



Washer Reservoir Level Sensor Component Specification

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 test is to evaluate the performance of the washer reservoir level sensor on a component level.

1.2 Applicability. This standard is applicable for all car, Multipurpose Passenger Vehicle (MPV), and truck models produced by GM Worldwide with a level sensor in the washer system reservoir.

1.3 Remarks.

- This document is intended to test performance requirements of a washer reservoir level sensor under environmental conditions.
- This document and any suggestions or revisions will be reviewed and/or updated annually by the Wiper and Wash Systems Global Subsystem Leadership Team (GSSLT).
- This procedure is a component level test. A vehicle level test is required for validation.

2 References

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

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

GMW3059 GMW3600

2.3 Additional References.

- Five (5) Phase document.
- GM Security Guidelines - (<https://gmweb.gm.com/HR/Security/Pages/FutureGuide.aspx>).
- GM1829 Analysis Development Validation Plan and Report (ADVP&R), located in the SSTs.
- Program Specific Component Technical Specifications (CTS).
- Program Specific Subsystem Technical Specifications (SSTs).

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities. Conforming to the relevant test procedures.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.1.2 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.

3.1.2 Equipment. Equipment is also listed in 4.3 Performance Requirements.

3.1.2.1 Climate Chamber. A climate chamber as follows.

- A range T_{min} to T_{max} suitable for level sensor test fixture.

- Recirculating air temperature cabinet.
- Test room, suitable for the execution of the test.
- Temperature range: -40 °C to +100 °C.
- Permissible temperature accuracy: ± 3 °C.
- Temperature rate of change shall be ± 1 °C/minute.

3.1.2.2 Holding Fixtures. Required for component level testing. The fixture is required to hold the level sensor in the vehicle position. The fixture shall be approved by the GM Design Engineer (DE) and/or Subsystem Validation Engineer (SVE).

3.1.2.2.1 Testing with Fluid Required (Reservoir). A fixture shall be built to hold the level sensor in vehicle position and capable of fully submerging the level sensor in fluid. The fixture may be built to accommodate more than one level sensor to facilitate time requirements.

3.1.3 Test Vehicle/Test Piece. Test samples shall be of production intent design and material for design validation (DV); or, production intent design and materials manufactured with production processes (from the supplier's production line) for product validation (PV). Any changes to the components or material, e.g., design, fit, form, function, properties, manufacturing process, and/or location of manufacture require revalidation. GM shall approve validation methods for product/process changes before the supplier is committed to the change. Refer to GMW3600.

3.1.3.1 Samples. Unless otherwise specified, six (6) samples of components or systems shall be tested.

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

3.1.3.3 Initial Level Sensor Measurements. All test samples shall be tested before each test and documented in Appendix A, Data Sheet A1. Samples shall be tested at 250 V for 2 s. Any level sensors which have a current leakage $> 40 \mu\text{A}$ shall be considered failed. All other requirements in the program specific Subsystem Technical Specification (SSTS) shall be met.

3.1.4 Test Time.

Calendar time:	7 d
Test time:	148 h
Coordination time:	4 h

3.1.5 Test Required Information. Requirements from the program specific Subsystem Technical Specification (SSTS) or respective specification are necessary in order to execute test methods in this document. Equipment and test sample detail is included in 3.1.2.

3.1.6 Personnel/Skills. The test facility shall have sufficient personnel having the necessary education, training, technical knowledge, and experience for performing the required tests.

3.2 Preparation. Preparation steps are also listed in 4.3 Performance Requirements.

This test procedure has been developed to reflect customer usage for markets which have developed road systems (more stable road systems and lesser amounts of unpaved and rough roads). Other regional or local requirements may necessitate additional test options. For further information, consult regional Engineering Center.

Visually examine each test specimen before testing and/or conditioning. The test specimens shall not exhibit any evidence of deterioration, cracks and/or other deformities that could affect performance, function and/or appearance. A control sample shall be retained. Photographs and/or video recordings of the samples being tested shall be taken.

3.3 Conditions. All conditions specified shall be targeted toward the specified value with any given tolerance ($\pm$) used to compensate for variation. During testing, conditions specified shall not be readjusted within the tolerance unless it is to maintain the particular test condition within the specified tolerance. If such an adjustment is made, it shall be approved by the applicable GM engineer prior to the start of any testing. Unless otherwise specified perform the tests in the as-received condition without any special preconditioning.

3.3.1 Environmental Conditions. Symbol definitions and specifications required for test methods contained in this procedure are listed in Table 1. Actual requirement values for the symbols shall be obtained from the Subsystem Technical Specification (SSTS) or the respective specification and recorded on Data Sheet A1.

