



Brake System Activation

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 provide a method to activate a vehicle brake system using an external pressure source.

1.2 Applicability. This standard can be applied to any inertially reacted multi axis road simulator, but is currently intended for implementation on the MTS 329LT and MTS 329PC Road Simulators (see GMW15189) as well as fixed reacted multi axis road simulator testing (see GMW14794).

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW14794

GMW15189

GMW15242

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.

3.2 Equipment. The recommended equipment is listed in the procedure section of this document. If this equipment is not available locally, equivalent equipment may be substituted.

3.3 Test Vehicle/Test Piece. Any 4 wheeled vehicle with hydraulic brakes.

3.4 Test Time.

Calendar time: 1 day to 3 days to prep test vehicle

Test time: 6 hours to 10 hours

Coordination time: 1 hour to 3 hours

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. No certification or education required to complete this procedure. Some general automotive repair skills are desired.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

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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.

4.3 Instructions. The following steps are required to pressurize the vehicle brake system on a multi axis road simulator using an external pressure source.

4.3.1 Remove Brakes. Remove the brake pads/shoes from the vehicle or test specimen.

4.3.2 Prepare Brakes. There are two options to preparing the brake pads: Machining the production-intent pads or using solid steel pads.

4.3.2.1 Machine the brake pad/shoe lining. This can be done to the original linings or to a new set. It is recommended to machine the brake pads/shoes wet to minimize dust exposure (see Appendix A, Figure A1). Save the original brake pads/shoes if the vehicle needs to be drivable at the conclusion of testing.

Note: As noted in GM Service manuals, do not create brake dust. Avoid causing any dust or particulate matter to become airborne where it could be inhaled. This includes not using compressed air to clean any dust that may be generated.

Although all GM Original Equipment Manufacturer (OEM) parts should be asbestos-free, the possibility exists that brake pads or shoes could have been manufactured with compounds unknown to GM. Some models or aftermarket brake parts may contain asbestos fibers which can become airborne in dust. Breathing dust with asbestos fibers may cause serious bodily harm. Use a water-dampened cloth in order to remove any dust on brake parts.

Equipment is available commercially in order to perform this washing function. These wet methods prevent fibers from becoming airborne. Because of this, it is recommended that pads or shoes be sent to an outside source that can machine the shoes/pads to the required thickness using the proper ventilation and dust collection.

4.3.2.2 As an alternative to machining the pads, it may be possible to use solid steel brake pads, however, buy-in from Brake Design Release Engineer (DRE) is recommended to use this method (see Appendix A, Figure A2).

4.3.2.3 The machined or solid steel brake pads must be reduced by sufficient thickness to allow the rubber to be bonded to the remaining lining and still allow for proper installation (see Appendix A, Figure A1). Normally the pads are machined, and shoes have the brake linings completely removed.

4.3.3 Rubber Preparation.

4.3.3.1 Acquire a sufficient quantity of DuPont Viton rubber or equivalent. Viton is preferred as it has been found to provide adequate grip with acceptable useful life. The rubber must be 90 durometers with a 3.2 mm (0.12 in) or 4.8 mm (0.19 in) thickness.

4.3.3.2 Using the lining as a template, cut the rubber to size. The alternative is to leave the rubber slightly oversize and trim it to size after gluing. The alternative method accounts for any slippage that may occur before the adhesive is fully cured.

4.3.4 Surface Preparation. Clean the lining and rubber with brake cleaner to provide a clean surface for bonding.

4.3.5 Adhesive. Bond the rubber to the linings using Loctite 380 Black Max Instant Adhesive (see Appendix A, Figure A1, Manufacturer Material Safety Data Sheet (MSDS) No. 38050). Clamp for 16 h to 24 h to allow the adhesive to cure.

4.3.6 Installation. Use brake cleaner to clean the drums/rotors. Install brake pads/shoes on the vehicle or test specimen.

Note: If the vehicle has drum brakes, the automatic brake adjuster must be removed and Loctite adhesive applied to the star wheel to prevent unintended brake adjustment.

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4.3.7 Manifold Block Installation.

4.3.7.1 For vehicles, trace the brake lines from the wheels to the first removable fitting. These fittings will typically be either at an Anti-lock Braking System (ABS) unit or the brake master cylinder.

4.3.7.2 Install a manifold block (see Appendix A, Figure A3) at the first removable fitting for each brake line so that the brake fluid pressure goes direct to each wheel. This bypasses the ABS unit.

4.3.7.3 The manifold block has a quick disconnect on it so that the vehicle can be removed for service with little to no bleeding of the brake lines.

4.3.7.4 For a fixed-reacted test, a simple fitting can be used to split the brake line to the two brake corners.

4.3.8 Brake Pressure Booster.

4.3.8.1 The recommended Single Acting Brake Pressure Booster is the PowRLock Model 25-0110 (see Appendix A, Figure A4). Other functionally equivalent brake pressure boosters are also acceptable.

4.3.8.2 Mount the brake pressure booster at a higher level than the brake corners to allow gravity bleeding of the brake system.

4.3.8.3 Attach the brake pressure booster output line to the master cylinder/manifold.

4.3.8.4 Install the remaining components as shown in the system flowchart in Appendix B, Figure B1.

4.3.9 Bleed Brakes. One method to bleed the brake system follows: Other methods (like suction bleeding) are acceptable.

4.3.9.1 Fill the brake pressure booster reservoir with brake fluid.

4.3.9.2 Attach a catch reservoir and hose to one bleeder screw on the brake corner and open the bleeder screw.

4.3.9.3 Push down the reservoir push rod and hold to allow a small amount of fluid to drain into the catch reservoir. Make sure shop air pressure is not applied while pushing down the push rod on the reservoir.

4.3.9.4 Release the push rod and close the bleeder screw.

4.3.9.5 Repeat 4.3.9.1 thru 4.3.9.4 for the remaining brake corners.

4.3.9.6 Turn on shop air to the brake booster and adjust the air pressure to approximately 69 kPa (10 psi). This value should be the minimum required to flow brake fluid through the system.

4.3.9.7 Manually activate the brake booster.

4.3.9.8 Slowly open the bleeder screw to drain a small amount of fluid, and then immediately close the bleeder screw.

4.3.9.9 Shut off the manual switch for the brake booster.

4.3.9.10 Push the plunger on the brake booster to replenish the fluid in the system, then release. Add brake fluid to top off the reservoir.

4.3.9.11 Repeat 4.3.9.7 thru 4.3.9.10 until there is no longer any air in the line.

4.3.9.12 Repeat 4.3.9.7 thru 4.3.9.11 for the remaining brake corners.

4.3.10 Pressure. Adjust the brake booster pressure to the pressure required to prevent slippage. This is typically between 11 340 kPa (1500 psi) and 15 170 kPa (2200 psi). Do not exceed 15 170 kPa (2200 psi) or burst pressure of any brake system component, including "weeping" of flexible lines.

4.3.11 Pressure Check.

4.3.11.1 Manually activate the system and make sure there is no pressure loss (observe for 30 s).

4.3.11.2 Repeat this pressure check several times.

4.3.12 Controls for Durability Testing. The brake system is automatically activated during durability testing by using either:

4.3.12.1 A digital output line which is set by placing triggers in the brake drive file, or,

4.3.12.2 Using a Digital to Analog (D/A) channel to send out a voltage to turn it on and off.

4.3.12.2.1 If the D/A channel method is used, a 5 V signal is used to pressurize the brake system and 0 V signal used to release the pressure.

4.3.12.2.2 The test console limits for the brake torque channels should be set to stop the test if there is a loss in hydraulic line pressure.

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