



Aero Shutter Assembly Blockage 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. The purpose of this procedure is to determine if an aero shutter assembly meets the blockage test requirements of the Component Technical Specification (CTS).

1.2 Applicability. This test procedure is to be used for all aero shutter assemblies.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3221

2.3 Additional References.

- Component Technical Specification (CTS)

3 Resources

3.1 Facilities. Environmental chambers capable of maintaining temperatures between 0 °C and 85 °C and large enough to test multiple aero shutter assemblies at one time.

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.

3.2.1 Software. Software and interfacing hardware shall be provided by the actuator supplier that includes the operating parameters for the actuator and can be used with a personal computer.

3.2.2 Pulse Width Modulation (PWM) or Local Interconnect Network (LIN) Generators. PWM or LIN generators are required to allow the software to send a signal to the actuator to cycle the aero shutter assembly and send a signal back through the software that the aero shutter assembly was able to successfully cycle. The generator must also be capable of representing the actuator sending a signal to the vehicle level controller and triggering the “re-try” operation mode when an obstruction prevents the louvers from cycling to the open or closed position.

3.2.3 Twelve Volt (12 V) Battery Source. A 12 V battery source is required to power the actuator.

3.2.4 Temperature Measurement. A contactless infrared pyrometer is required to measure surface temperature.

3.2.5 Camera. A camera is required for pre and post-test photographs.

3.3 Test Vehicle/Test Piece.

3.3.1 Test Piece. The parts used for design validation (DV) testing are to be complete aero shutter assemblies off of prototype tools. The parts used for product validation (PV) are to be complete aero shutter assemblies off of production tools.

3.3.2 Test Piece Quantity. Per CTS.

3.3.3 Conditioning. Condition to GMW3221, Code A.

3.4 Test Time.

Calendar time: 1 d

Test time: 3 h

Coordination time: 2 h

3.5 Test Required Information.

3.5.1 Maximum Torque. The maximum actuator torque is required for blockage condition 1, holding the shutters closed and attempting to open. In case of a Brushless DC (BLDC) actuator; this test must STOP once the actuator reaches the Boost torque. (Torque value to be documented within the test report). This value must match the maximum torque listed on the actuator drawing.

3.5.2 Nominal Torque. The nominal operating torque is required for blockage condition 2, placing a foreign object between the louvers and blocking the operation in the closing direction. In case of BLDC actuator; this test must STOP once the actuator reaches the Nominal torque. (Torque value to be documented within the test report). This value must match the nominal torque listed on the actuator drawing.

3.5.3 Test Setup Photographs. Take photographs of the test setup prior to start of test.

3.5.4 Part Photographs. Take photographs of the aero shutter assemblies to be tested before, during and after each of the environments of the two different blockage scenarios.

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 in 3.4.

4 Procedure

4.1 Preparation.

4.1.1 Test Piece Constraints. The aero shutter assembly is to be securely constrained to a test fixture representing all vehicle attachments and the correct vehicle orientation. An example is provided in Figure 1.



Figure 1: Example of Test Setup

4.1.2 Blockage Location. The louvers of the aero shutter assembly are to be blocked at the location that is the furthest away from the actuator. The intention is to comprehend the maximum deflection and stress within the louver and linkage mechanism.

4.2 Conditions.

4.2.1 Environmental Conditions. Test is to be run at ambient, hot, and cold temperatures per the CTS.

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.

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