Table 1: Temperature and Voltage Parameters and Tolerances

Parameter/Symbol	Default Specification	Tolerance
Minimum Temperature (T_{min})	-30 °C	Specification ± 3 °C
Maximum Temperature (T_{max})	+85 °C	Specification ± 3 °C
Repaint and Storage Temperature (T_{RPS})	-	Specification + 3 °C
Cold Storage Temperature (T_{CS})	-	Specification + 3 °C
Ambient temperature (T_{amb})	+23 °C	Specification ± 3 °C
Test Time	-	Specification $\pm 0.5\%$
Room Ambient Relative Humidity (RH)	50%	Specification $\pm 5\%$
Chamber Relative Humidity	-	Specification $\pm 5\%$
Pulse Width Modulation (PWM) Voltage	-	Specification + 0.25 V
Nominal Voltage (V_{nom}) at motor terminals	-	Specification ± 0.25 V
Force (Loading)	-	Specification $\pm 5\%$
Distance (excluding dimensional check)	-	Specification $\pm 5\%$

3.3.2 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. Refer to Table 1 for more test conditions.

3.3.3 Test Verification. To verify the level sensor is functioning properly before, during or after a certain test events, use the following.

- Set up test stand or fixture with a reservoir or similar container. The reservoir or similar container (to be approved by the GM SVE and/or DE) shall have a valve installed at the bottom to adjust the fluid level inside the reservoir or container.
- Mark the reservoir or container at 25 mm below and 25 mm above the level sensor access location (check the program specific SSTs to ensure the level sensor will actuate at 25 mm. If not, adjust the lines up and down to accommodate a program specific level sensor).
- Mount the level sensor into the washer reservoir or similar container.
- Fill the reservoir or similar to the 25 mm line below the level sensor access location.
- Confirm the level sensor reads "Low Level" and document conditions in test report
- Fill the reservoir or container to the 25 mm line above the level sensor access location.
- Confirm the level sensor reads "FULL" and document conditions in test report.
- Open the valve in the bottom to allow the fluid to drain out of the reservoir. CLOSE VALVE WHEN FLUID REACHES THE 25 mm LINE BELOW THE LEVEL SENSOR ACCESS LOCATION.
- Confirm the level sensor reads "Low Level" and document conditions in test report.
- Remove level sensor from reservoir or container and continue with next test step.

3.4 Instructions. Instructions are listed in 4.3 Performance Requirements.

3.5 Data.

3.5.1 Calculations. Not applicable.

3.5.2 Interpretation of Results. Not applicable.

3.5.3 Test Documentation. All test results shall be documented in the Data Sheet A1. The supplier is required to update the Analysis Development Validation Plan and Report (ADVP&R) (GM1829) and provide updates to the GM SVE and DE. Design Review Based on Test Results (DRBTR) results are to be documented.

Required Documentation. The following is also required for ALL test reports.

- Procedure number and section numbers on all test reports.
- Requirement being met and SSTS requirement number.
- All test parameters for environment and equipment.
- Any authorized deviations to the plan.
- Test setup and the individual test results shall be photographed.
- Completed and signed GM1829, ADVP&R.

3.5.3.1 Evaluation Reports. The supplier shall write evaluation reports to document the results of all validation activities and shall make the test results and evaluation reports available to GM engineers upon request. See GMW3600. All test reports are to be in English and available 2 weeks after test completion.

3.6 Safety. This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. All results shall be documented on Data Sheet A1.

3.7.1.1 Notification. GM Validation Engineer is to be notified of test failures within a 24 h period of occurrence.

3.7.1.2 Five (5) Phase Requirements. The supplier shall use a Five (5) Phase document for all test failures. The Five (5) Phase document shall be submitted within 48 h.

3.8 Product Security. Security protocol for the test vehicle must be followed per GM Security Guidelines.

4 Requirements and Procedure

4.1 General. Not applicable.

4.1.1 Observance of Specification. Not applicable.

4.2 Installation Position. See performance requirements in 4.3.

4.3 Performance Requirements.

4.3.1 Hot and Cold Temperature Storage.

4.3.1.1 Hot Storage.

Purpose	Verify that if the level sensor is stored in a location which has high ambient temperatures, it will not have any lasting effect on the level sensor's performance.
Equipment	• Environmental chamber capable of: • A range T_{min} to T_{max} suitable for the level sensor test fixture. • Recirculating air temperature cabinet. • Test room, suitable for the execution of the test. • Temperature range: -40 °C to +90 °C. • Permissible temperature accuracy: $\pm 3\text{ °C} \pm 1\text{ °C/minute}$.
Samples	Six (6) samples.

