



Closure Panel Handle, Lock, Latch System, Durability

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. This test is performed to verify that the handle/lock/latch sub-systems are functioning properly and that the operating efforts are within their specified ranges throughout their cycle life.

1.2 Applicability. This procedure applies to all passenger cars, light duty trucks, and medium duty trucks having swing-open doors, sliding doors, endgates, and liftgate closure panel systems. With modifications to fixturing and the text within this procedure, this procedure may also be applicable to any other closure panels having handle/lock/latch type systems.

1.3 Remarks. This procedure describes the method of performing a closure panel system's handle/lock/latch durability test. This system includes any or all of the following: Door latch, inside handle, outside handle, power lock, manual lock, child security lock, and the key cylinder (and all associated fasteners, linkages, etc.)

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW15084

GMW15780

GMW15820

GMW15831

2.3 Additional References.

- CG2911 Pre-Test Checklist
- CG2917 Post Test Checklist
- Global Door Subsystem Technical Specifications (SSTS), Table 3.1.5.7-II for Visual/Functional and Measured Data Required Checks.

3 Resources

3.1 Facilities. The major facility should contain the equipment described in 3.2 in addition to environmental chambers capable of providing the test environments specified in the applicable sections of the SSTS.

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 list(s) include fixturing and instrumentation typically used 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.

Note: Because of the level of sophistication involved in creating the test equipment for this procedure, many of the dimensions in this procedure remain in conventional units rather than being converted to units (International

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System of Units SI – Metric units). As the test equipment is upgraded, reconfigured, or rebuilt, and SI based hardware and software is incorporated, the referenced dimensions in this test procedure will be changed over to SI units.

3.2.1 Fixturing.

3.2.1.1 A moveable handle/lock/latch durability cart to support the test material. Cart mobility may be required for movement of the closure panel(s) in and out of environmental chambers. A typical cart used for Handle/Lock/Latch testing is shown in Figure A2.

3.2.1.2 Structural metal framing (“Unistrut” brand is shown in figures) to support the pneumatic devices that are used to cycle the handle/lock/latch components (see Figures A2 and A3).

3.2.1.3 Pneumatic cylinders with a 2.7 cm diameter bore size for operating the handle/lock/latch system functions, e.g., handles, manual locks, and child locks (see Figure A3).

3.2.1.4 Non-rotating pneumatic cylinder – Festo brand DZH-1 1.5875 to 5.08 cm, PPV-A-S6-16262 H360 is shown in Figure A1; (1 per latch) to support and activate the latch striker and provide the simulated weather-strip seal force on the latch system (see 3.5.8). The mating striker for the provided latch is attached to this cylinder via an adapter (see Figure A1).

Note: Heat tape may be required on pneumatic actuators to prevent freezing if testing is conducted in a cold environment.

3.2.1.5 Rotary pneumatic cylinder (phdbrand, 3-position, miniature rotary cylinder - series 3R11A2180X90-V with 90 degree per side angle adjustment to rotate the key. Similar cylinder is shown in Figure A4). This cylinder is equipped with rotational limit adjustments for the lock and unlock positions. The cylinder also has a 3rd position that is used for the key's neutral position (see Figure A4).

3.2.1.6 Various adapters for linking knobs, handles, keys, strikers, etc., to the actuating and load-measuring devices.

3.2.1.7 Outside diameter: 0.79375 cm outside diameter (OD) nylon air lines to supply air from the console to the control box on the cart. This set of lines is typically approximately 7.5 m in length in order to accommodate moving the test set-up into environmental chambers.

3.2.1.8 Outside diameter: 0.635 cm OD air lines to supply air from the cart's control box out to the individual component's pneumatic cylinders on the cart.

3.2.2 Instrumentation.

3.2.2.1 Some of the desired controller features are:

- Individual closed-loop load control for strikers, inside handles, and outside handles.
- 0 to 20 V range selection for power lock durability cycling.
- Flexibility that allows the user to build the required or requested power lock durability cycle.
- Adjustable “rest” period between cycles for each individual component being tested.
- Controller keeps track of the required and total cycle counts, in each environment, for each individual component being tested.
- Automatic zeroing and load scaling capability for all load cells. The user enters the 100 k Ω shunt resistor value, and the console uses this number when scaling all loads.
- Delayed start timer (use is optional).

3.2.2.2 Hermetically-sealed load cells with a capacity of approximately 1.5 times the specified loads (see 3.5). The load cells will be used to apply the seal force load to the closure panel's latch, and the pull loads for the inside and outside handles.

Note: The following are typical sizes: 1100 N load cells for the door strikers and 500 N load cells for the inside and outside handles.

3.2.2.3 Torque wrenches with capacities of approximately 1.5 times the torque specification provided in 3.5; these are used to measure key cylinder efforts and provide proper torque to fasteners.

3.2.2.4 Force gages with capacities of approximately 1.5 times the specifications (see 3.5); these gages are used to measure operating efforts of the closure panel's handles, the inside manual lock actuator, and the child

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lock. A force gage (when pressure switches are used) is also used to check the load supplied by handle actuators for overload or snap back cycles.

