Electric Park Brake - Component Mechanical Performance Test Procedure

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.

Note: If there is a conflict between this document and a specific cable print or Component Technical Specification (CTS), the print or CTS shall take precedence.

1.1 Purpose. This document sets forth the global procedure for testing the mechanical performance of the electric parking brake (EPB) module.

1.2 Foreword. Not applicable.

1.3 Applicability. This is a component test procedure, applicable to EPB mechanisms that are of the single-cable puller variety.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3172

3 Resources

3.1 Facilities. Laboratory or shop area.

3.2 Equipment. Standard lab fixtures, load, and travel measuring devices are required. Electronic equipment capable of monitoring EPB functionality during testing is required.

3.3 Test Vehicle/Test Piece. Production representative EPB component assemblies are to be used when testing to this procedure.

3.4 Test Time.

Calendar time:	45 days
Test hours:	480 hours
Coordination hours:	24 hours daily 20 days

GMW3172: 45 days. The specific test procedures described in this document take place concurrent with GMW3172, but taken alone would occupy 20 days when wear cycle testing runs 24 h per day.

3.5 Test Required Information. All safety procedures shall be followed while installing thermocouples in brake components.

3.6 Personnel/Skills. An experienced, trained brake technician or engineer.

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 the procedure shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.2.2.1 This test is to be run in conjunction with the electrical test procedure GMW3172. Specific instruction is given in each section that tells where to insert each mechanical test into the GMW3172 testing sequence. References to GMW3172 Test Leg numbers are from the flow chart located in the GMW3172 handbook. Motor-on-Caliper (MoC) type EPB components can ignore references to spring packs and cables. MoC assemblies must pass GMW3172 as dictated in this document with the caliper housing present. The EPB Electronic Control Unit (ECU), if separate from the mechanical unit, must still pass this test with the Environmental codes called out in the CTS. References to the setup fixture in Figure A1 are to be ignored for MoC, and, in its place, a simple fixture that allows the EPB to perform its normal clamping function is appropriate.

4.2.2.2 When any procedure specifies cycling, it is implied to mean the maximum attainable cable load at the locked and held condition, unless specifically noted. Apply and release modes are to be initiated electrically using 14 V, unless noted otherwise.

4.2.2.3 Any design change to the part(s) made to correct a failure of any part of this test must be communicated to the responsible GM engineer to determine if the change warrants restarting the entire test procedure, or only a portion thereof.

4.2.2.4 Measurement devices used in this procedure must be accurate to within 1% of the master calibration.

4.2.2.5 Temperatures cited in this procedure are to be held to ± 1 °C.

4.3 Instructions.

4.3.1 General Performance/Wear Life. Paragraph 4.3.1 is to be run on four different EPB assemblies that are being tested to Test Leg 2 of GMW3172, with the total cycles evenly distributed throughout the Power Temperature Cycling phase. These parts must see 8 h of dust exposure just prior to starting the Power Temperature Cycling phase, per the dust procedure found in the “smart switch” test flow from the GMW3172 handbook.

If the EPB is a cable-puller, mount the EPB module using the production intent fastener locations. Attach a spring pack to the output end of the cable as shown in Appendix A, Figure A1. Ensure that full load is attained without reaching solid height on any spring.

Note: The EPB initialization sequence (sometimes called “pre-stretch” or “cable seating”) should be run prior to starting this test. Set the mechanical stop “A” in the position shown in Appendix A, Figure A1 (10 mm from engagement) after running the initialization sequence.

4.3.1.1 Cable Force Output/Caliper Clamp Force.

4.3.1.1.1 Prepare to measure force at the output end of the cable.

4.3.1.1.2 At room temperature, cycle the unit. Remove the input voltage and record the observed force. Repeat at 9 V and 16 V. For MoC, do this using clamp force measurements.

4.3.1.1.3 Repeat paragraph 4.3.1.1.2 after soaking the unit for one hour at -40 °C. Repeat after a one hour soak at 85 °C.

4.3.1.2 Apply/Release Time. Cycle the unit and record the amount of time it takes the module to reach 1500 N (the start time should be when the EPB has received the signal to apply). Release the system and record the amount of time it takes to release the spring pack to the start position (the start position is defined as noted in 4.3.1, above, with mechanical stop returned to the 10 mm gap as in Appendix A, Figure A1). The start time should be when the EPB has received the signal to release. For MoC, times should be measured to the agreed to target clamp force.