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Conditions	Part orientation shall represent shipping package orientation, if known. See program specific SSTs for conditions.
Preparation	Prior to test, the Test Engineer is to evaluate the level sensor under the following conditions: V_{nom} , V_{max} and V_{min} . Ensure the level sensor is working correctly. Document environmental conditions and observation. Visually examine each test specimen before testing and/or conditioning. The test specimens shall not exhibit any evidence of deterioration, cracks and/or other deformities that could affect performance, function and/or appearance. A control sample shall be retained. Photographs and/or video recordings of the samples being tested shall be taken.
Procedure	- Place the six (6) samples in the chamber in shipping orientation. The level sensor shall not be powered. - Set the chamber temperature to +90 °C with air circulation. Dwell for 100 h inside of the chamber from the time steady state of the chamber is reached. - After exposure, remove the level sensors from the chamber and dwell at ambient +23 °C $\pm$ 3 °C for 4 h. - Install parts in vehicle position (if known) on test fixture or in a washer reservoir and operate to verify test requirements.
Acceptance Criteria	- The level sensor shall function properly before and after test per requirements in the program specific SSTs. - The subsystem/component shall not show any damage, such as cracks, hardenings or deformations, which could impair its function at any point during the test. - Current draw shall be within the design specification.

4.3.1.2 Cold Storage.

Purpose	Verify that if the level sensor is stored in a location which has low ambient temperatures, it will not have any lasting effect on the level sensor's performance.
Equipment	- Environmental chamber capable of the following. - A range T_{min} to T_{max} suitable for the level sensor test fixture. - Recirculating air temperature cabinet. - Test room, suitable for the execution of the test. - Temperature range: -40 °C to +90 °C. - Permissible temperature accuracy: $\pm$ 3 °C $\pm$ 1 °C/minute. - A fixture may be required to hold components in shipping position.
Samples	Six (6) samples.
Conditions	Part orientation shall represent shipping package orientation if known.
Preparation	Prior to test, the Test Engineer is to evaluate the level sensor under the following conditions: V_{nom} , V_{max} and V_{min} . Ensure the level sensor is working correctly. Document environmental conditions and observations.
Procedure	- Place (6) level sensor samples in an environmental chamber and set temperature to -40 °C $\pm$ 3 °C. Maintain temperature for 100 h. - After exposure, remove the level sensors from the chamber and dwell at ambient for 4 h. - Install parts in vehicle position (if known) on test fixture or in a washer reservoir and operate to verify test requirements.

- Acceptance Criteria
- a. The level sensor shall function properly before and after test per requirements in the program specific SSTs.
 - b. The subsystem/component shall not show any damage, such as cracks, hardenings or deformations, which could impair its function at any point during the test.
 - c. Current draw shall be within the design specification.

4.3.2 Operating Temperature Range.

4.3.2.1 Thermal Cycling.

Purpose	Verify that the level sensor shall operate and function properly for the temperature range of -20 °C to 80 °C when submerged in fluid
Equipment	Fixture Pump.
Samples	Six (6) samples.
Conditions	See program specific SSTs for conditions.
Preparation	Visually examine each test specimen before testing and/or conditioning. The test specimens shall not exhibit any evidence of deterioration, cracks and/or other deformities that could affect performance, function and/or appearance. A control sample shall be retained. Photographs and/or video recordings of the samples being tested shall be taken. Install the level sensor in the fixture and/or washer bottle and place into the climate chamber. Ensure that the level sensor is working properly by checking the output. Fill with washer fluid to above the level sensor.
Procedure	a. After confirmation that the level sensor is properly functioning and the fixture is set up properly, set the temperature in the chamber to -20 °C. b. Hold at this temperature for 4 h. c. After the 4 h, increase the temperature to 80 °C. d. Hold at this temperature for 4 h. e. After the 20 h, reduce the temperature to -20 °C. f. Hold at this temperature for 8 h. g. After the 8 h, increase the temperature up to 80 °C. h. Hold at this temperature for 4 h. i. After the 8 h, reduce the temperature to 20 °C. j. Hold at this temperature for 4 h. k. Place the level sensors in a reservoir and subject to five (5) freeze thaw cycles consisting of: 1. 8 h at T_{min} (default is -30 °C) then 2. 4 h at T_{amb} (default is 23 °C) or until the system thaws. l. If the level sensor does not function properly, stop the test. m. Test results are to be documented in Data Sheet A1.
Acceptance Criteria	The level sensors must meet the SSTs requirements Note: The change in temperature shall be at the discretion of the GM SVE or Test Engineer.

4.3.3 Washer Fluid Resistance.

Purpose	This test ensures that the switch shall function properly in five (5) types of solvents.
Equipment	Washer Reservoir.
Samples	Three (3) level sensors.