



Brake System Floor Check Procedure

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This procedure describes the process to measure the relationship between the brake pedal travel and the brake pedal force.

1.2 Applicability. This procedure is applicable to all passenger cars, multi-purpose vehicles, and light duty trucks.

1.3 Remarks. A floor check is a test of the brake system, either in a vehicle or on a brake system test bench. The floor check maps the brake pedal travel as a function of the brake pedal force. For a vehicle test, the vehicle is at rest with the engine running to supply power assist to the brake system. For a brake system bench test, a source to supply power assist to the system is required.

The floor check measures the travel of the full brake system or, by using clamps to block fluid flow to the corners, measures the pedal travel associated with the operation of each brake corner and the apply system. Note that unseen damage to the structure of the flexible brake hose is possible when using clamps to crimp the hose. If crimping hoses on a saleable vehicle is necessary, installation of new hoses is required when testing is finished. For some vehicle tests, only the full system performance may be required.

The floor check test may be performed at various times during a vehicle test sequence to gain information. A floor check after new brake parts are installed and before any instrumentation has been installed in the brake system provides a brake system baseline measurement. The baseline can be used to return the brake system to original performance levels in the event of leaks or air ingestion in the hydraulic system.

A floor check performed after the installation of instrumentation in the brake system may be compared to the baseline to determine that no air was introduced during the installation.

A floor check inserted in the brake test matrix can measure the increase in travel due to friction material wear or can indicate possible problems with the hydraulic system.

Floor check data which includes the Engine Control Module (ECM)/powertrain brake pedal position data from the vehicle network **bus** is needed when determining the brake pedal threshold values for Enhanced Electronic Pedal Override (EEPO). Therefore, it is recommended that the ECM/powertrain brake pedal position data be collected during all floor check measurements.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

CMVSS 135 FMVSS 135

2.2 GM Standards/Specifications.

GMW14974

2.3 Additional References. Not applicable.

3 Resources

3.1 Facilities. Use laboratory or shop area.

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3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Pedal Force Transducer. Range 0 N to 900 N. Accurate within 2 N.

3.2.2 Pedal Travel Transducer. This is accurate within 0.5 mm.

3.2.3 Vacuum Transducer. For vehicles equipped with a vacuum power brake booster, installation of a vacuum transducer capable of measuring 0 kPa to 105 kPa on the booster side of the check valve is recommended to record booster vacuum. An adapter at the booster may be required.

3.2.4 Vehicle Network Bus Tool. The vehicle network bus tool should be used to obtain brake pedal position and other brake apply related signals from the vehicle network. The following (3.2.4.1 through 3.2.4.5) vehicle network signals should be collected when available (actual signal names may vary).

3.2.4.1 ECM/Powertrain Brake Pedal Position. This data is needed when determining the brake pedal threshold values for EEPO calibrations.

3.2.4.2 Body Control Module (BCM) Brake Pedal Position. This data should be collected as an additional reference channel, if available. It can be used along with the brake pedal driver applied pressure channel to characterize the travel-force relationship of the brake without the use of external transducers.

3.2.4.3 Brake Pedal Driver Applied Pressure. This data should be collected as an additional reference channel, if available. It can be used along with the BCM brake pedal position channel to characterize the travel-force relationship of the brake without the use of external transducers.

3.2.4.4 Input Rod Position. This data should be collected as an additional reference channel for eBoost systems, if available.

3.2.4.5 Master Cylinder (M/C) Simulator Pressure. This data should be collected as an additional reference channel for eBoost systems, if available.

3.2.5 Vacuum Gage/Readout. The booster vacuum level (if applicable) should be readable from driver's seat. This might be done via a gage or through the data acquisition display.

3.2.6 Optional: Vacuum Bleed Valve. This should be accessible from driver's seat.

3.2.7 Digital Data Acquisition System. Capable of recording all channels at 100 Hz scan rate.

3.2.8 Appropriate Signal Conditioning Equipment and Cabling.

3.2.9 Calibration Record. Instrumentation is to be calibrated as required. Document instrumentation details and calibration dates in the test record/report, unless this information is otherwise preserved in the laboratory records.

3.3 Test Vehicle/Test Piece. The specific vehicle chosen for testing should be representative with respect to the brake system. The hydraulic brake system should be free of leaks and should be fully bled to remove any air in the system prior to test.

