Uniform Procedures For Collision Repair

BR51—Brakes, Anti-Lock And Traction Control

 v.2.3

1. Description

This procedure describes diagnosis, repair, replacement, inspection, and testing requirements for anti-lock brake systems (ABS) and electronic traction control systems (TCS).

2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality repair of anti-lock brake systems and electronic traction control systems. This procedure is intended for use by professionals who are qualified through training and experience.

3. Referenced Documents

The following documents are considered part of this procedure by reference.

3.1 Procedures

BR11 Brakes
EL21 Self-Diagnostics
HM01 Hazardous Materials
PS01 Personnel Safety

3.2 Other Information

Equipment-specific information
Vehicle-specific diagnostic information
Vehicle-specific repair information

4. Equipment And Material Requirements

4.1 Equipment

The use of this equipment is included in this procedure:

- ❑ pressure bleeding equipment and required adapters
- ❑ vacuum bleeding equipment and required adapters
- ❑ HEPA-filter vacuum system
- ❑ digital volt-ohm meter (DVOM)
- ❑ jumper wires
- ❑ static electricity protection equipment
- ❑ depressurizing equipment and adapters
- ❑ flare-nut wrench set
- ❑ caliper piston retractor
- ❑ non-magnetic feeler gauge

Some ABS and TCS systems may require these additional items:

- ❑ OEM specialty testers
- ❑ universal or vehicle-specific scan tools with ABS and TCS programming
- ❑ universal or vehicle-specific breakout boxes
- ❑ tone ring removal and installation tools

5. Damage Analysis

5.1 General Brake Damage

A general brake inspection is described in **BR11**.

5.2 ABS Or TCS Damage

If there is an ABS or TCS complaint, inspect the systems for these conditions:

- ❑ improper brake-pedal feel and operation
- ❑ brake fluid leaks
- ❑ contaminated brake fluid
- ❑ mixed or improper tire sizes
- ❑ improper accelerator-pedal feel and operation
- ❑ improper throttle operation
- ❑ noisy operation

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5. Damage Analysis (cont'd)

If the ABS or TCS dash warning lamp does not light, flashes, or stays on continuously, inspect for these conditions:

- ❑ blown fuses
- ❑ damaged, disconnected or corroded wiring, connectors, or terminals
- ❑ cracks or missing teeth on a speed-sensor tone ring
- ❑ loss of magnetism in a speed sensor
- ❑ improper speed-sensor air gap
- ❑ metal filings or grease on a speed sensor or tone ring
- ❑ damaged relays or switches
- ❑ damaged sensors
- ❑ damaged control module
- ❑ damaged hoses and lines
- ❑ damaged motor and pump assembly
- ❑ damaged hydraulic modulator
- ❑ improper operation of the engine throttle
- ❑ damaged throttle cables
- ❑ damaged throttle-adjuster motor assembly

If no damage is identified, perform the vehicle maker's ABS and TCS diagnostic tests. See **EL21**. Replace any parts that fail the diagnostic tests.

6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Brake Fluid Safety

Wear rubber gloves when working with brake fluids. Immediately wipe up spilled brake fluid.

6.3 High-Pressure Safety

ABS and TCS use brake fluid under extremely high pressure. To prevent injury from high brake-fluid pressures, follow the vehicle maker's recommendations for depressurizing the system.

7. Environmental Safety

Hazardous material safety information is in **HM01**.

8. Vehicle Protection

8.1 ABS And TCS Parts

To protect ABS and TCS parts from damage:

- ❑ Immediately plug any opened brake system lines or hoses.
- ❑ Do not press the brake pedal when any ABS parts are removed.
- ❑ Use only new brake fluid stored in a sealed container.
- ❑ Use only the vehicle maker's recommended brake fluid. Refer to the recommendation on the master cylinder cover, or in the vehicle service or owner's manual.
- ❑ Use static protection equipment when testing and handling electrical parts.

8.2 Adjacent Areas

Protect adjacent plastic and painted surfaces from exposure to brake fluid, brake dust, and cleaning solvents.

9. Repair Procedure

9.1 Control Module Replacement

To replace a control module:

- ❑ 1. Turn the ignition switch to the LOCK position, and remove the key.
- ❑ 2. Remove and isolate the negative battery cable.
- ❑ 3. Put on static electricity protection before touching the control module.
- ❑ 4. Remove all connector retaining clips from the control module electrical connectors.
- ❑ 5. Disconnect the electrical connectors.
- ❑ 6. Remove all mounting fasteners.
- ❑ 7. Remove the control module.
- ❑ 8. Position the replacement control module in the proper location.

