GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW15310

Coolant System Surge Tank Assembly

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 Scope. This standard establishes the requirements for a Coolant System Surge Tank Assembly. The functions, performance, design constraints, and validation required of the component are defined in this document. All requirements of this specification must be met in order to demonstrate design and production validation.

1.2 Mission/Theme. The Coolant System Surge Tank Assembly provides a pressurized reservoir for coolant deaeration, coolant expansion and contraction, and a fill port for the assembly plant. Its design is critical to the operation of the powertrain cooling system as it must maintain a full, deaerated coolant system. The engineering test schedule contained within this specification defines the minimum performance and durability criteria necessary for design and production validation. In addition, the minimum requirements for in process testing of on-going production are outlined. The schedule is intended as a supplement to normal material inspections, dimensional checking and in process controls, and should in no way adversely influence adherence to other inspection operations.

1.3 Classification. Bill of Material (BOM) row 313 Coolant Plumbing and Hardware.

2 References

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

2.1 External Standards/Specifications.

SAE J1344

2.2 GM Standards/Specifications.

GM6277M	GMW3097	GMW3191	GMW15760
GMW3059	GMW3103	GMW3431	GMW16331
GMW3091	GMW3172	GMW15758	GMW16594

2.3 Additional References.

- GM Best Practice 313.001 Surge Tank Volume Determination and Design Guidelines
- GM Part Number 13500354 Fill Neck Drawing
- GM Part Number 13502353 Surge Tank Pressure Cap
- GM Part Number 13503566 Wiring Connector
- GM Part Number 15078148 Sensor Drawing
- GM Part Number 90346580 Connector Drawing
- GM Part Number 13503566 Connector Drawing
- SOR Appendix C
- USCAR Spec 120-S-002-1-A02

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. Not applicable.

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3.1.2 Content. See SOR Appendix C.

3.1.2.1 Physical Content. See SOR Appendix C.

3.1.2.2 Functional Content. See SOR Appendix C.

3.1.3 Ambient Environment. The following is the ambient environment in which the Surge Tank Assembly must operate.

3.1.3.1 Normal Operating Range: (-40 to +125) °C.

3.1.3.2 Maximum Under-Hood Temperature Excursions: (-50 to +150) °C.

3.1.3.3 Humidity Range: (0 to 100) %.

3.1.3.4 Altitude: (-150 to +4600) m.

3.1.3.5 Engine Compartment. Surge Tank Assembly and all components may be exposed and shall be resistant to all typical, in car used fluids and substances listed below:

a. Coolant to GM6277M
b. De-ionized water
c. Fuel: Gasolin, Ethanol, Diesel, Bio-Diesel B5, B20
d. Oils/Fluids available on market: for engine, transmission, power steering, brakes
e. Engine degreasers and-cleaners available on market
f. Salt Water Solution 5 % by mass

3.1.4 Interfaces. Not applicable.

3.1.5 Usage Definition. Not applicable.

3.1.6 Failure Mode and Effects Analysis (FMEA). Detailed design and process FMEAs shall be submitted to the GM Release Engineer and Validation Engineer upon request and shall be maintained as part of the vendor records of the Design and Product Validation. The FMEAs shall be updated each time a design change occurs.

3.1.7 Finish. The surge tank assembly shall be free of burrs or any sharp edges which may be detrimental to satisfactory assembly or safe handling.

3.1.8 Identification. See paragraph 3.3.3.

3.1.9 Internal/External Dryness/Cleanliness. All assemblies shall be thoroughly dry, prior to shipment. Parts shall not include any debris and not be exposed contaminations or durable lubes. Oil, grease or any contaminants may interfere with proper handling or cause plugging or have a detrimental effect on the material and function properties.

3.2 Product Characteristics.

3.2.1 Performance Requirements. Validation of surge tanks will be through vendor laboratory tests and vehicle durability and performance testing at GM Laboratory and Proving Ground facilities (see Appendix A for the Sequence Test Chart). Specific validation tests include, but are not limited to, the following tests.

