustment, or improperly assembled brake parts. A too loose condition can also be caused by inoperative or improperly assembled parking brake components. Always confirm that the parking brake components are assembled properly. Perform the following procedure to adjust the parking brake:

1. Verify the parking brake lever is in the released (down) position.
2. Raise and support the vehicle.
3. Remove the wheel mounting nuts and the rear tire and wheel assemblies.
4. Utilizing the access hole in the rotors, adjust the parking brake shoes.
5. Reach inside the vehicle and fully apply and release the parking brake.
6. With the parking brake lever in the fully applied (up) position, attempt to rotate the rear rotors by hand (to ensure that the parking brake shoes are working properly).
7. With the parking brake lever in the released (down) position, attempt to rotate the rear rotors by hand (to ensure that the parking brake shoes are not dragging).
8. Install both rear tire and wheel assemblies and the wheel mounting nuts.
(Tighten: Wheel mounting nuts to 110 N·m)

DIAGNOSIS & TESTING

9. Tighten or loosen the parking brake adjustment nut (1) to adjust the parking brake.



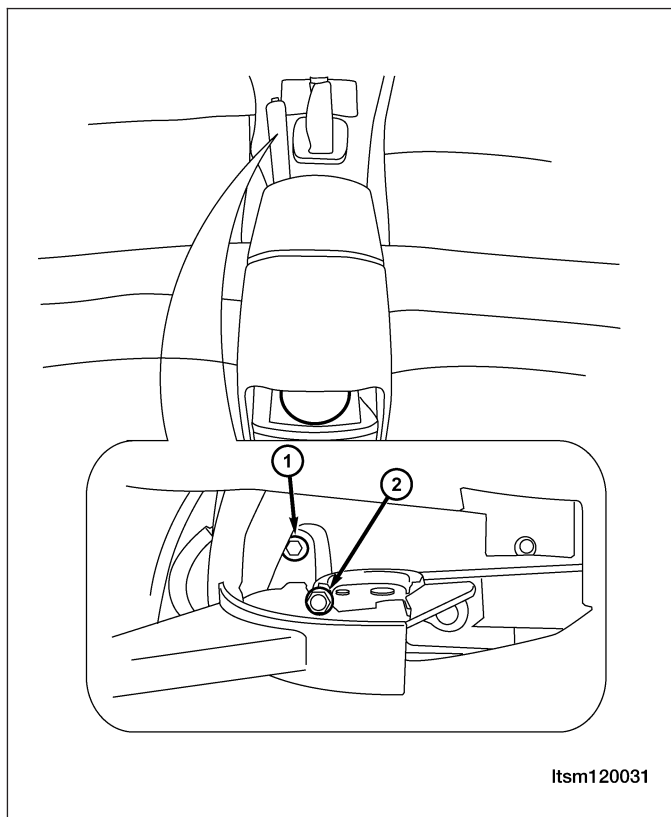
10. Lower the vehicle.

ON-VEHICLE SERVICE

Parking Brake Lever

Removal & Installation

1. Block the tire and wheel assemblies so the vehicle does not move once the vehicle parking brake lever is released.
2. Remove the center console (See Center Console Removal & Installation in Section 15 Body & Accessories).
3. Loosen the adjusting nut (2) on the lever's output cable, taking tension off parking brake cables.
4. Back the nut off until it is flush with the end of the output cable.
5. Remove the bolts (1) attaching the parking brake lever to the vehicle.
(Tighten: Parking brake lever bolts to 30 N·m)
6. Remove the parking brake assembly.
7. Installation is in the reverse order of removal.