3.2.2.5 Proximity sensor to monitor whether the striker has released from the latch when the inside or outside handle is actuated; the GMNA Body Test Lab uses an extended sensing distance proximity sensor to determine the position of the striker load cell (Part No. AK1-AN-4H from Automation Direct is shown in Figure A1).

3.2.2.6 A scribe and/or paint pen that is suitable for marking applicable fasteners in order to check for movement and/or rotation throughout the test.

3.3 Test Vehicle/Test Piece.

3.3.1 This test requires a closure panel assembly including the applicable following subassemblies: latch, inside and outside handles, inside manual lock actuator, power lock, key cylinder and key, and child security lock. Also, any trim (hard/soft) which may contribute, through support, interference, or friction, to operating efforts or range of travel of various lock/latch components, should be installed. It is recommended that the test parts/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. 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.

Calendar time: 44 d (70 d for trucks)

For a complete 1 life test
including all components.

Engineer time: 60 h

Technician time: 40 h

3.5 Test Required Information. Refer to Table 3.1.5.7-II of the Global Door SSTS, for Visual/Functional and Measured Data Required Checks.

3.5.1 Durability cycle requirements, and a precise definition of what constitutes a cycle.

3.5.2 Percentage of cycles to be conducted at each environmental condition, and if applicable, any particular sequence in which the testing should be performed, e.g., perform cold cycles first, followed by hot, followed by ambient, followed by humidity.

3.5.3 Key Cylinder Operating Effort and Range (also known as Travel). Minimum and maximum torque values and allowable degradation. Maximum operating range value. This applies only to those doors that have key cylinders.

3.5.4 Inside Handle Operating Effort and Range. Minimum and maximum unlatching efforts and allowable degradation, along with the location at which effort is measured and load is applied during testing. Maximum operating range value.

3.5.5 Outside Handle Operating Effort and Range. Minimum and maximum unlatching efforts and allowable degradation, along with the location at which effort is measured and load is applied during testing. Maximum operating range value.

3.5.6 Manual Lock Actuator Operating Effort and Range. Minimum and maximum forces and/or torque values and allowable degradation in these values throughout testing. Minimum and maximum operating range values.

3.5.7 Child Security Lock Operating Effort and Range. Minimum and maximum forces and/or torque values and allowable degradation in these values throughout testing. Minimum and maximum operating range values if applicable.

3.5.8 Striker force that is exerted on the door latch, simulating the closure panel/body weatherstrip load (seal force), and the amount of travel of the striker into the latch (see the **note** in 4.3.1.3).

3.5.9 Power lock operating voltage and the duration of each power lock/unlock actuation. Also, specify the frequency of the power lock cycles, e.g., 1 cycle/minute, etc.

3.5.10 List of fasteners to be monitored throughout the test.

3.5.11 If required, any loads beyond operating efforts to be applied to inside and outside handles before or during durability testing.

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3.5.12 For all components to be tested, specify how frequently functional, effort, and travel checks should be performed on each component.

3.5.13 All applicable fastener torque values and description of whether the value is a nominal, minimum, or maximum torque value.

3.5.14 Pre-test material, set up, and functional checks (refer to table 3.1.5.7-II of the Global Door SSTs and Pre-Test Checklist CG2911 located in the General Motors Global Document Management (GDM) database).

3.6 Personnel/Skills. Prior experience in setting up and running similar tests and experience in the use of the referenced test equipment are critical to achieving the estimated times shown in “3.4 Test Time”.

4 Procedure

4.1 Preparation.

4.1.1 Sample Inspection. The test and requesting engineers should inspect the test items to insure all components that comprise the test are 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 procedure(s).

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

4.2 Conditions.

4.2.1 Environmental Conditions. Environmental conditions for this test can be found in the Durability Usage Definition section 3.1.5 of the Global Subsystem Technical Specification (GSSTS) document.

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.

All deviations must be documented prior to beginning the test.

4.3 Instructions.

4.3.1 Set Up Instructions.

4.3.1.1 Mount and secure the closure panel(s) to the handle/lock/latch durability cart. Secure the panels in approximate design position (see Figure A2).

4.3.1.2 Ensure that all component fasteners are torqued to specification, and then mark all appropriate fasteners in order to check for movement and/or rotation throughout the test.

4.3.1.3 Attach the striker and load cell fixturing to the non-rotating pneumatic cylinder. Secure this fixture to the cart, similar to what is shown in Figure A1, and then align the fixturing to ensure proper operation with the closure panel latch. Note that misalignment of the latch and striker can cause binding that will lead to false striker load readings, false handle effort readings, and also cause premature latch and striker wear along with possible load cell malfunctions.

Note: Per the requesting engineer, the striker fixture may need to be adjusted in the inboard/outboard directions in order to limit how far the striker cylinder allows the striker to travel into the latch. This is done in cases where the requesting engineer does not want the striker to contact the back of the latch as the striker is inserted into the latch. Even though this is not the standard, be aware that it has been requested in the past.