Test procedures are described in paragraph 4.3. Test cadence shall follow Appendix A.

Leak Test (according to paragraph 3.2.1.1), Torque-ON/Torque-OFF Test (according to paragraph 3.2.1.2), and Coolant Level Sensor and Float Test (according to paragraph 3.2.1.3) are Pre and Post tests. These tests shall be run before and after each string of tests as confirmation of test completion.

Following Burst Strength at Ambient (according to paragraph 3.2.1.9), Torque-ON/Torque-OFF Test (according to paragraph 3.2.1.2) and Coolant Level Sensor and Float Test (according to paragraph 3.2.1.3) shall be run as informational tests. Interpreting a failure of Torque-ON/Torque-OFF Test or Coolant Level Sensor and Float Test shall be at the discretion of GM Engineering.

3.2.1.1 Leak Test. Tank shall not leak at a rate > 0.005 l/minute (5 cm^3/minute).

3.2.1.2 Torque-ON/Torque-OFF Test. The torque off result shall be 1 Nm minimum but ≤ 4.0 Nm.

3.2.1.3 Coolant Level Sensor Test. The sensor float shall demonstrate proper buoyancy in the coolant/water mixture. 100 % electrical switch functionality is required.

3.2.1.4 Temperature Soak Test (High/Low). No visible deformation (dimensional changings) or surface cracks allowed.

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3.2.1.5 Creep Test. Surge tank shall meet the requirements of the Leak, Torque On/Off, and Coolant Level Sensor and Float tests. No visible deformation (dimensional changings) or surface cracks allowed.

3.2.1.6 Pressure Cycle Test. Surge tank shall meet the requirements of the Leak, Torque On/Off, and Coolant Level Sensor and Float tests. No visible deformation (dimensional changings) or surface cracks allowed.

3.2.1.7 Drop Test. After samples return to ambient temperature, inspect for damage. If there is either no damage or insignificant damage, use this sample for the remaining tests shown in Appendix A. Insignificant damage is defined as visible damage that would not be expected to affect normal fit, function or durability. If significant damage is observed, discard the damaged sample(s). This requirement is satisfied if at least two of the four samples tested sustain either no damage or insignificant damage. If more than two samples sustain either no damage or insignificant damage, select two samples for the remaining tests shown in Appendix A on the remaining undamaged samples.

3.2.1.8 Vibration Test. Surge tank shall meet the requirements of the Leak, Torque On/Off, and Coolant Level Sensor and Float tests. No visible deformation (dimensional changings) or surface cracks allowed.

3.2.1.9 Burst Strength at Ambient. Surge tank shall not fail < 500 kPa.

3.2.1.10 Electrical Switch and Connector Test. Switch shall fulfill GMW3431, GMW3172, GMW3091, GMW3097 and GMW3103. Connector shall fulfill GMW3191

3.2.1.11 Coolant Fill Test. The surge tank shall not experience any form of failure, damage or loss of function.

3.2.1.12 Coolant Flow Level Test. The free level of coolant in adjacent chambers shall not exceed 3 mm of height difference with 5 l/minute (5 dm^3/minute) of coolant flow.

3.2.1.13 Max Torque Test. The surge tank fill neck shall exhibit no damage or loss of function.

3.2.1.14 In Process Leak Test. No leak permitted during a 5 s hold period.

3.2.1.15 In Process Coolant Level Sensor Test, If Equipped. The coolant level sensor must exhibit proper electrical continuity function.

3.2.1.16 In Process Coolant Level Float Test. The sensor float shall demonstrate no degradation of buoyancy in the coolant/water mixture.

3.2.2 Physical Characteristics. See SOR Appendix C.

3.2.2.1 Dimensions and Capacity. Refer to released Engineering Drawing.

3.2.2.2 Mass Properties. See SOR Appendix C.

3.2.3 Reliability.

3.2.3.1 Reliability Evaluation Point. This specification, as written, provides a test exposure representing a Reliability Evaluation Point (REP) of 10 years of corrosion and 240 000 km (150 000 miles) of severe customer usage at the vehicle level.