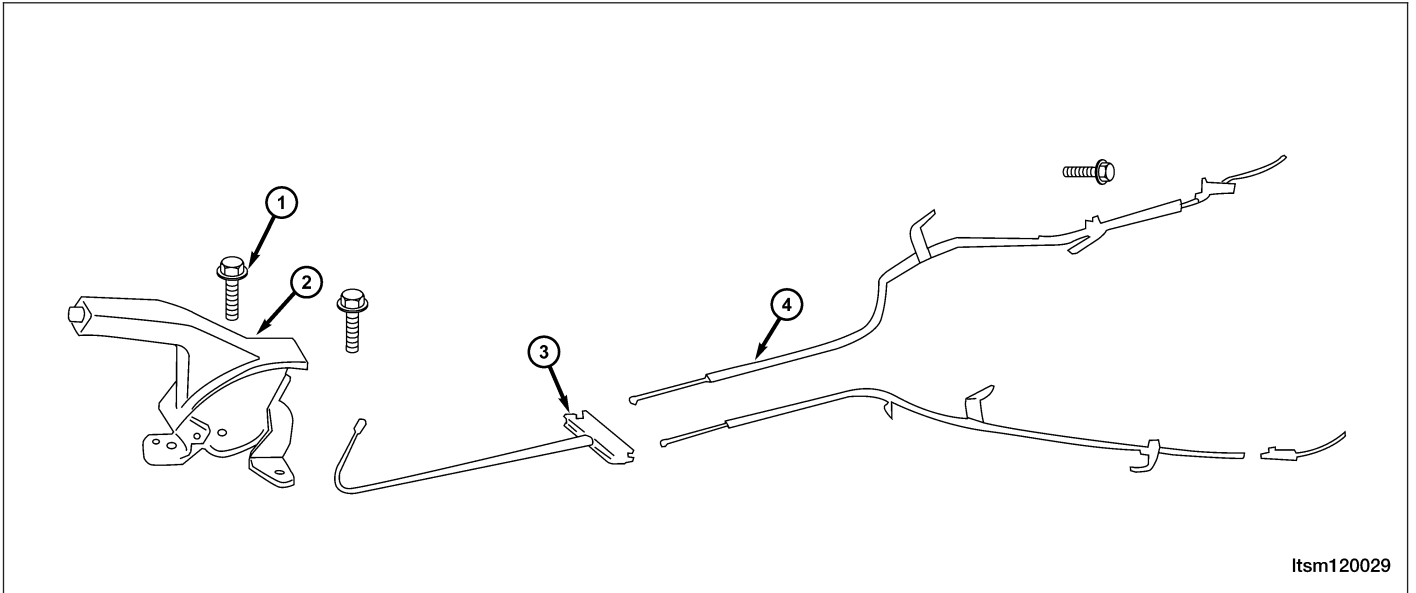


Installation Notes:

- After installation, adjust the parking brake cable as necessary (See Parking Brake Adjustment in Section 12 Brakes).

Parking Brake Cable

Removal & Installation

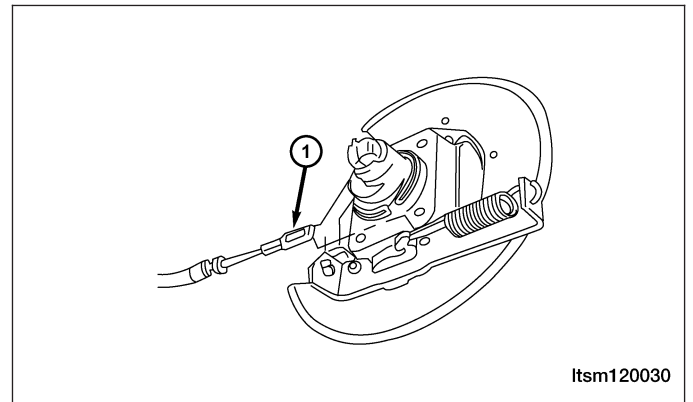


1. Remove the handrail case (2).
2. Remove the adjusting bolt (1) of hand brake.
3. Loosen the fixing bolts of right and left cable bracket (3).
4. Remove the hand brake cable (4).
5. Remove the fixing bolts of right and left hand brake cable.
6. Remove the hand brake cable (1) from the brake actuator.
7. Installation is in the reverse order of removal.

NOTE :

The parking brake should be adjusted after replacing brake shoes or hand brake cable.

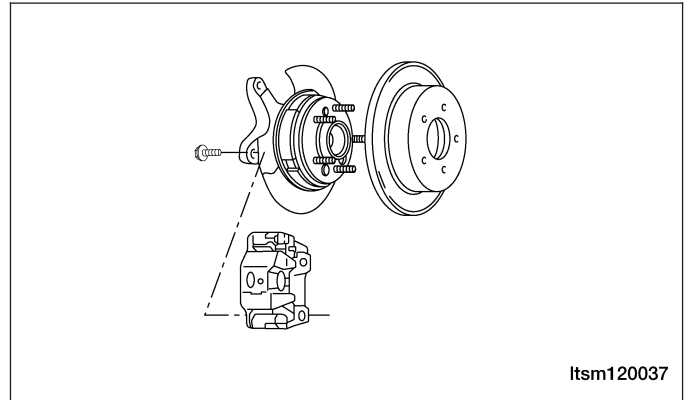
- Loosen the parking brake handle.
- Forcibly step on brake pedal once.
- Pull the parking brake handle up by four teeth.
- After completing the above procedures, loosen the parking brake to inspect the two rear wheels to see whether they can be turned freely. Otherwise, the above process of adjustment should be repeated.



