



Door Lock System, Lock Cylinder – Effort Test

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. To evaluate the door lock cylinder system by subjecting it to (3) three functional tests; torque to lock and unlock, key insertion and extraction effort, and key rotation angle for locking, unlocking, and total travel.

1.2 Foreword. Not applicable.

1.3 Applicability. This standard applies to all passenger cars, light duty trucks, and medium duty trucks having any swing open doors, sliding side doors, end gates, decklids, or any other door design having an outside key cylinder which actuates any of the body closure's locking systems.

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 Specification – SSTS.
- Vehicle Technical Specification – VTS.

3 Resources

3.1 Facilities. GM North America Body Test Laboratory or a similarly equipped test facility.

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 following lists include 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 not on a body, the door must be rigidly clamped to a fixture, such as a laboratory door cart.

3.2.1.2 Torque wrench key adapter.

3.2.1.3 Force gage key adapter.

3.2.2 Instrumentation.

3.2.2.1 Torque wrench with a capacity approximately 1.5 times the specification.

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3.2.2.2 Force gage with a capacity of approximately 1.5 times the specification.

3.2.2.3 Protractor, tape, and wire.

3.3 Test Vehicle/Test Piece. One (1) fully assembled door including all sheet metal parts, reinforcements, and the entire locking assembly including the lock module, lock cylinder, attaching lock rods, and any part or trim material which may add to the frictional efforts involved with this test. The key for the cylinder is also required. It is recommended that the test parts/assembly be dimensionally certified before testing is started.

3.4 Test Time. The following is an estimate on the amount of 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, scheduling of witnesses for tests, actual readiness of test samples upon receipt, unique or additional requests for detailed test information, and 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.

Technician Resource: 1 hour

Engineer Resource: 2 hours

Calendar Duration – total: 1 day

3.5 Test Required Information. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. Reference VTS/SSTS if applicable.

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 extremes.
- Location of customer representative load application.
- Symmetry - left hand versus right hand.
- Color.
- Mold or die source, etc.

3.5.2 The following specifications are required to run this test.

Note: In some cases, additional specifications may be required, such as maximum key rotation (to the stops), rotation and effort required to activate certain vehicle anti-theft devices, etc.

3.5.2.1 The maximum torque required to lock or unlock the door.

3.5.2.2 The key insertion/extraction effort.

3.5.2.3 The key rotation angle to lock/unlock.

3.5.2.4 Maximum key rotation angle in the lock/unlock directions.

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.

4 Procedure

4.1 Preparation.

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4.1.1 Sample Inspection. 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.

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.

4.1.2.1 Many lock cylinder keys include a key boot. In most cases, the key boot will not alter the torque and force data readings and, therefore, its removal from the key is optional.

4.1.2.2 Inspect the key and remove any burrs that may be present.

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, the typical environmental conditions for this test are the temperature, humidity, and pressure at the major test facility. Unless otherwise noted, these 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.

4.3.1.1 Perform the following functional/operational tests/evaluations. Specifically, insert, extract, and rotate the key in the lock cylinder at least five (5) times. This will remove any burrs that may be present in the lock cylinder system that could alter test results. As applicable, note any irregular sounds or erratic operation indicating a potential problem with design, manufacture, or assembly, and verify observations with the requesting engineer.

4.3.1.2 Clamp the door securely to the fixture (i.e., door cart) in approximate body position so the door lock cylinder is accessible.

4.3.2 Test Operation Instructions.

4.3.2.1 Operating Instructions to Determine Key Insertion and Extraction Effort.

4.3.2.1.1 Using the force gage and key adapter, insert the key into the lock cylinder until it is fully engaged. The key should be normal to the surface of the lock cylinder and aligned with the key slot in the cylinder while inserting. A smooth and constant motion should be applied. See Appendix A, Figure A2 for an illustration of this test. Record the peak force required to insert the key prior to the key bottoming out in the cylinder. Do not turn or rotate the key at this time. Record the force on Appendix A, Data Sheet A1, Instrument Calibration.

4.3.2.1.2 With the key fully engaged in the lock cylinder and with the key and force gage oriented as in 4.3.2.1.1, determine the peak force required to extract the key. A wire loop can be tied through the key chain slot of the key to facilitate performance of this step. Record the force on Appendix A, Data Sheet A2.

Note: The Key Insertion/Extraction Effort, 4.3.2.1.1 and 4.3.2.1.2, is a manually run test and is operation sensitive. It is recommended that three (3) sets of data be acquired and the results averaged to minimize potential error from a single test.

4.3.2.2 Operating Instructions to Determine Minimum Torque to Lock/Unlock Test.

4.3.2.2.1 Insert the key.

4.3.2.2.2 Rotate the key so the cylinder is in the full locked position and record the direction of rotation, clockwise or counterclockwise, required to lock the door. Return the key to neutral position. Make sure the centerline of the key coincides with the centerline of the head of the torque wrench. See Appendix A, Figure A2 for a setup illustration.

4.3.2.2.3 Using the torque wrench and the key adapter, slowly apply a torque to the key until the door is unlocked, and record the peak torque. Return key to neutral position.

Note: Key travel may extend beyond the unlocked position. If this is the case, ignore torque values encountered in the range beyond where unlocking occurs.

4.3.2.2.4 Repeat 4.3.2.2.3, starting in the unlocked position and determine the peak torque required to move to the locked position.

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