3.2.3.2 Reliability Requirements. This standard, as written, supports the demonstration of the required reliability of ≥ 99 % at a 50 % confidence (R99C50), at the REP for the surge tank. The supplier shall utilize "vehicle equivalent" laboratory test setups to simulate "in vehicle" orientations. If the orientation may be different from one vehicle to another, use the orientation which will provide the worst case loads for all physical level Reliability demonstration testing.

The Reliability Demonstration is provided by the Design Validation (DV) Endurance Tests specified in paragraph 3.7.1.3 in contrast to DV, the Endurance Tests specified for Product Validation (PV) in paragraph 3.7.2.3, are intended to confirm the reliability demonstrated during DV.

Note: The required number of test samples may be negotiable if it is not practical to run, for example, 23 samples. The negotiation of sample size should consider test equipment limitations, physical size of test samples, test duration, etc. However, reduction of the sample size may require inclusion/use of longer test durations or other test methods such as Highly Accelerated Stress Screening (HASS), Highly Accelerated Stress Testing (HAST), Calibrated Accelerated Life Testing (CALT), Highly Accelerated Life Testing (HALT), etc. Weibull slope values available from previous failure testing may be considered as a way to reduce the sample size and/or test duration. (For detail refer to GMW14156 Test Reliability Requirements Guidelines, and GMW14157 Statistical Confidence Level for Reliability Validation Testing).

3.2.3.3 Vehicle Durability. The surge tank assembly may be exposed to full-vehicle durability testing. All incidents will be addressed to the supplier for root cause analysis and irreversible corrective action.

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Note: Test to Failure (TTF) is always the preferred method. Failure is defined as, but not limited to, the loss of function, unacceptable performance degradation and non-conformance of the component as stated in this specification.

3.2.3.4 Accelerated Test Methods. GM encourages the use of appropriate Accelerated Test Methods, wherever possible; for example, the use of accelerated stress testing to reduce test time (GMW8758 Calibrated Accelerated Life Testing).

Note: GM Validation Engineering shall review and accept Reliability demonstration test plans prior to the supplier submitting the Analysis Development Validation (ADV) Test Plan for approval.

3.2.3.4.1 Prior to production release, the supplier must demonstrate surge tank assembly performance, durability and reliability targets are met through various laboratory testing such as Life Cycle test, Leak and Drop, etc. Cost of this testing is the supplier's responsibility.

3.2.4 Serviceability. See SOR Appendix C.

3.2.5 User Interface. See SOR Appendix C and requirements in this document.

3.3 Design and Construction. See SOR Appendix C.

3.3.1 Materials, Processes and Parts Selection Guidelines.

3.3.1.1 Material Guidelines. According to GMW16594. Oxidation stability: 336 h at (+150 ± 3) °C without visible material and transparency degradation.

3.3.1.2 Processes Guidelines. Not applicable.

3.3.1.3 Parts Guidelines. Not applicable.

3.3.2 Design Guidelines and Constraints. See SOR Appendices B and C.

3.3.3 Identification and Marking. The coolant surge tank shall have the following markings to GMW16331 clearly displayed on the outside/underside of the part and not on a surface that is noticeable to the customer.

- GM Part Number
- Manufacturing date, as follows:

  DDD Y (**DDD** = Day of Year (001 to 365), **Y** = Last Digit of Year (0 to 9))

  Example: 1235 Represents 03 May 2005
- Manufacturer's Identification.
- Tool/Cavity Number.
- Material Content (required for all parts).
- Recycling Symbol per SAE J1344.

