



## Brake System Reservoir Design Verification

### 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 test procedure is to determine if the brake system reservoir design meets the applicable requirements of either:

- Federal Motor Vehicle Safety Standard (FMVSS) 135, Light Vehicle Brake Systems; or.
- FMVSS 105, Hydraulic Brake Systems.

**1.2 Applicability.** This standard is applicable to all vehicles required to certify to FMVSS 135 or FMVSS 105.

**1.3 Remarks.** This procedure results in an analysis that may be used to determine compliance to the applicable requirements in FMVSS 135 sections 5.4.1, 5.4.2, and 5.1.1(a)1, or FMVSS 105 sections 5.4.1, 5.4.2, and 5.3.1(b).

### 2 References

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

#### 2.1 External Standards/Specifications.

FMVSS 105                      FMVSS 135

#### 2.2 GM Standards/Specifications.

None

### 3 Resources

**3.1 Facilities.** Brake test laboratory required.

**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.** Equipment for measurements of brake fluid is required.

**3.3 Test Vehicle/Test Piece.** Production intent brake fluid reservoir is required. Drawings of the brake fluid reservoir may also be required.

**3.4 Test Time.** Time required for analysis and engineering report is approximately 2 days to 3 days.

**3.5 Test Required Information.** Not applicable.

**3.6 Personnel/Skills.** The responsible GM design engineer, GM performance engineer, brake apply system supplier engineer, or other qualified engineer shall execute this procedure. A review by the Program brake release engineer and validation analyst is suggested.

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December 2017

Page 1 of 11

## 4 Procedure

**4.1 Preparation.** Not applicable.

**4.2 Conditions.**

**4.2.1 Environmental Conditions.** Not applicable.

**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** The accuracy of the analysis results from this procedure is dependent on the quality of the apply system data available at the time of the analysis.

**4.2.2.2** Changes to the brake system after model year regulatory validation may require a new analysis.

**4.3 Instructions.**

**4.3.1** Complete the data sheets included in Appendix A, Data Sheets A1 and A2. Refer to FMVSS 135 or FMVSS 105 documents for any needed clarification of the requirements. The appropriate FMVSS 135 or FMVSS 105 section numbers are listed on the data sheets.

**4.3.2** The data sheet for the Master Cylinder Displacement Determination has sections for physical measurement and for calculation of the fluid levels. Only one (1) method is required for compliance verification.

## 5 Data

**5.1 Calculations.** The completed worksheets contain the test results and the summary sheet stating a Pass/Fail judgment for the applicable requirements. Use these worksheets to report the results in the published evaluation report.

**5.2 Interpretation of Results.** The results may be used to document compliance to the applicable requirements in FMVSS 135 sections 5.4.1, 5.4.2, and 5.1.1(a)1, or FMVSS 105 sections 5.4.1, 5.4.2, and 5.3.1(b).

**5.3 Test Documentation.** Publish the results in an engineering evaluation report stored in the GM Global Document Management (GDM) system.

## 6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

## 7 Notes

**7.1 Glossary.** Not applicable.

**7.2 Acronyms, Abbreviations, and Symbols.**

**FMVSS** Federal Motor Vehicle Safety Standard

**GDM** Global Document Management

**GSSLT** Global Subsystem Leadership Team

## 8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW15110

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December 2017

Page 2 of 11



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## 9 Release and Revisions

This standard was originated in February 2006. It was first approved by Global Chassis Brakes Subsystem Leadership Team in February 2006. It was first published in April 2007.

| Issue | Publication Date | Description (Organization)                                                                                                                                     |
|-------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | APR 2007         | Initial publication.                                                                                                                                           |
| 2     | JUL 2012         | Revised to include FMVSS105 testing: changes in 1.1, 1.2, 1.3, 4.3.1, 5.2. 3.4 updated with expected completion time. (Brake Global Subsystem Leadership Team) |
| 3     | DEC 2017         | Revised to current template. (Chassis - Brake Global Subsystem Leadership Team (GSSLT))                                                                        |

