



Fuel Filler and Charge Port Door System, Operating Efforts and Durability Cycle

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 procedure is to determine, if a fuel filler or charge port door system meets the operating effort and cycle durability requirements of the Subsystem Technical Specifications (SSTS).

1.2 Applicability. This procedure applies to all passenger cars and light duty trucks which utilize a hinged door to cover the fuel filler or charge port pocket and cap.

1.3 Remarks. The fuel filler and charge port door should undergo cycling through full design travel. This procedure can be conducted on any level of experimental, production, or prototype material. However, consideration should be given to the effects of build tolerances, different paint processes, and the effect of paint bake ovens on the hinges, springs, and materials utilized in the design.

For example; the position of the fuel or charge port door during the production paint bake process may affect counterbalance spring output.

A Fuel/Charge Door Vertical Stiffness Test, and/or a Fuel/Charge Door Check Load Strength Test may be combined with this test in order to minimize lab set up time.

The actual program durability and life cycle requirements are to be established before and provided to the lab prior to beginning the test. The actual cycle durability schedule may vary by program, and may include ambient temperature cycling as well as Hot Temperature and Cold Temperature cycling so as to simulate actual customer use conditions.

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

3 Resources

3.1 Facilities. GM Body Test Lab or similarly equipped test facility. Environmental Chamber with humidity control capable of maintaining -40 °C to 90 °C temperature and able to accommodate the full test setup or a full size (non-commercial) test vehicle.

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 in a GM Body Test Lab to perform this test. Other equipment may be substituted at the discretion of the testing facility as long as it provides the

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same data and/or data record, with equivalent accuracy without compromising the test intent as specified herein or by the requester.

3.2.1 Fixturing.

3.2.1.1 Pneumatic actuators of a stroke and bore size determined by the door's geometry and the forces required to operate the system.

3.2.1.2 Basic fixture materials and structural framing, such as Unistrut, to position the actuators.

3.2.2 Instrumentation.

3.2.2.1 Torque wrench(s) with a range of approximately 1.5 times the maximum torque(s) specified by the requesting engineer.

3.2.2.2 If required for electrically actuated fuel or charge port door release mechanisms, use an appropriate voltage power supply.

3.2.2.3 Force gages (and accessories) of capacity appropriate to the effort specifications.

3.2.2.4 Pneumatic controller with an appropriate number of channels for the number of actuators required.

3.2.2.5 Protractor or similar angle measurement device to determine the fuel filler or charge port door angle relative to adjacent body panels or to the closed position.

3.2.2.6 Instrumentation to measure door slam velocity and bump force.

3.3 Test Vehicle/Test Piece. A car/truck body or section of a body which surrounds the fuel filler or charge port door, fuel filler or charge port door assembly, fuel filler/charge port pocket, remote or emergency release mechanisms, associated wires, cable, all system fasteners, and any other components associated with the system. Depending on system configuration, a fuel filler tube/neck, cap and cap tether may be required to perform this test.

It is required that the door assembly, especially those parts affecting the lock system's performance, be dimensionally certified before testing is started.

3.4 Test Time. The following is an estimate on 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, scheduling of witnesses for tests, actual readiness of test samples upon receipt, unique or additional requests for test details, running multiple samples (times shown are one system), etc.

These times consider typical 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 this time.

Calendar time: 14 d

Test time: 26 h

Coordination time: 2 h

3.5 Test Required Information.

3.5.1 Performance Objectives. The requesting engineer is responsible for providing specifications appropriate to the particular vehicle line being tested. Consider designing the test to cover for extremes of build process, design tolerances and severe customer usage. If testing should include some worst case scenarios, some potential problems may be uncovered. Discuss with the requesting engineer, if testing should include some worst case scenarios, such as tolerance stack-ups, build variations, misalignment, minimum/maximum fastener torque(s), lubrication, environmental extremes, etc.

3.5.1.1 Specifications for the following items are required to monitor performance during this test.

3.5.1.1.1 Maximum/minimum operating efforts, both opening and closing, for the door and the release mechanism.

3.5.1.1.2 Durability cycle requirements (quantity, cycle rate, number of lives, etc.)

3.5.1.1.3 Sequence and percentage of cycle count in environmental conditions.

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3.5.1.1.4 Load specification for check load.

3.5.1.1.5 Load points to operate open and closed (swing lines).

3.5.1.1.6 Angle requirements or limits.

3.5.1.1.7 Torque specifications for all fasteners.

3.5.1.1.8 Orientation of filler pipe and cap (if applicable).

3.5.1.1.9 Orientation of remote release mechanism (if applicable).

3.5.1.1.10 Frequency of measuring operating efforts and clearances, if different than prior to and after cycling.

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.

4 Procedure

4.1 Preparation.

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. Note on the Data Sheet A2 any evidence of damage to the fuel filler or charge port door or contact to the surrounding components prior to testing.

4.1.2 Sample Preparation. The fuel filler or charge port door assembly or components of the assembly must be provided by the requester. The body panel specific to where the test door and all related hardware is supposed to be installed into is cut out in a large enough section so that an adequate fixture could be built making the body panel as part of the fixture. A general recommended cut out is about 300 mm around the opening for the door. Smaller cut outs may interfere with fixtures and test setup. Once set up with the fixtures in place, the door assembly as installed must represent the production intent condition in all measurable manners on the vehicle. Any deviations must be reported and approved by the requester.