3.3.4 Workmanship. See SOR Appendix C and requirements in this document.

3.3.5 Interchangeability. Not applicable

3.3.6 Packaging. See SOR Appendix C and requirements in this document.

3.4 Documentation. See SOR.

3.5 Support of System/Subsystem/Component/Part After Sale. See SOR.

3.6 System/Subsystem/Component/Part Operator Training. Not Applicable.

3.7 Testing Requirements.

3.7.1 DV Phase. (GMW15758, paragraph 3.2.1 Design Validation).

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Table 1: DV Test Table

Paragraph	Test	No. of Samples	Test Type
3.2.1.1	Leak Test	24	Performance
3.2.1.2	Torque-ON/Torque-OFF Test	24	Performance
3.2.1.3	Coolant Level Sensor and Float Test	24	Performance
3.2.1.4	Temperature Soak Test (High/Low)	6	Performance
3.2.1.5	Creep Test	6	Performance
3.2.1.6	Pressure Cycle Test	6	Endurance
3.2.1.7	Drop Test	4	Performance
3.2.1.8	Vibration Test	4	Performance
3.2.1.9	Burst Strength at Ambient	4	Performance
3.2.1.10	Electrical Switch and Connector Test	See applicable GMWs	
3.2.1.11	Coolant Fill Test	4	Performance
3.2.1.12	Coolant Flow Level Test	4	Performance
3.2.1.13	Max Torque Test	4	Performance

3.7.1.1 Test Samples. Design representative test samples may be produced from prototype tooling or from equivalent production tooling, but must represent design intent, including design tolerances and material variation within the materials specification. The exceptions are those assemblies needing to be specially manufactured under extremes of dimensions and/or tolerances to meet the test requirements of the specification. Any exceptions to this requirement shall be reviewed beforehand and approved by the GM Global HVAC/PTC Engineer issuing the approval.

3.7.1.2 Approval Requirements. Approval shall be provided by the GM Design Responsible Engineer and the GM Validation Engineer.

3.7.1.3 Documentation. All test samples must be qualified dimensionally. All data points must be reported. For samples destructively tested, mode of failure must be reported. All test specimens must be retained by the supplier for one year and be available for review by the GM HVAC/PTC Global Engineer, if requested. Test Procedures referencing specific minimum test values, must be met by the –3 sigma limit of the sample population tested.

3.7.2 PV Phase. (GMW15758, 3.2.2 Product Validation).

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Table 2: PV Test Table

Paragraph	Test	No. of Samples	Test Type
3.2.1.1	Leak Test	24	Performance
3.2.1.2	Torque-ON/Torque-OFF Test	24	Performance
3.2.1.3	Coolant Level Sensor and Float Test	24	Performance
3.2.1.4	Temperature Soak Test (High/Low)	6	Performance
3.2.1.5	Creep Test	6	Performance
3.2.1.6	Pressure Cycle Test	6	Endurance
3.2.1.7	Drop Test	4	Performance
3.2.1.8	Vibration Test	4	Performance
3.2.1.9	Burst Strength at Ambient	4	Performance
3.2.1.10	Electrical Switch and Connector Test	See applicable GMWs	
3.2.1.11	Coolant Fill Test	4	Performance – Test not required if no internal changes from DV to IV
3.2.1.12	Coolant Flow Level Test	4	Performance - Test not required if no internal changes from DV to IV
3.2.1.13	Max Torque Test	4	Performance.

3.7.2.1 Test Samples. Production test samples must be produced on production representative equipment including the effects of manufacturing-induced variation. Sample selection of components to be utilized for the purpose of PV Reliability requirements demonstration shall be in concurrence with the guidelines set forth in GMW15760.

3.7.2.3 Approval. Approval shall be provided by either the appropriate GM Design Engineer or GM Program Validation Engineer.

3.7.2.4 Documentation. Documentation shall be provided as required by the normal Production Part Approval Process (PPAP).