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❑ 9. Install all mounting fasteners, duplicating the original mounting method.
❑ 10. Torque all fasteners to the vehicle maker's recommendations.
❑ 11. Reconnect all electrical connectors.
❑ 12. Position the retaining clips in the proper locations.
❑ 13. Reconnect the negative battery cable.
❑ 14. Start the vehicle and check the dash lamp operation.
❑ 15. Road-test the vehicle.

9.2 Speed Sensor Replacement

To replace a speed sensor:

❑ 1. Turn the ignition switch to the LOCK position, and remove the key.
❑ 2. Remove and isolate the negative battery cable.
❑ 3. Remove all connector retaining clips.
❑ 4. Disconnect the electrical connectors.
❑ 5. Remove the speed sensor mounting fasteners.
❑ 6. Remove the speed sensor.
❑ 7. Position the replacement speed sensor in the proper location.
❑ 8. Install all mounting fasteners, duplicating the original mounting method.
❑ 9. Torque all fasteners to the vehicle maker's recommendations.
❑ 10. Measure and adjust the air gap between the speed sensor and the tone ring. Use the gauge block supplied with the replacement part or a non-magnetic feeler gauge. Some speed sensors may not be adjustable.
❑ 11. Route electrical wires to duplicate the original position.
❑ 12. Reconnect all electrical connectors.
❑ 13. Position the retaining clips in the proper location.
❑ 14. Reconnect the negative battery cable.
❑ 15. Start the vehicle and check the dash lamp operation.
❑ 16. Road-test the vehicle.

9.3 Tone Ring Replacement

The replacement of some ABS tone rings may require replacement of the entire wheel bearing and hub or axle shaft assembly. Some ABS tone rings may be replaced separately. To replace a tone ring:

❑ 1. Make sure the tone ring is identical and has the same amount of teeth.

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❑ 2. Use the vehicle maker's recommended puller to remove the tone ring. DO NOT hammer on a tone ring.
❑ 3. Use the vehicle maker's recommended tools for installing the replacement tone ring.
❑ 4. Start the vehicle and check the dash lamp operation.
❑ 5. Road-test the vehicle.

9.4 Pressure Or Engagement Switch Replacement

To replace an ABS pressure switch, or TCS engagement switch:

❑ 1. Depressurize the ABS system, following the vehicle maker's recommended procedure, before replacing an ABS pressure switch.
❑ 2. Turn the ignition switch to the LOCK position, and remove the key.
❑ 3. Remove all electrical connector retaining clips.
❑ 4. Disconnect the electrical connectors.
❑ 5. Remove the switch.
❑ 6. Install the replacement switch using the recommended sealant, if necessary. Torque the switch to the vehicle maker's recommendations.
❑ 7. Route electrical wires to duplicate the original position.
❑ 8. Reconnect all electrical connectors.
❑ 9. Position the retaining clips in the proper location.
❑ 10. Repressurize the ABS system, if necessary, following the vehicle maker's recommendations.
❑ 11. Check for leaks.
❑ 12. Start the vehicle and check the dash lamp operation.
❑ 13. Road-test the vehicle.

9.5 Hydraulic Parts Replacement

To replace an ABS motor and pump assembly, hydraulic modulator, or hydraulic valve:

❑ 1. Depressurize the ABS system following the vehicle maker's recommended procedure.
❑ 2. Turn the ignition switch to the LOCK position, and remove the key.
❑ 3. Remove all electrical connector retaining clips.
❑ 4. Disconnect the electrical connectors.
❑ 5. Remove and seal all hydraulic lines.
❑ 6. Remove all mounting fasteners.
❑ 7. Remove the part or assembly.

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❑ 8. Position the replacement part or assembly in the proper location.
❑ 9. Install all mounting fasteners, duplicating the original mounting method.
❑ 10. Torque all fasteners to the vehicle maker's recommendations.
❑ 11. Reinstall all hydraulic lines. Torque all connections to the vehicle maker's recommendations.
❑ 12. Route electrical wires to duplicate the original position.
❑ 13. Reconnect all electrical connectors.
❑ 14. Position the retaining clips in the proper location.
❑ 15. Bleed the brake system following the vehicle maker's recommendations.
❑ 16. Start the vehicle and check the dash lamp operation.
❑ 17. Check for leaks.
❑ 18. Check the fluid level.
❑ 19. Road-test the vehicle.