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December 2017

Page 3 of 11

## Appendix A

## Data Sheet A1: Brake System Reservoir Design Verification page 1 of 2



## Brake System Reservoir Design Verification

|                            |                         |                        |
|----------------------------|-------------------------|------------------------|
| Model Year & Program _____ | Brake System Type _____ | Date _____             |
| PER / Report Number _____  | Hydraulic Split _____   | Brake System RPO _____ |

Part Numbers: Brake Booster / Master Cylinder / Reservoir Assembly \_\_\_\_\_  
 Brake Reservoir with Fluid Level Indicator \_\_\_\_\_  
 Brake Master Cylinder \_\_\_\_\_

Instructions: This sheet must be completed for **Each Type of Service Brake System** to be released on the Model Year and Platform listed above.

To answer the questions which do not apply to the type of Service Brake System, Product Features, or Options available on the Model Year and Platform listed above, enter NA in the YES column

| FMVSS<br>135                                                                                                                                                                                                                                                                                                                                       | FMVSS<br>105 | <b>BRAKE SYSTEM RESERVOIR</b>                                                                                                                                                                                                                                                                                                                                                                | YES   | NO    | Initials |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|----------|
| S5.4.1                                                                                                                                                                                                                                                                                                                                             | S5.4.1       | The vehicle is equipped with a master cylinder that has a reservoir compartment for each service brake subsystem serviced by the master cylinder.                                                                                                                                                                                                                                            | _____ | _____ | _____    |
| S5.4.1                                                                                                                                                                                                                                                                                                                                             | S5.4.1       | A complete loss of fluid from one subsystem reservoir compartment leaves some fluid in the other subsystem reservoir compartment(s).                                                                                                                                                                                                                                                         | _____ | _____ | _____    |
| S5.4.2                                                                                                                                                                                                                                                                                                                                             | S5.4.2       | The total volume of fluid in the master cylinder (when filled to the nominal "Full" line) is greater than or equal to the fluid displacement resulting when all the wheel cylinders or caliper pistons serviced by the reservoir move from a new lining, fully retracted position (as adjusted initially to the manufacturer's recommended setting) to a fully worn, fully applied position. | _____ | _____ | _____    |
| NOTE: In determining the fully worn, fully applied position, assume that the lining is worn to:<br>(1) Rivet or bolt heads on riveted or bolted linings, or<br>(2) 0.8 mm of shoe or pad mounting surface on bonded linings, or<br>(3) The limit recommended by the manufacturer if this results in more fluid displacement than (1) or (2) above. |              |                                                                                                                                                                                                                                                                                                                                                                                              |       |       |          |
| NOTE: For a vehicle equipped with a brake power unit, consult the platform release engineer for additional FMVSS 135 / FMVSS 105 fluid volume requirements (for charging system piston(s) or accumulator(s) to normal operating pressure).                                                                                                         |              |                                                                                                                                                                                                                                                                                                                                                                                              |       |       |          |
| S5.4.2                                                                                                                                                                                                                                                                                                                                             | S5.4.2       | The volume of dedicated fluid in each master cylinder subsystem compartment (NOT including common fluid that is available to two or more subsystems) is greater than or equal to the volume of fluid displaced by the master cylinder piston servicing that subsystem in a full stroke of the piston.                                                                                        | _____ | _____ | _____    |
| S5.5.1(a)(1)                                                                                                                                                                                                                                                                                                                                       | S5.3.1(b)    | If the brake fluid reservoir is equipped with a brake fluid level indicator, does the indicator activate at a brake fluid level equal to or greater than a fluid level of 1/4 of the fluid capacity of that reservoir compartment                                                                                                                                                            | _____ | _____ | _____    |

|       |       |            |
|-------|-------|------------|
| _____ | _____ | Date _____ |
| Name  | Title |            |
| _____ | _____ | Date _____ |
| Name  | Title |            |

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Page 4 of 11

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