3.7.3 Steady State Part Monitoring (GMW15758).

Table 3: SSPM Test Table – monthly (*to be performed yearly)

Test Name	Procedure	Number of Production Test Samples
3.2.1.1	Leak Test	6
3.2.1.2	Torque-ON/Torque-OFF Test.	6
3.2.1.3	Coolant Level Sensor and Float Test.	6
3.2.1.4 *	Temperature Soak Test (High/Low)	6
3.2.1.5 *	Creep Test	6

3.7.3.1 Test Samples. Production parts selected at random (GMW15760). Run tests to paragraphs 3.2.1.1 thru 3.2.1.3 once a month. Run tests to paragraphs 3.2.1.1 thru 3.2.1.5 once a year.

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3.7.3.2 Approval. Tests are self-approved by the supplier, subject to audit by GM Supplier Quality Engineering.

3.7.3.3 Documentation. In the case of a Steady State Part Monitoring test result not meeting requirement, the affected production lot shall be retained by the supplier until Root Cause Analysis is complete. The supplier shall then decide the disposition of the affected production lot. The supplier has three options for this retained lot; it shall be either 1) scrapped or 2) corrected and certified (which may mean lot testing the revised part again) based on the root cause analysis or 3) shipped without correction if deemed to be acceptable based upon the root cause analysis. In any event, GM Supplier Quality Engineering shall be notified whenever any of the above options is exercised.

3.7.3.4 Alternative Compliance. Supplier may request an exemption from Steady State Part Monitoring, provided he can demonstrate that sufficient process controls are in place so as to make testing unnecessary. The approval is to be provided by either GM Supplier Quality Engineering or the GM Design Responsible Engineer.

3.7.4 In Process Testing.

Table 4: In Process Test Table

Test Name	Procedure	Number of Production Test Samples
3.2.1.14	In Process Leak Test	100 %
3.2.1.15	In Process Coolant Level Sensor Test, if equipped	100 %
3.2.1.16	In Process Coolant Level Sensor Float Test	each production run

3.7.4.1 Test Samples. All Parts are tested.

3.7.4.2 Approval. Tests are self-approved by the supplier, subject to audit by GM Supplier Quality Engineering.

3.7.4.3 Documentation. In the case of a In Process Testing result not meeting requirement, the affected production lot shall be retained by the supplier until Root Cause Analysis is complete. The supplier shall then decide the disposition of the affected production lot. The supplier has three options for this retained lot; it shall be either 1) scrapped or 2) corrected and certified (which may mean lot testing the revised part again) based on the root cause analysis or 3) shipped without correction if deemed to be acceptable based upon the root cause analysis. In any event, GM Supplier Quality Engineering shall be notified whenever any of the above options is exercised.

3.7.4.4 Alternative Compliance. Supplier may request an exemption from In Process Testing, provided he can demonstrate that sufficient process controls are in place so as to make testing unnecessary. The approval shall be provided by either GM Supplier Quality Engineering or the GM Design Responsible Engineer.

4 Validation

4.1 General. Production parts shall be selected at random according to GMW15760 unless otherwise stated.

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

4.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this specification shall be determined correctly with respect to its physical definition.

4.2 Validation Cross Reference Index. See CG2991 Surge Tank (High and Low Temp-Pressure) - GMW15310_16288 ADVPR.

4.3 Test Procedures. The tank shall be filled during tests with coolant comprised of 50 % by volume coolant agent (GM6277M) and 50 % by volume water, to the cold fill level when coolant is used in the test procedure.

4.3.1 Leak Test. Increase tank inlet fitting with air pressure from 0 kPa to 175.0 kPa over 30 s and hold.

4.3.2 Torque-ON/Torque-OFF Test. Install cap onto tank, recording the torque required to reach the stop point, (highest reading before the stop is reached (4.0 Nm maximum)) immediately remove the cap, recording the breakaway torque required.

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4.3.3 Coolant Level Sensor Functionality Test. Place the surge tank in a fixture such that it is resting in the in-vehicle (as installed in vehicle) position at (+23 ± 5) °C. The surge tank shall be filled to the cold fill line. The float should be pushed to the low coolant level using a small rod for 5 s then release. Repeat this cycle 20 times. Record electrical switch function throughout 20 cycles.

