



Brake Master Cylinder Reservoir Switch Point

1 Scope

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 test is to objectively quantify the fluid level which activates the fluid level switch and customer warning telltale for various scenarios.

1.2 Foreword. Test conditions are established to approximate the conditions the components experience in a vehicle. This test procedure shall be used for development and/or validation testing. The following scenarios are tested in this standard with fully worn brake linings:

- Level ground; static vehicle state.
- 30% upward and downward grades with and without failed circuit.
- 0.5G dynamic lateral acceleration with and without failed circuit.

1.3 Applicability. This test applies to all motor vehicles equipped with a brake fluid reservoir.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14927 GMW15110

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 General Motors Milford Proving Ground or equivalent test facility. Requires level pad (garage); straight track for stopping tests; 30% grade; Figure Eight Road and Belgian Block or equivalent facility.

3.2 Equipment.

3.2.1 Accelerometers to measure fore-aft and lateral accelerations.

3.2.2 Ohm meter.

3.2.3 Data acquisition system.

3.2.4 Service brake pedal force transducer.

3.2.5 Service brake pedal travel transducer.

3.2.6 Hydraulic circuit by-pass valve or equipment to induce brake single circuit failure.

3.2.7 Document instrumentation identification numbers and calibration details in the test record.

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3.3 Test Vehicle/Test Piece. Test vehicle selection should consider the combination of type and size of tires, type of wheels and wheel covers, engine, body type, suspension, and front to rear mass (weight) distribution which is representative of the extreme characteristics of the vehicle family. Caliper, brake lining thickness, brake pipe size, hydraulic cylinder size (typically master cylinder), brake fluid type, fully worn clutch (where applicable), full clutch consumption (where applicable), suspension body roll, and center of gravity are key parameters to consider. Pre-test analysis should be completed to select the appropriate vehicle for test.

3.4 Test Time.

Calendar time: 2 to 3 days

Test hours: 8 to 12 hours

Coordination hours: 1 to 2 hours

3.5 Test Required Information. Brake system and test engineer must approve the brake system prior to test. Any test components not in new condition must be approved by test engineer.

3.6 Personnel/Skills. An experienced, trained brake tester is required for vehicle instrumentation and test performance.

4 Procedure

4.1 Preparation.

4.1.1 Document vehicle and brake system information in the test record.

4.1.2 Install fully worn brake pads or linings at all brake corners. Unless otherwise specified, fully worn linings are linings with a friction material thickness at first occurrence of the wear indicator warning when installed in the caliper.

4.2 Conditions.

4.2.1 Environmental Conditions. The ambient temperature shall be any temperature between -20 °C and 40 °C.

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 Vehicle Test Loading. Vehicle loading should be the loading for worst-case center of gravity height (highest above ground level). The Test Request Engineer shall specify the vehicle loading at time of test.

4.2.2.2 Ballast. Driver plus instrumentation are considered part of the ballast.

4.3 Instructions.

4.3.1 Level Ground, Static Vehicle.

4.3.1.1 Test during the following conditions:

4.3.1.1.1 Fully worn front and rear linings with corresponding fluid level.

4.3.1.1.2 Fluid level intentionally adjusted to the minimum level as specified on the reservoir. Document the removed volume from 4.3.1.1.1 to achieve this level.

4.3.1.2 Verify sufficient fluid exists to not activate the fluid level switch.

4.3.1.2.1 Record if warning lamp is illuminated.

4.3.1.2.2 Measure resistance across switch terminals (with unplugged connector).

4.3.1.2.3 Re-install harness connector to switch.

4.3.2 Grades.

4.3.2.1 All Circuits Functional.

4.3.2.1.1 Test during the following conditions with the fluid level intentionally adjusted to the minimum level as specified on the reservoir:

4.3.2.1.1.1 Thirty percent (30%) upward grade.

4.3.2.1.1.2 Thirty percent (30%) downward grade.

4.3.2.1.2 Verify sufficient fluid exists to cover the outlets of all circuits and not activate the fluid level switch.

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4.3.2.1.2.1 Conduct floor check per GMW14927 full system test.

4.3.2.1.2.2 Apply the brakes with vehicle stationary on grade to > 50% stroke ten times at 100 N/s.

4.3.2.1.2.3 Conduct floor check per GMW14927 full system test.

4.3.2.1.2.4 Compare floor check results.

4.3.2.1.2.5 Record if warning lamp is illuminated.

4.3.2.1.2.6 Measure resistance across switch terminals (with unplugged connector).

4.3.2.1.2.7 Re-install harness connector to switch.

4.3.2.2 Either Circuit Non-Functional.

4.3.2.2.1 Test during the following conditions with either circuit failed:

4.3.2.2.1.1 Thirty percent (30%) upward grade.

4.3.2.2.1.2 Thirty percent (30%) downward grade.

4.3.2.2.2 Verify sufficient fluid exists to cover the outlets of the functional circuit.

4.3.2.2.2.1 Conduct floor check per GMW14927 full system test.

4.3.2.2.2.2 Apply the brakes with vehicle stationary on grade to > 50% stroke ten times at 100 N/s.

4.3.2.2.2.3 Conduct floor check per GMW14927 full system test.

4.3.2.2.2.4 Compare floor check results.

4.3.2.2.2.5 Record if warning lamp is illuminated

4.3.2.2.2.6 Measure resistance across switch terminals (with unplugged connector).

4.3.2.2.2.7 Re-install harness connector to switch.

4.3.2.2.3 Conduct test for both circuits.

4.3.3 Acceleration/Deceleration.

4.3.3.1 All Circuits Functional.

4.3.3.1.1 Test during the following conditions with the fluid level intentionally adjusted to the minimum level as specified on the reservoir:

4.3.3.1.1.1 Lateral acceleration 0.5G, clockwise.

4.3.3.1.1.2 Lateral acceleration 0.5G, counterclockwise.

4.3.3.1.1.3 Three (3) laps of Belgian Blocks between 20 and 30 km/h.

4.3.3.1.1.4 Accelerate at wide open throttle (WOT) to vehicle speed of 100 km/h.

4.3.3.1.1.5 Make a brake stop 100 km/h at a deceleration rate of 0.1G.

4.3.3.1.1.6 Make brake stops from 100 km/h at deceleration rates of 0.2G, 0.5G and maximum deceleration (with cycling of the antilock brake system if vehicle is so equipped).

4.3.3.1.1.7 Drive three alternating curves on the figure-eight road at the highest attainable speed.

4.3.3.1.1.8 Make three brake stops at 1 s intervals at a deceleration rate of 0.5G. The initial speed for the 2nd and 3rd stop is the final speed of the previous stops.

4.3.3.1.2 Verify sufficient fluid exists to cover the outlets of all circuits and not activate the fluid level switch.

4.3.3.1.2.1 Conduct floor check per GMW14927 full system test.

4.3.3.1.2.2 Expose vehicle to above conditions.

4.3.3.1.2.3 Conduct floor check per GMW14927 full system test.

4.3.3.1.2.4 Compare floor check results.

4.3.3.1.2.5 Record if warning lamp is illuminated.

4.3.3.2 Either Circuit Non-Functional.

4.3.3.2.1 Test during the following conditions with either circuit failed:

4.3.3.2.1.1 Lateral acceleration 0.5G, clockwise.

4.3.3.2.1.2 Lateral acceleration 0.5G, counterclockwise.

4.3.3.2.1.3 Three (3) laps of Belgian Blocks or equivalent facility between 20 and 30 km/h.

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