



Washer Reservoir Cap

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 standard defines the testing methodology and requirements for validating the washer reservoir cap to GM requirements.

1.2 Applicability. This standard applies to all original equipment and replacement windshield wiper components for passenger cars, Multipurpose Passenger Vehicles (MPV), and trucks.

1.3 Remarks. This document is the GM Worldwide Washer Reservoir Cap testing standard. Its purpose is to establish a common test methodology for a washer reservoir cap to ensure a high quality world class system is consistently developed and produced. This is a living document and any suggestions or revisions will be reviewed and/or updated annually by the Wiper and Wash Systems Global Subsystem Leadership Team (GSSLT).

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW16044

2.3 Additional References.

- 5-Phase Document
- Component Technical Specification (CTS)
- GM Security Guidelines (<https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx>)
- Subsystem Technical Specification (SSTS)

3 Resources

3.1 Facilities. No special facilities required.

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 Thermal chamber large enough to contain test fixture and capable of -30 °C to +80 °C with controlled humidity.

3.2.2 Instron machine capable of pulling at 500 mm/minute to 1000 mm/minute.

3.2.3 Specific fixtures for each test.

3.2.4 Force Gage.

3.3 Test Vehicle/Test Piece.

3.3.1 Unless otherwise specified, six (6) samples of components from each cavity shall be tested.

3.3.2 All components/systems used in testing shall be within drawing specifications and have supporting data prior to start of test.

3.3.3 Test samples shall not be used before 24 h after completion of molding process. Samples shall be stored in the same condition as they are shipped to the Tier 1 supplier (open or closed).

3.4 Test Time. Time is dependent on test being performed.

3.5 Test Required Information.

3.5.1 GM Validation is to be notified of any test failures within 24 h period of occurrence.

3.5.2 Supplier to develop 5-Phase Document for all test failures.

3.5.3 Product Security. Security protocol for the test vehicle must be followed per GM Security Guidelines available at <https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx>.

3.6 Personnel/Skills. A person with previous wiper washer reservoir test experience who has conducted similar tests for GM.

4 Procedure

4.1 Preparation.

4.2 Conditions.

4.2.1 Environmental Conditions. The following conditions apply to all tests, unless otherwise specified:

- Ambient temperature: $+23\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$.
- Humidity shall be 50% to 75% for all tests unless otherwise specified.
- Minimum Temperature (T_{MIN}) is $-30\text{ }^{\circ}\text{C}$ unless otherwise specified.
- Maximum Temperature (T_{MAX}) is $+80\text{ }^{\circ}\text{C}$ unless otherwise specified.

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.

4.2.3 Part Orientation. Parts shall be tested in vehicle orientation unless otherwise specified.

4.2.4 Emerging Market Environmental Conditions. Emerging markets are to use the following unless stated otherwise in the program specific SSTs.

- $T_{\text{min}} = -20\text{ }^{\circ}\text{C}$ for India.
- $T_{\text{min}} = -40\text{ }^{\circ}\text{C}$ for Russia.
- $T_{\text{min}} = -15\text{ }^{\circ}\text{C}$ for South America only.

4.3 Instructions.

4.3.1 Durability/Reliability.

4.3.1.1 Purpose. This test is to verify a washer cap will meet specified performance requirements during a vehicle's lifetime with reliability and confidence level of R99C50 at one (1) life. One (1) life is defined as 500 cycles. One (1) cycle is defined by opening cap 180 degrees and closing it. When doing more than one (1) life to meet reliability and confidence requirements, after one (1) life run at ambient. For testing to failure, stop at 5000 cycles.

4.3.1.2 Test Equipment. See 3.2.

4.3.1.2.1 Cycle counter/encoder.

4.3.1.2.2 Oscilloscope.

4.3.1.3 Test Samples. See 3.3.1, six (6) samples from each cavity. Two (2) samples on the nominal diameter fixture; two (2) samples on the minimum diameter fixture; two (2) samples on the maximum diameter fixture.