4.3.4 Temperature Soak Test (High/Low). Place the surge tank in the test fixture in the test chamber.

Raise the chamber temperature to +115 °C.

Hold the tank at this temperature for 240 h after stabilization.

Lower the chamber temperature to -40 °C.

Hold the tank at this temperature for 24 h after stabilization.

4.3.5 Creep Test. Place the surge tank in the test fixture in the test chamber, Increase the chamber temperature to +80 °C.

Heat the coolant up to +130 °C. The test chamber should have a coolant bypass loop to stabilize the coolant temperature without allowing flow through the surge tanks. Once the coolant has reached +130 °C in the bypass loop then coolant flow can be directed through the surge tanks and the pressure stabilized. Once temperature and pressure has stabilized the test time can begin.

Test conditions are as follows:

Surge tank pressure: 150 kPa.

Flow: +130 °C coolant through the surge tank at a rate of 2.0 l/minute (2.0 dm^3/minute).

Time: 100 h.

4.3.6 Pressure Cycle Test. Place the surge tank in the test fixture in the test chamber, lower the test chamber temperature to -40 °C.

Complete 1000 cycles subjecting the tank to a pressure cycle of 0 kPa to 50 kPa to 0 kPa, at a rate of One (1) cycle/s. Raise the test chamber to +100 °C.

Complete 100 000 cycles subjecting the tank to a pressure cycle of 0 kPa to 100 kPa to 0 kPa at a rate of One (1) cycle/s. Raise the test chamber to +125 °C.

Complete 10 000 cycles subjecting the tank to a pressure cycle of 100 kPa to 175 kPa to 100 kPa at a rate of One (1) cycle/s.

4.3.7 Drop Test. Cold soak samples at (-20 ± 2) °C for 2 h.

Remove sample number one (1) and immediately suspend it by its front mounting hole, with the hole at 1 m above a concrete floor surface.

Release sample number (1) within 1 minute after removal from chamber.

Remove the next sample, rotate it 90° from the previous sample, and immediately suspend it so that the face of the tank is parallel to the floor with that face at 1 m above the concrete floor surface.

Release this sample within 1 minute after removal from chamber.

Repeat for remaining samples. No samples should repeat the orientation of a previous sample.

4.3.8 Vibration Test. Install surge tank in a rigid frame, in vehicle position, using production representative mounting. This frame is attached to the vibration table. Optional Vibration Schedule. If available, test for 200 h using vehicle road-load accelerometer data.

All coolant lines are installed and attached to a rigid external support in vehicle position.

The surge tank shall be filled with water to the cold fill line, and pressurized to 125.0 kPa.

Test conditions are as follows:

Frequency: 15 Hz

Displacement: 2.4 mm (3/32 in)

Time: 100 h Fore-Aft (from vehicle position), 100 h Vertical

4.3.9 Burst Strength at Ambient. Place the surge tank in the test fixture in the test chamber.

Increase the internal pressure at a rate of 10 kPa/s until the tank fails with visible cracks or leaks.

Inspect the low coolant sensor, if equipped, for function.

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4.3.10 Electrical Switch and Connector Test.

Test to GMW3431, test cycles 10 000 ON/OFF.

Test to GMW3172 – CCGDE-IPK59K.

Test the Electro Magnetic Compatibility (EMC) to GMW3091, GMW3097 and GMW3103. Section immunity to power line magnetic fields.

Connector test to GMW3191 TC3 VC1 SC3.

4.3.11 Coolant Fill Test. Place the surge tank in a test fixture in the test chamber. Subject the surge tank to a vacuum of 1.5 kPa for the duration of 1 minute. Inspect for damage.

If no damage is evident then flow coolant at a rate of 25 l/minute (25 dm^3/minute) at 200 kPa for a period of 2 minutes through the surge tank. Inspect for damage.

4.3.12 Coolant Flow Test. Flow coolant at a rate of 5 l/minute (5 dm^3/minute) Continue flowing coolant for until levels in chambers stabilizes without changes for 5 minutes.