4.1.2.1 Assemble the fuel filler or charge port door into the pocket/quarter panel assembly according to the Master Process Documents (MPD).

Note: MPD should be consulted throughout this process for order of assembly, torque specifications, etc.

4.1.2.2 If this test is to be conducted on a cut out section of the body, the section should be rigidly mounted in body position.

4.1.2.3 If requested, install the fuel filler pipe and cap in the specified position.

4.1.2.4 Construct a fixture to position the pneumatic actuators to simulate customer usage. The test fixture should be designed to operate the fuel door or charge port through its full design travel and should apply the opening and closing forces to the area of the door simulating customer usage. Examples of fixtures are shown in Figures B1 thru B5.

4.1.2.5 If applicable, position an actuator to operate the fuel filler or charge port door release cable or electric release simulating customer usage.

Cable routing and wire length may affect system performance. If this occurs, the requesting engineer should be consulted.

4.1.2.6 Mark all fasteners in order to make any movement obvious.

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 test facility (3.1). Unless otherwise noted, these conditions are typically 22 °C +3 °C (72 °F + 5 °F), relative humidity of 40% +20% and atmospheric pressure equivalent to the local barometric (which is variable during any given day and from day to day). Environmental Chamber with humidity control should be capable of maintaining -40 °C to 90 °C temperature.

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 Set Up Instructions. See Figure B1 through Figure B6 in Appendix B for examples.

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4.3.1.1 Cycle the lock system through at least five full cycles to ensure proper operation and seating of all system components. Note any irregular sounds or erratic operations indicating a potential problem with assembly or design, and verify observations with the requesting engineer.

4.3.1.2 Connect the cylinders of the test fixture to the pneumatic controller.

4.3.1.3 Adjust the air pressure to the minimum allowable. This reduces the risk of damage to the test sample and will highlight any increases in system operating efforts during durability cycling. With the air pressures at minimum, any increase in fuel door/charge port operating effort will result in a failure of the test fixture to function and will automatically shut down the test. This will alert the operator to check for an increase in operating effort.

4.3.1.4 If the fuel filler or charge port door system has an electric release, adjust the power supply to the voltage specified by the requesting engineer. Designs with high power usage and/or long wire runs may experience voltage drop. Electrically actuated release systems should not be cycled at battery voltage without consideration of actual expected voltage by the requesting engineer.

4.3.2 Test Operation Instructions.

4.3.2.1 The following effort measurements should be conducted prior to and after cycling; opening effort, closing effort, remote release effort, opening angle, and fuel filler or charge port door swing clearance.

4.3.2.2 Opening effort is measured by applying a force to the fuel door or charge port at the typical point a customer would use. The force is applied using a force gage and appropriate accessories such as a hook or an extension tip as necessitated by the design. Beginning with the door in the closed or **ajar** position (depending on, if the system uses a remote release), the force is applied in a direction tangent to the fuel door/charge port swing line. The force should be applied slowly (25 mm/s) opening the door using the force gage and noting the peak force prior to reaching any full open/check stop. For fuel doors or charge port doors with a push-push mechanism slowly push the door with a force gauge until hearing the audible click of the push-push mechanism and release the force gauge. Record the result. Repeat for a total of three readings and average the results.

4.3.2.3 Closing effort is measured in the same manner as opening effort. Beginning with the fuel door or charge port in the full open position slowly (25 mm/s), apply the force required to close the fuel door/charge port. Note the peak force obtained prior to contacting any latching mechanism. If additional effort is required to latch the door, such as with some remote release systems, record the force required to do so. For fuel doors or charge ports with a push-push mechanism slowly push the door with a force gauge until hearing the audible click of the push-push mechanism and release the force gauge. Repeat for a total of three readings and average the results.

4.3.2.4 Remote release effort is measured by applying a force to the remote release handle or electrical switch. The force should be applied slowly (25 mm/s) until the system releases and in a way that the customer would do so. Peak force should be recorded. Repeat for a total of three readings and average the results.

4.3.2.5 Door/hinge swing clearance is measured using a scale and positioning the fuel filler or charge port door anywhere within its design travel which might allow contact between the door and its surrounding body panels or trim.

Measurement of clearance between the fuel filler or charge port door and the quarter panel during dynamic overtravel can be accomplished by placing a small (2 mm x 10 mm x 10 mm) piece of modeling clay in the area of minimum clearance or any area of the body which is likely to come into contact with the door during an opening cycle or check load type cycle. The thickness of the clay at the area of minimum clearance after cycling represents the overtravel or swing clearance.

4.3.2.6 The flushness and gaps between the fuel filler or charge port door and the surrounding body panels should be measured prior to testing and periodically during testing.

4.3.2.7 Check for contact between the fuel filler or charge port door and surrounding body panels or components. Any squeak or rattle noises should also be noted on the Data Sheet A2.

4.3.2.8 Begin cycling the fuel filler or charge port door (cycle rate = 6/minute) to the fully opened and closed positions without being restrained beyond any hinge over-center position in either direction. This means that when the spring mechanism in the door system, which provides the force to hold the door open or closed, begins to cause the door to move on its own, this movement should not be restricted by the test fixture.

4.3.2.9 The test should be monitored for contact between the fuel filler or charge port door and surrounding body panels or components. Indications of contact include scratched paint, metal filings, or dents. The test sample should also be monitored for any squeak or rattle noises during testing.

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