4.3.1.4 Adjust the striker position sensing device (proximity sensor) so that it senses when the striker is fully retracted from the latch (see Figure A1).

4.3.1.5 Zero the striker load cells and establish the load scaling.

Note: The reason for completing step 4.3.1.5 is to prepare the striker load cells for steps 4.3.1.7 and 4.3.1.8. In 4.3.1.7 and 4.3.1.8, the controller will use the striker load cells to automatically close-loop control around the desired striker load (i.e., simulated seal load).

4.3.1.6 To obtain correct performance measurements, it is recommended that the handles, inside manual lock actuator, and key cylinder be manually cycled approximately five (5) times prior to recording effort values. This “break-in” of a new system will reduce the influence of burrs, mold flash, etc., that may be present in the newly assembled system. Perform these cycles at this time.

4.3.1.7 Fully engage the striker into the latch.

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4.3.1.8 Perform any functional/operational tests/evaluations as requested or as may be referenced in Section 2 References; see 4.3.2.4 for a list of effort checks to be performed. As applicable, note any irregular sounds or erratic operation that may indicate a potential problem with design, manufacture, or assembly, and verify these observations with the requesting engineer.

4.3.1.9 If applicable, adapt the rotary pneumatic cylinder to the closure panel's key to achieve proper operation when locking and unlocking the key cylinder (see Figure A4). Insure that the rotational center of the rotary pneumatic cylinder coincides with the rotational center of the key cylinder. Misalignment can cause binding, key breakage, and premature key cylinder wear.

4.3.1.10 As applicable, adapt a pneumatic cylinder for proper operation of the outside handle. The cylinder will be used to unlatch the closure panel via the outside handle. There may be cases where the requesting engineer will require a specific load to be applied to the outside handle during each cycle. Refer to 3.5.5, and incorporate a load cell or equivalent method if requested.

4.3.1.11 As applicable, adapt a pneumatic cylinder for proper operation of the inside door handle. The cylinder will be used to unlatch the door via the inside handle. See Figure A3. Similar to the outside handle above, incorporate a load cell or equivalent method if a specific load has been requested in 3.5.4.

4.3.1.12 As applicable, adapt pneumatic cylinder(s) for proper operation of the manual inside lock actuator (to lock and unlock). (see Figure A3). For "double pull unlocking" systems, the controller is programmed to pull the inside handle to unlock the manual lock to complete the cycle.

4.3.1.13 If performing power lock cycling, make the appropriate cable connection from the control box on the cart directly into the power lock actuator motor on the latch, thus bypassing the power lock switch. Be sure to set the power source to the proper supply voltage such that the specified operating voltage is obtained at the latch.

4.3.1.14 If applicable, adapt pneumatic cylinder(s) for proper operation of the child security lock actuator.

4.3.1.15 Before beginning durability cycling, re-zero all load cells that will be used during the test.

4.3.1.16 Make any final adjustments in the positioning of the various cylinders adapted to the handle/lock/latch systems, e.g., manual locks, child locks, inside handles, outside handles. As an example, if the requesting engineer or GSSTS specifies that the outside handle be actuated just enough to release the striker from the latch, without loading the outside handle past the stop position, then the pneumatic cylinder would be adjusted so that it "bottoms-out" just after the striker is released. Likewise, if requested to load the outside handle to 100 N, then adjust the cylinder such that when it pulls on the outside handle, the cylinder does not run out of travel when attempting to apply the load.

4.3.1.17 Adjust the manual lock pneumatic actuator so that its full stroke ends before the minimum travel of the lock button is achieved, allowing the lock button to complete its travel under the bell crank spring load.

4.3.1.18 Adjust the child lock pneumatic actuator so that there is no pressure against either stop point of the lock, and no drag on the lever during or between cycles.

4.3.1.19 When cycling manual locks, child locks, and key cylinders, some controllers allow the user to enter the pressure value that is sent to the pneumatic cylinder when cycling each of these components. The range allowed is 7 kPa to 550 kPa. Flow controls may be added to control the rate at which the component is actuated and released.

4.3.1.20 Connect any additional required air lines or sensing wires.

Note: When connecting air lines to the inside and outside handles. It is essential to include a flow control valve on the return line of the handle cylinders when using load cells (see Figure A3). The reasoning for this is that the load cells are sensitive to impacts that occur when pulling or releasing the inside and outside handles too fast. As a result of this, **snap-back** cycles should not be performed when using load cells. **Snap-back** cycles can only be performed when load cells are not installed.

4.3.2 Test Operation Instructions.

4.3.2.1 Determine the sequence of cycles, durations, etc., from the SSTS documents and from test requestor information (3.5). It should include all methods and combinations of latching, locking, etc. and should simulate expected customer usage. The following example (4.3.2.1.1 to 4.3.2.1.10) illustrates such a sequence for a side door system.

4.3.2.1.1 Insure that the door is in the unlocked condition.

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