



1. Description

This procedure describes methods for using on-board diagnostic tests for troubleshooting electronically controlled systems. Inspection and evaluation requirements are also included.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing on-board diagnostic tests of electronically controlled systems, to locate failures and confirm repairs. 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

- BR51 Brakes, Anti-Lock And Traction Control
- EL01 Wire Repair
- EL11 Troubleshooting
- HM01 Hazardous Materials
- PS01 Personnel Safety
- RE21 Airbag Systems
- SU51 Air Springs

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Electrical Test Equipment

The following equipment is used in this procedure:

- jumper wires
- digital volt-ohmmeter (DVOM)
- generic and vehicle-specific scan tools
- generic and vehicle-specific breakout boxes and test harnesses
- electro-static discharge (ESD) strap



5. Damage Analysis

5.1 Self-Test Inspection

Perform the vehicle maker's specific self-test procedures for the systems being diagnosed. Consult the vehicle maker's service manual for information on the various systems that can be diagnosed using specific self-test features. Most of the following systems can be diagnosed using either built-in self-tests or scan tool-activated tests:

- engine
- drivetrain
- emission system
- restraint system
- anti-lock brakes and traction control
- air springs

Look for these conditions with the appropriate dash lamp:

- does not light during bulb-check procedures
- remains lit after self-test routines
- flashes one or more diagnostic trouble codes

If possible, perform a road-test, noting any symptoms of improper vehicle operation. See **11.2**.



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

Before working around battery acid spills or leakage, clean the area with baking soda and water, followed by soap and water.



7. Environmental Safety

Does not apply.



8. Vehicle Protection

8.1 Electronic Parts

To protect computers and other sensitive electronic parts from damage during testing and repair:

- Follow the vehicle maker's recommendations for recording and resetting electronic memories, if the battery must be disconnected.
- Disarm the passive restraint system, if working in the area of the airbag sensors, modules, or wiring. Follow the vehicle maker's recommendations.
Note: Disconnecting the battery will cause stored diagnostic codes to be erased.
- Do not repair airbag harness wiring, unless recommended by the vehicle maker.
- Protect computer modules, connectors, and wiring from dirt, heat, static electricity, and moisture. Use an ESD strap when handling computers and other sensitive parts.
- Loosen or remove any wiring harnesses or electrical parts that could be damaged during the repair process.
- Use a DVOM with at least a 10 megohm internal impedance.
- Avoid touching electrical terminals.
- Do not store computers and other sensitive electronic parts near electric welders or other high-energy electrical equipment.
- Do not test a computer module unless directed by a service manual procedure.
- Do not unpack a replacement module until it is to be installed on the vehicle.



9. Repair Procedure

9.1 Using Diagnostic Trouble Codes

Computer systems, with on-board diagnostic test functions, test system circuits during normal vehicle operation. Additional diagnostic tests may be initiated by the service technician. Problems that occurred during normal operation may be stored as history codes, while those occurring during technician-initiated tests are stored as current codes. Intermittent problems may require that heat, cold, vibration, and moisture be applied to circuit parts to simulate conditions that cause trouble codes to be set.

To use both current and history trouble codes:

1. Read and understand the diagnosis and testing section of the vehicle's service manual for the computer system being tested.
2. Determine the equipment and procedures required to perform either flash-code or scan-tool diagnostics.
3. Initiate the on-board diagnostic tests, and read the stored trouble codes. Vehicle-specific procedures may require the codes to be cleared and read a second time.
4. Use service manual trouble-code flowcharts to develop a plan for testing circuit problems identified by current and history codes.

(cont'd)



9. Repair Procedure (cont'd)

- 5. Perform electrical testing as specified by the trouble-code flowcharts. Also perform basic troubleshooting steps.
Note: A specific test harness or breakout box may be required to perform this testing.
- 6. Make decisions, and repair or replace circuit parts, based on the testing results.
- 7. Clear current and history trouble codes.
- 8. Re-test the system to verify the repair.

9.2 Flash-Code Diagnostics

Some computer systems allow current or stored trouble codes to be read using a dash lamp. To perform these flash-code diagnostics:

- 1. Determine how trouble codes are displayed using the vehicle maker's service manual.
- 2. Initiate the on-board diagnostic test using jumper wires, switches, or other system-specific procedures provided by the vehicle maker.
- 3. Allow time for the computer to perform the test function.
- 4. During the test, note the dash lamp operation.
- 5. When the test has finished, determine the trouble codes using service manual information to interpret the dash lamp operation.

9.3 Scan Tool Diagnostics

Some computer systems require trouble codes to be read using a vehicle-specific tester or scan tool. To perform these diagnostics:

- 1. Locate the vehicle system diagnostic connector.
- 2. Install the vehicle-specific tester or scan tool power and diagnostic cables.
- 3. Using the specific instructions for the tester or scan tool, command the tester or scan tool to display any trouble codes.

Vehicle-specific testers and scan tools may also perform other specialty tests, such as displaying computer memory values or testing the operation of specific circuit parts.

9.4 No-Code Or Symptom-Diagnostics

To perform symptom-diagnostics when there are no displayed trouble codes:

- 1. Locate the service manual symptom flowchart that correctly identifies the vehicle's symptoms.
- 2. Perform the electrical testing specified by the symptom flowcharts.
Note: A vehicle-specific test harness or breakout box may be required to perform electrical testing.
- 3. Make decisions, and repair or replace circuit parts, based on the testing results.
- 4. Verify the system repair.



10. Use Of Recycled (Salvage) Parts

Does not apply



11. Inspection And Testing

11.1 Inspection After Self-Diagnostic Repairs

After repairs requiring on-board diagnostic tests, inspect the vehicle for these conditions:

- proper operation of all warning lamps
- no current trouble code is displayed
- all history codes have been cleared

Correct any defects.

11.2 Road-Test

Road-test the vehicle, following the vehicle maker's recommendations. Check for any of these conditions:

- improper warning lamp operation
- driveability problems
- transmission shifting problems
- braking or traction-control problems
- heating or cooling problems

Correct any defects.