4.3.13 Max Torque Test. Place surge tank in a fixture. Install cap onto tank to a torque of 12 Nm minimum.

4.3.14 In Process Leak Test. Each production surge tank shall be pressurized to 70 kPa minimum with clean, dry shop air.

4.3.15 In Process Coolant Level Sensor Test. Each production surge tank, if equipped with a coolant level sensor, shall have the coolant level sensor checked for electrical continuity.

4.3.16 Coolant Level Float Test. The following procedure shall be performed for each production run of coolant sensor floats. Securely plug the fittings of the surge tank. Fill the surge tank assembly to the full cold line with a 50 % antifreeze agent to GM6277M and 50 % water mixture. Place the surge tank in a fixture such that it is resting in the in-vehicle (as installed in vehicle) position at (+23 ± 5) °C. Maintain this condition for 12 h.

5 Provisions for Shipping

5.1 Shipping. All surge tank assemblies shall be packed such that they are protected from water, dirt, dust and other debris that may negatively impact surge tank performance and use. The packaging must be capable to protect the surge tanks from damage during commercial air, rail, truck, or boat transportation. Damage during shipping shall not be accepted.

5.2 Storage. Service parts shall be adequately protected to ensure satisfactory assemblies after a storage period of five (5) years beyond the date of shipment from the manufacturer's plant.

6 Notes

6.1 Glossary. Not applicable.

6.2 Acronyms, Abbreviations, and Symbols.

BOM	Bill of Material
CCC	Corporate Common Component
DV	Design Validation
FMEA	Failure Mode and Effects Analysis
GD&T	Geometric Dimensioning and Tolerancing
iMAN	Information Manager
IPT	In Process Testing
IVER	Integration Vehicle Engineering Release
KPC	Key Product Characteristic
pcs	Pieces
PV	Production Verification
SSPM	Steady State Part Monitoring
REP	Reliability Evaluation Point

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7 Additional Paragraphs

7.1 All parts or systems supplied to this standard must comply with the requirements of GMW3059, **Restricted and Reportable Substances for Parts.**

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

GMW15310

9 Release and Revisions

This standard was originated in April 2006. It was first approved by the HVAC Plumbing GSSLT in May 2007. It was first published in June 2007.

Issue	Publication Date	Description (Organization)
1	JUN 2007	Initial publication.
2	SEP 2010	Content rationalized; specification numbers corrected; design guidelines removed (HVAC and Powertrain Cooling).
3	NOV 2012	Content rationalization, Specifications update. Life cycle test approval detailed. Burst pressure test removed. PVA Life cycle test limited to each 12 months. Electrical sensor and float tests defined. Transport condition detailed. Specifications number corrected. (HVAC Plumbing GSSLT).