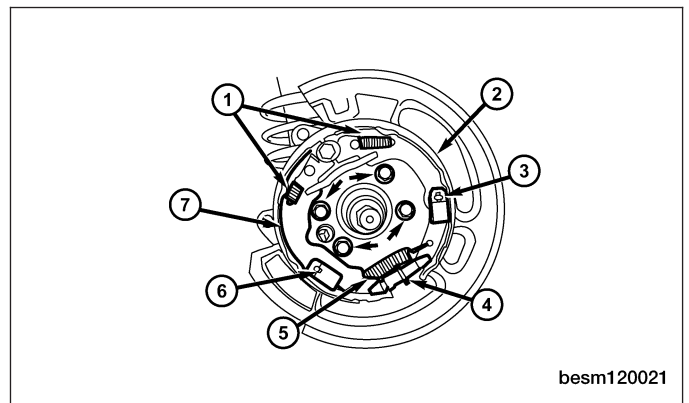
Parking Brake Shoes

Removal & Installation

1. Raise and support the vehicle.
2. Remove the rear wheel mounting nuts and both rear tire and wheel assemblies.
(Tighten: Wheel mounting nuts to 110 N·m)
3. Access and remove rear brake rotor (See Rear Brake Rotor Removal & Installation in Section 12 Brakes).
4. Turn the brake shoe adjuster wheel until the adjuster is at shortest length.



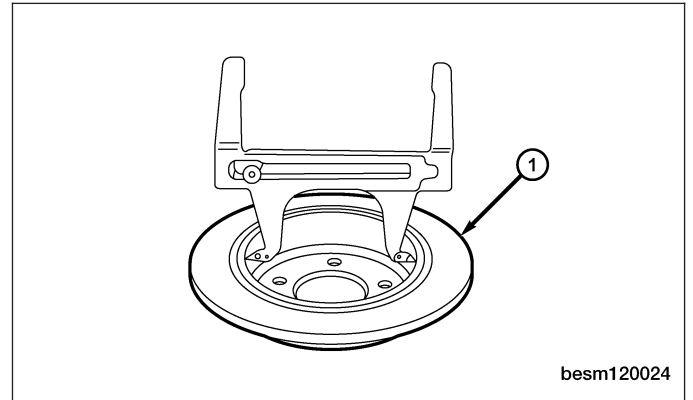
5. Remove the brake shoe hold-down springs (3) and pins (6). Rotate the pins 90° to disengage.
6. Remove the parking brake cable from the arm on the rear parking brake shoe.
7. Remove the brake shoes (2, 7), adjuster (4) and lower return spring (5) as an assembly from the support plate.
8. Remove the lower return spring (5) and adjuster (4) from the shoes (2, 7).
9. Remove the parking brake shoes.



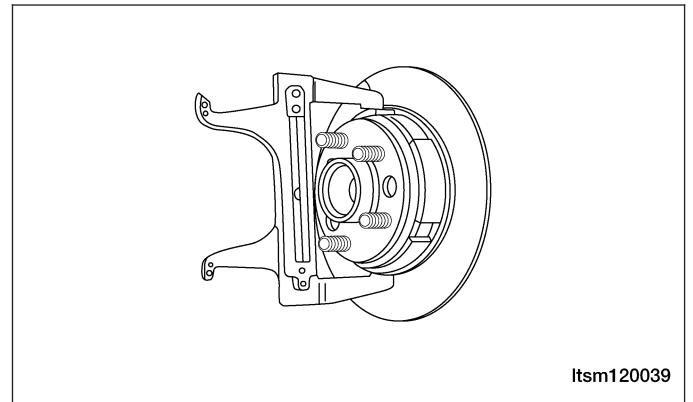
10. Installation is in the reverse order of removal.

Installation Notes:

- Perform the following to measure and adjust parking brake shoes:
 1. Using a brake measuring gauge or equivalent, measure the inside diameter of parking brake drum (1).
 2. Place the brake measuring gauge over the parking brake shoes at their widest point.



3. Using the adjuster wheel, adjust the parking brake shoes until the linings on both parking brake shoes just touch the jaws on the brake measuring gauge.
- After installation, adjust the parking brake cable as necessary (See Parking Brake Adjustment in Section 12 Brakes).



BRAKE SHOES	NEW THICKNESS	MINIMUM THICKNESS
Rear Shoes	2.5 mm	1.5 mm

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