3.4 Test Time.

Calendar time: 1 day

Test hours: 0.5 hours

Set up hours: 2 hours to 4 hours installation of parts and instrumentation

3.5 Test Required Information.

3.5.1 All safety procedures shall be followed during vehicle set up and during test.

3.5.2 Ensure proper ventilation during times when vehicle engine is running.

3.6 Personnel/Skills. An experienced, trained brake technician is required.

4 Procedure

4.1 Preparation.

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4.1.1 Build vehicle with brake parts per test request. Thermocouples may be installed in pads, linings, rotors, or drums before the vehicle build for the floor check, if requested. Use instructions in Canada Motor Vehicle Safety Standard (CMVSS)/Federal Motor Vehicle Safety Standard (FMVSS) 135 for thermocouple installation in the friction material. Use instructions in GMW14974 for thermocouple installation in brake rotors and drums.

4.1.2 To achieve a representative baseline performance measurement, do not install brake line pressure transducers in the brake system before an initial floor check is completed.

4.1.3 Install the floor check instrumentation. If the pedal travel transducer is a string potentiometer or similar mechanism with internal spring loads, attaching the pedal travel transducer to the pedal force transducer (instead of to the brake pedal) will allow a measurement of the travel transducer spring force. If attached directly to the pedal, the pedal force measurement will include the internal forces due to the travel measurement device.

4.1.4 Record vehicle and brake system information in the test record/report.

4.2 Conditions.

4.2.1 Environmental Conditions. Vehicle and all brake components should be at typical indoor laboratory ambient temperature of 13 °C to 30 °C. If running a floor check following on-track brake tests, cool the brake system to near laboratory ambient before running the floor check.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 Floor checks can be run for various reasons and at various points in an extensive brake test matrix. Refer to the work request and note the condition of the brake system in the data record for each floor check test.

4.2.2.2 For standard engine manifold vacuum booster systems, the boost pressure should measure approximately 70 kPa for each brake pedal apply. Use the engine or other supply and vacuum bleed off methods to establish the 67 kPa to 70 kPa boost pressure.

4.2.2.3 For hydraulic booster systems, use the hydraulic pressure supplied by the vehicle engine at idle. For bench applications and other types of power assist, use the same assist for all brake system applies. Indicate on the test record (test data sheet) the type of assist and the method of obtaining the assist level. For vacuum systems with vacuum pumps, consult the requesting engineer for the required power assist level (or test at the engine idle vacuum condition). The typical vacuum level for an electrical vacuum pump system is approximately 75 kPa. For mechanical vacuum pump systems, the typical vacuum level is 90 kPa or higher.

4.2.2.4 Engine may remain running for the floor check brake applies that require brake power assist (boost).

4.3 Instructions.

4.3.1 For Full System.

4.3.1.1 Perform three (3) moderate brake applies to seat the brake components.

4.3.1.2 Use engine or other supply to establish the boost (assist) level. For standard engine manifold vacuum boosters, use 67 kPa to 70 kPa for the booster pressure. For other types of brake boost systems use the boost settings as specified in section 4.2.2.3.

4.3.1.3 Start data acquisition system.

4.3.1.4 Apply the brake pedal at a rate of 133 N/s $\pm$ 5 N/s to a pedal force limit of 890 N.

4.3.1.5 Release brake pedal. Stop data acquisition.

4.3.1.6 Repeat 4.3.1.2 through 4.3.1.5 until a total of three (3) runs is complete. Wait at least 1 minute between brake pedal applies.

4.3.2 For No Assist Full System.

4.3.2.1 Perform three (3) moderate brake applies to seat the brake components.

4.3.2.2 For vacuum boosted systems, with the engine off, bleed all vacuum from the booster with multiple brake applies or other methods. For other assist systems, establish a no assist condition, if possible.

4.3.2.3 Start data acquisition system.

4.3.2.4 Apply the brake pedal at a rate of 133 N/s $\pm$ 5 N/s to a pedal force limit of 890 N.

4.3.2.5 Release brake pedal. Stop data acquisition.

4.3.2.6 Repeat 4.3.2.2 through 4.3.2.5 until a total of three (3) runs is complete. Wait at least 1 minute between brake pedal applies.

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