9.6 Lateral Acceleration Or Steering Angle Sensor Replacement

To replace a lateral acceleration sensor, or steering angle sensor:

❑ 1. Turn the ignition switch to the LOCK position, and remove the key.
❑ 2. Remove all electrical connector retaining clips.
❑ 3. Disconnect the electrical connectors.
❑ 4. Remove the sensor mounting fasteners.
❑ 5. Remove the sensor.
❑ 6. Position the replacement sensor in the proper location.
❑ 7. Install all mounting fasteners, duplicating the original mounting method.
❑ 8. Torque all fasteners to the vehicle maker's recommendations.
❑ 9. Route electrical wires to duplicate the original position.
❑ 10. Reconnect all electrical connectors.
❑ 11. Position the retaining clips in the proper location.
❑ 12. Start the vehicle and check the dash lamp operation.
❑ 13. Perform the system diagnostic test, if necessary.
❑ 14. Road-test the vehicle.

9.7 Throttle-Adjuster Motor Assembly Replacement

To replace a throttle-adjuster motor assembly:

❑ 1. Turn the ignition switch to the LOCK position, and remove the key.
❑ 2. Remove all electrical connector retaining clips.
❑ 3. Disconnect the electrical connectors.
❑ 4. Remove all cables.

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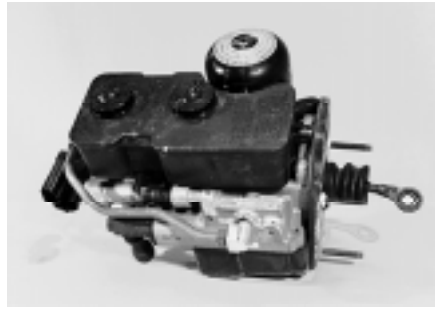
9. Repair Procedure (cont'd)

- ❑ 5. Remove all motor assembly mounting fasteners.
- ❑ 6. Remove the motor assembly.
- ❑ 7. Position the replacement motor assembly in the proper location.
- ❑ 8. Install all mounting fasteners, duplicating the original mounting method.
- ❑ 9. Torque all fasteners to the vehicle maker's recommendations.
- ❑ 10. Reinstall all throttle and cruise control cables. Torque all connections to the vehicle maker's recommendations.
- ❑ 11. Route electrical wires to duplicate the original position.
- ❑ 12. Reconnect all electrical connectors.
- ❑ 13. Position the retaining clips in the proper location.
- ❑ 14. Start the vehicle and check the dash lamp operation.
- ❑ 15. Road-test the vehicle.

10. Use Of Recycled (Salvage) Parts

10.1 Salvage ABS And TCS System Parts



Use only salvage parts that exactly duplicate the original parts.

To prevent damage, salvage hydraulic parts must be filled with hydraulic fluid and all openings sealed before shipping or storage.

Do not use salvage ABS or TCS parts having any of these defects:

- ❑ visible damage
- ❑ brake fluid contamination
- ❑ electrical terminal corrosion
- ❑ missing or damaged teeth on a tone wheel
- ❑ loss of magnetism in a speed sensor

Do not use salvage hydraulic parts from flood-damaged vehicles.

11. Inspection And Testing

11.1 Inspection After Repair

Inspect the ABS and TCS systems for these conditions:

- ❏ proper routing of hydraulic lines and electrical wiring
- ❏ proper installation of all mounting fasteners and retaining clips
- ❏ proper connection of all electrical connectors
- ❏ proper brake fluid level
- ❏ no visible damage or corrosion

Correct any defects.

11.2 Testing After Repair

To test an ABS system:

❏ 1. Check the brake pedal operation and feel.
❏ 2. Check for proper operation of the ABS dash warning lamp.
❏ 3. Road-test the vehicle. The road test should include a braking stop that would cause the ABS to activate.

Correct any defects.

To test a TCS system:

❏ 1. Check the brake pedal operation and feel.
❏ 2. Check the throttle operation and feel.
❏ 3. Check for proper operation of the TCS dash warning lamps.
❏ 4. Road-test the vehicle. The road test should include cornering and acceleration, to induce traction control events.

Correct any defects.