



Door Lock System, Inside Manual Lock Actuator – Effort Test

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. To evaluate the efforts required to lock and unlock the door using the inside manual lock actuator, or to pull the inside handle to perform double pull unlock.

1.2 Applicability. This standard applies to all passenger cars, light duty trucks, and medium duty trucks having any swing open doors, sliding side doors, or any other door design having an inside manual lock actuator.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

- Subsystem Technical Specifications (SSTS)
- Vehicle Technical Specifications (VTS)

3 Resources

3.1 Facilities. The facility should have all of the equipment listed in 3.2 and be capable of providing the conditions required in 4.2.

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.

Note: The description includes fixturing and instrumentation typically used by the GM North America Body Test Laboratory to perform this test. Other equipment may be substituted at the discretion of the testing facility as long as it provides the same data and/or data record with equivalent accuracy as specified herein or by the requestor.

3.2.1 Fixturing.

3.2.1.1 If the door is not on a body, it must be rigidly clamped to a fixture, such as a laboratory door cart, that can constrain it in a fixed position.

3.2.1.2 Force gage accessories, as required, needed to push and/or pull the specific type of lock actuator being tested, or to pull the inside handle to perform double pull unlock. See Appendix A, Figure A1 for typical lock actuator illustrations.

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3.2.2 Instrumentation. Force gage or torque wrench, depending on lock type with a capacity approximately 1.5x the specification.

3.3 Test Vehicle/Test Piece. One (1) fully assembled door including interior trim and the entire locking assembly, including the latch assembly, attaching lock rods or cables, interior lock components and surrounding trim. Trim may affect lock system efforts. It is recommended that the door assembly be dimensionally certified before testing is started.

3.4 Test Time. The following is an estimate of the amount of time (work hours) needed to perform this procedure.

Note: These time estimates are approximate averages. Actual times vary considerably depending on early component failures and subsequent availability of replacement parts, testing to varying multiples of cycle lives, varying requirements for frequency of environmental test conditions, scheduling problems for test facilities, test equipment malfunctions, scheduling of overtime and/or multiple shifts, actual readiness of test samples upon receipt, unique or additional requests for detailed test information, running multiple samples (times shown are for one (1) system), etc.

3.4.1 These times consider preparation and other downtime, actual test, and analysis of data in capturing a total calendar time. Report writing, approval, processing, etc., are not part of these times.

Technical Resource: 2 h

Engineer Resource: 2 h

Calendar Duration (total): 1 d

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. (Reference Side Closure section from SSTS: Effort – Manual Door Lock Controls and Travel).

3.5.1 Testing worst case scenarios may uncover some potential problems. Discuss with the requesting engineer if testing should include some worst case scenarios. Depending on which test is being performed and which level of parts or systems is being tested, consider if any of the following may apply.

- Tolerance stack ups
- Build variations
- Misalignment
- Minimum/maximum fastener torques
- Lubrication
- Environmental extreme
- Location of customer representative load application
- Symmetry (left hand versus right hand)
- Color
- Mold or die source, etc.

3.5.2 The following specifications or information are required to run this test.

3.5.2.1 The performance objective (efforts) to lock or unlock the door using the inside lock manual actuator, or to unlock the door using the inside handle to perform a double pull unlock.

3.5.2.2 Environmental conditions/extremes during test (4.2).

3.5.2.3 Alternative load locations or loading techniques.

3.5.2.4 Worst case scenarios conditions/configurations.

3.5.2.5 Load application points and orientations.

3.6 Personnel/Skills. Prior experience in setting up and running similar tests, and experience in the use of the referenced test equipment, is critical to achieving the estimated times shown in 3.4.1.

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4 Procedure

4.1 Preparation.

4.1.1 Sample Inspect. The test and requesting engineers should inspect the test items to ensure all material listed in 3.3 is of correct design level and assembled properly. Visually inspect the actuators and their surrounding areas. For comparison to post-test inspection, see 4.3.3.

4.1.2 Sample Preparation. This test is normally run on the test subject in an as-received condition. If it is requested to be run in a specifically adjusted condition, follow the applicable procedures.

4.1.3 Facilities and/or Equipment Preparation. Record the instrumentation calibration information on Appendix A, Data Sheet A1, or an equivalent document.

4.2 Conditions.

4.2.1 Environmental Conditions. Unless otherwise specified in this document's text or by the requesting engineer, this test is to be run at -30 °C, 80 °C, and ambient, typically the environmental conditions at the major test facility (3.1.1). Unless otherwise noted, ambient conditions are typically 22 °C ± 3 °C, relative humidity of 40% ± 20%, and atmospheric pressure equivalent to the local barometric pressure (which is variable during any given day and from day to day).

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 Setup Instructions. Perform any functional tests, operational tests, or evaluations as requested or as referenced in the SSTS or VTS. Specifically, cycle the lock system through at least five (5) full cycles to ensure proper operation and seating of all system components. Ensure all fasteners are torqued to their production specified values. Note any irregular sounds or erratic operation indicating a potential problem with design, manufacture, or assembly, and verify observations with the requesting engineer.

4.3.2 Test Operation Instructions.

Note: This evaluation is a manually run test and is susceptible to human error. It is recommended that this test be run for at least three (3) trials to provide multiple readings that can be averaged together.

4.3.2.1 Test Operation for Linear Motion Actuator.

4.3.2.1.1 Determine a force application point on the lock actuator by considering typical customer usage (3.5.2.5). Record this location by photograph, sketch, etc., in data for the test. It is possible that lock/unlock efforts may vary depending on where the force application point is. It should be as close to the center of the available loading surface as possible.

4.3.2.1.2 Attach the appropriate accessory (hook attachment, flat target shape, or specially made attachment) to the handheld force gauge. Hold the force gauge so that it remains parallel to the direction of travel for the hook actuator throughout the entire travel. See Appendix A, Figure A1 for sample setup illustrations. Zero the gage as necessary.

4.3.2.1.3 Find the force required to lock and unlock the door by pushing, or pulling, depending on actuator style using a smooth and constant effort. This will reduce the possibility of false readings due to sudden starts or stops. For systems equipped with double-pull unlock, find the force required to unlock the door by pulling on the inside handle at the required load point. In all cases, do not push or pull the lock actuator or handle to its end stop. See Figure A3. Record the results on Appendix A, Data Sheet A2. Repeat this step for a total of three (3) sets of measurements.

4.3.2.1.4 Test Operation for Rotary Motion Actuator. Find the torque required to lock/unlock using a torque wrench and a suitable adapter using a smooth and constant effort. Make sure the centerline of the lock actuator coincides with the centerline of the head of the torque wrench. See Appendix A, Figure A2 for setup illustration. Record the results on Appendix A, Data Sheet A2. Repeat this step for a total of three (3) sets of measurements.

4.3.3 Post-test Instructions. Measure and record any areas of visible deformation and/or breakage. Note any discrepancies in the manual lock actuator and the area immediately adjacent to the actuator

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