



Braking with a Trailer

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. The purpose of this standard is to predict the braking performance of a vehicle towing a trailer, using tow vehicle tests and combination vehicle geometric parameters. Additionally, this procedure contains instructions for evaluating the combination braking performance of the test vehicle with an unbraked trailer per the SAE J2807 recommended practice.

1.2 Applicability. This procedure is applicable to all passenger cars, multipurpose vehicles, and light trucks with proportioning valves. Vehicles with dynamic rear proportioning (DRP), height-sensing proportioning, or other variable proportioning require stated assumptions about front to rear brake balance to obtain meaningful results from the analysis tool. The analysis tool cannot accurately predict the braking performance of a tow vehicle if booster run-out is reached outside of the data range and under 4.9 m/s² of deceleration.

1.3 Remarks. This standard describes a method to validate the performance of a combination vehicle to the braking with trailer requirements for brake temperature, service brake pedal force, and park brake gradeability. The procedure uses data measured during road tests on a vehicle without a trailer to analytically predict the brake performance of the same vehicle while towing a trailer. The tool predicts the following for the vehicle/trailer combination: service brake pedal force, Brake Equilibrium Temperature (BET). Consideration is also given for combination braking performance with an unbraked trailer.

2 References

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

2.1 External Standards/Specifications.

SAE J2807

2.2 GM Standards/Specifications.

GMW14924	GMW15102	GMW15112
GMW14976	GMW15106	

2.3 Additional References.

Brake System Synthesis Software (BrakePro)

3 Resources

3.1 Facilities.

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.

3.1.3 Pedal Feel Ramp Stop testing requires a level, dry asphalt or concrete test surface to perform straight-line brake testing.

3.1.4 A circular test road is preferred for the Brake Equilibrium Temperature Test to minimize steering input variation. An oval test track may be used. The road surface must be a smooth, hard surface.

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3.1.5 A variable grade ramp is required to perform the park brake portion of this test.

3.1.6 A calibrated vehicle weighing station (including suitable ballast material) which will provide measurements of the front and rear axles is required.

3.2 Equipment.

3.2.1 Data acquisition and recording equipment is required. Refer to the procedure section for data scan rate information.

3.3 Test Vehicle/Test Piece.

3.3.1 Refer to the specific test procedures referenced in the instructions below for specific details regarding test vehicle configuration and setup.

3.3.2 New brake pads and/or linings, rotors and/or drums, and park brake linings are recommended at the start of the test.

3.4 Test Time.

Calendar time: 3 days to 4 days for testing, if required

Test time: 16 hours (Burnish, Testing), if required

Coordination time: 8 hours (Analysis)

3.5 Test Required Information. BrakePro software is available per request to the GM Brake Development Group at the Milford Proving Ground, Milford, Michigan. Contact the current Engineering Group Manager or the platform Brake Development Engineer.

3.6 Personnel/Skills. An experienced brake test technician is required to perform vehicle tests. An experience brake engineer is required for test analysis.

4 Procedure

4.1 Preparation.

4.1.1 Vehicle and brake system information should be documented in the test record.

4.1.2 The test weights and weight distributions should be specified in the test request.

4.2 Conditions.

4.2.1 Environmental Conditions.

4.2.1.1 Road surface must be dry.

4.2.1.2 BET testing shall be restricted to an ambient temperature range of -6 °C to 35 °C. For other test sections the ambient temperature may be any temperature between -20 °C and 40 °C.

4.2.1.3 For BET testing, sustained wind speed must be less than 16 km/h; wind gusts must be less than 32 km/h.

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.

4.3 Instructions.

4.3.1 This analysis requires data from ramp stops, thermal brake equilibrium temperature testing, and grade hillhold testing. If this testing has been done on a platform vehicle with correct brake system and loading, use the existing data for the analysis. If testing has not been done previously, run the tests described in the following paragraphs.

4.3.1.1 Pedal Feel Ramp Stops. Perform pedal feel ramp stops at Gross Vehicle Weight Rating (GVWR) following instructions for ramp stops in GMW14976. Torque wheels at all four corners are required. Data should be recorded at 100 Hz scan rate with at least 0.5 s of data recorded before the application of the brake pedal. Temperature data should be recorded at a 10 Hz scan rate. If pedal force increase is to be determined via actual testing with a trailer rather than by analysis, additional pedal feel ramp stops with the trailer will also need to be performed. Follow instructions for ramp stops in GMW14976, except with trailer attached. Added precautions and/or permissions may be required to perform stops with a trailer.

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