4.3.1.3 Release Strategy Verification (not applicable to MoC).

4.3.1.3.1 Measure the position of the stop “A” (relative to an unmoving reference). See Appendix A, Figure A1.

4.3.1.3.2 Cycle the unit and release. Again, measure the position of the stop “A”, and note the difference from the value measured in paragraph 4.3.1.3.1.

4.3.1.3.3 Repeat paragraphs 4.3.1.3.1 and 4.3.1.3.2 for a total of 5 cycles.

4.3.1.4 Wear Life Testing. The EPB module must be monitored throughout the cyclic wear test for proper function (including detection of unintentional applies and releases). The method for doing this must be included in the final test report.

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The EPB shall be applied 150 000 times during the GMW3172 Power Temperature Cycling. No maintenance (lubrication, adjustment, etc.) allowed during this test. From there, continue to apply and release at ambient temperatures, and note the number of cycles attained until failure and the failure type.

4.3.1.5 End of Wear Test Performance Re-Verification. Repeat paragraphs 4.3.1.1 to 4.3.1.3. For 4.3.1.3, use the same measuring reference used in the original test.

4.3.2 Other Tests - Run During GMW3172.

4.3.2.1 Manual Release. Perform the following test on all parts that have completed the corrosion portion of GMW3172. Use the test fixture as in Appendix A, Figure A1. Cycle the unit and hold at maximum load. Release the system using the intended tool/provision. Record the position of mechanical stop “A” upon release.

4.3.2.2 Disengagement. Testing for inadvertent mechanical release of the EPB is to be done on parts that are being subjected to the 100 g “Mechanical Shock” portion of Test Leg 1 in GMW3172. The EPB is to be cycled to the maximum load attainable at 14 V at ambient temperature and locked (e.g., with cable load retained) when subject to the shock cycles. Insure that all planes are tested. Record any loss of cable load, or if MoC, record any loss of clamp load.

4.3.2.3 Other Tests - Run on Any Parts. Paragraph 4.3.2.3 is to be run on any six pieces used for the GMW3172 test.

4.3.2.3.1 Frozen Cable Detection–Apply (not applicable to MoC).

4.3.2.3.1.1 Lock the spring pack such that no cable travel can occur.

4.3.2.3.1.2 Cycle the unit. Record if an “error” message is sent to the Controller Area Network (CAN) bus to indicate a possible mechanical problem to the vehicle operator.

4.3.2.3.1.3 Repeat paragraphs 4.3.2.3.1.1 and 4.3.2.3.1.2, this time allowing 5 mm of cable travel prior to locking the spring pack.

4.3.2.3.2 Frozen Cable Detection–Release (not applicable to MoC).

4.3.2.3.2.1 Cycle the Unit. Prior to releasing, place a stop at the output end of the cable in the spring pack that prevents the cable from traveling in the release direction.

4.3.2.3.2.2 Cycle the EPB to the Release Mode. Record if an error message is sent to the CAN bus to indicate an incomplete release condition is detected.

4.3.2.3.3 Disconnected Cable Detection (not applicable to MoC).

4.3.2.3.3.1 De-couple the cable button from the springs such that a minimum of 100 mm of free cable travel is possible.

4.3.2.3.3.2 Cycle the unit and record the amount of cable travel observed at the point that an “error” signal was sent to the CAN bus indicating a disconnected cable is present in the system.

4.3.2.3.4 Rapid Cycle Durability. Using the test fixture in Appendix A, Figure A1, cycle the unit to the maximum attainable cable load or clamp load (at ambient temperature and 14 V). Immediately release the system. Continue the apply and release sequence at the rate of 20 cycles per minute until part failure occurs. Record the type of failure and number of cycles attained.

4.3.2.4 Production Fastener Compatibility. All parts being tested in the GMW3172 Corrosion phase must include production intent fasteners attached to the EPB mounting provisions with the appropriate torque specification. After the Corrosion phase of the test leg, insure that the fasteners can be disassembled without damaging the EPB module.

4.3.2.5 Production Cable Sealing Integrity. The GMW3172 Humidity Test and the Seal Test must include production intent cables in order to evaluate the robustness of the cable to EPB interface. Parts finishing durability cycling after GMW3172 Test Leg 2 shall be evaluated for sealing using the seal evaluation technique (in Test Leg 3). Note any leaks and their cause.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Document the test results indicated on the example data sheet in Appendix A, Figure A2. Results may be compared to requirements in the applicable technical specifications.

5.3 Test Documentation. Publish test results in an engineering report stored in the global document management system.

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