4.3.1.4 Test Preparation. See 4.1.

4.3.1.4.1 If GM validation engineer is not available to view test, provide video record showing test setup and initial system operation.

4.3.1.4.2 Reliability requirement can be met through success or failure testing. Review with GM validation engineer and receive agreement on which method will be used before start of test.

4.3.1.4.3 Failure Test. Recommended for Design Validation (DV) testing. A minimum of six (6) samples from each cavity shall be used. Repeat durability test profile, until a failure defined on the drawing or in the program specific SSTS is detected. Analyze the resulting failure data using a Weibull probability plot to estimate the reliability. The estimate shall be R99C50 or better at one (1) life. Deviations to this must have approval by the GM Subsystem Vehicle Engineer (SVE) and Design Engineer (DE) for the program.

Note: A Beta slope of 1.5 shall be used as a default and for new suppliers or new designs. The value can be increased based on the following:

- Experienced supplier.
- Approval by the SVE and DE for the program.

Supplier shall notify SVE and DE of the Beta slope used and whether success or failure test method will be used prior to start of any testing.

Table 1: Reliability 99% with 50% Confidence (R99C50)

Chart Using Beta = 1.5	
Sample Size	Number of Life Cycles
3	5.09
6	3.21
Chart Using Beta = 2.0	
Sample Size	Number of Life Cycles
3	3.39
6	2.40
Chart Using Beta = 3.0	
Sample Size	Number of Life Cycles
3	2.26
6	1.79

4.3.1.4.4 Success Test. Recommended for Product Validation (PV) testing. Six (6) samples from each cavity shall be used. Table 1 provides direction for required test duration with six (6) samples. Repeat durability test profile, until life cycles have been run without failure.

4.3.1.5 Cap Opening and Closing Efforts during Durability. Set up test fixture with metal gauge simulating the plastic reservoir to perform force testing using Instron Pull Tester per Figure 1. This test maybe completed during the durability testing and does not need to be run separately.

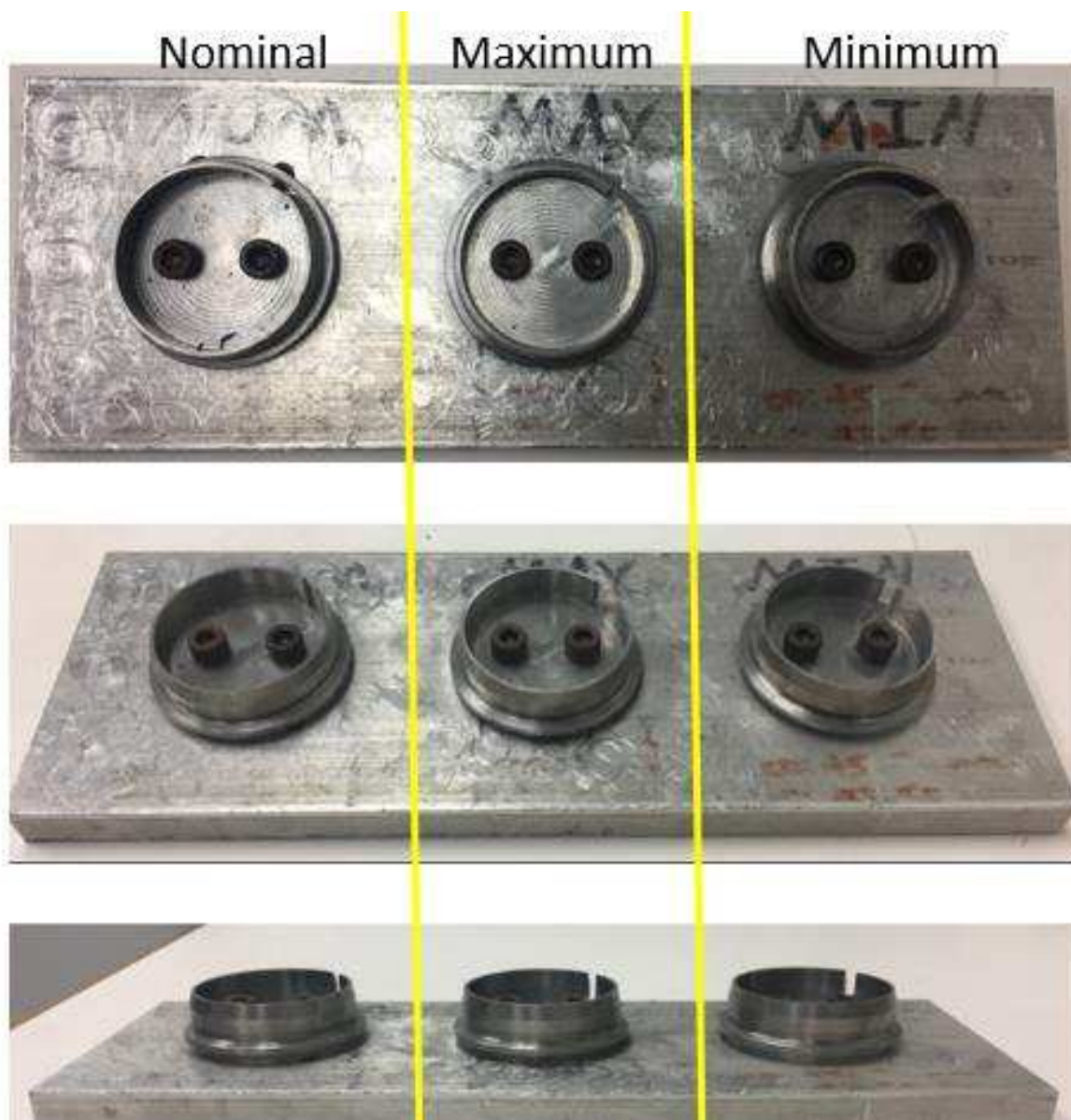


Figure 1: Metal Fixture

Note: Figure 2 shows test setup. A bottle shall NOT be used. A maximum diameter and minimum diameter fixture must be used per Figure 2.

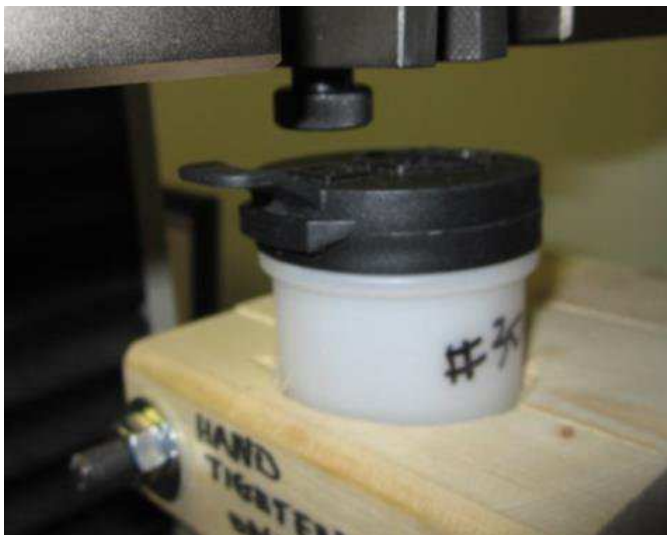
4.3.1.6 Test Condition. Instron pull speed is 500 mm/minute.

4.3.1.6.1 Conduct durability/reliability test using durability test profile in Figure 3 for passenger vehicles, and Figure 4 for trucks. Verification of system operation and data monitoring equipment shall be done at least twice a day.

Picture 1



Picture 2



Setup for Closing Cap

Close-up of Closing Cap

Picture 3



Setup of Opening Cap

Picture 4



Close-up of Opening Cap

Figure 2: Test Setup for Opening and Closing the Cap – USE FIXTURE ONLY