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Appendix A

Figure A1: Sequence Test Chart - DV

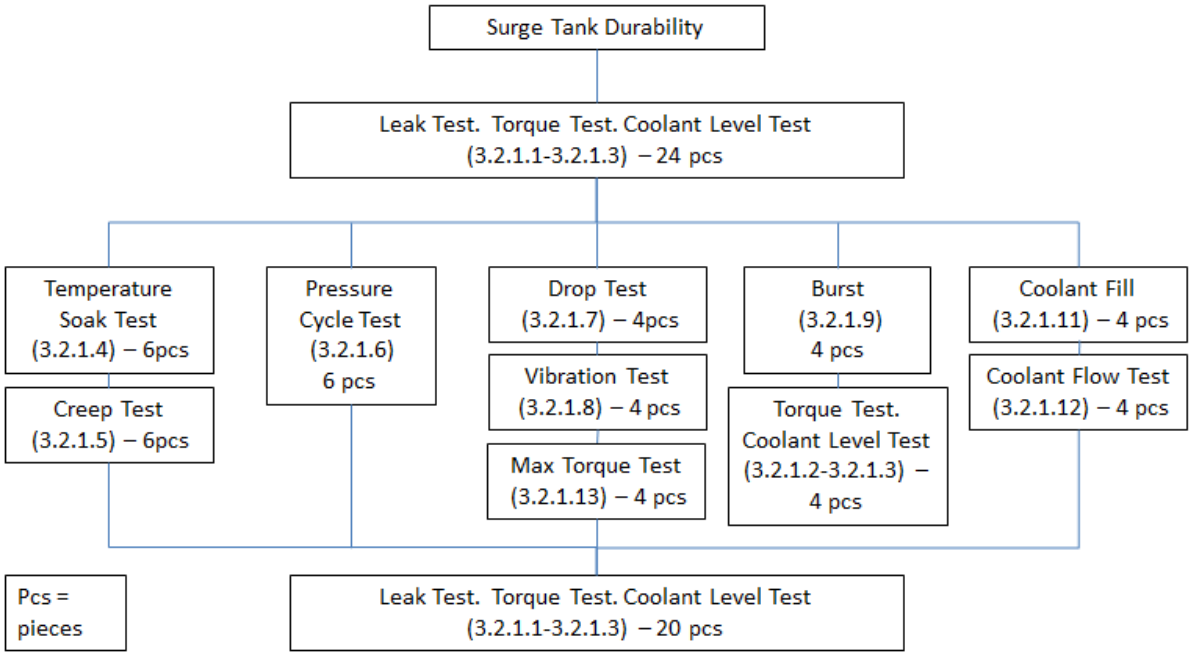

Figure A2: Sequence Test Chart - PV

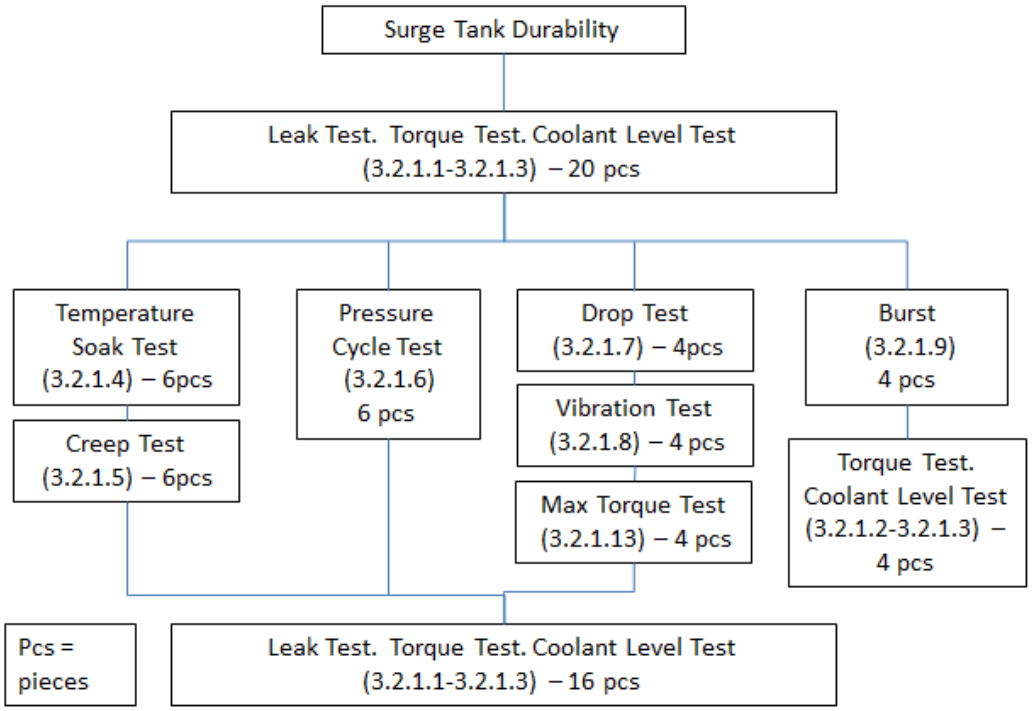

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Figure A3: Sequence Test Chart – Steady State Part Monitoring

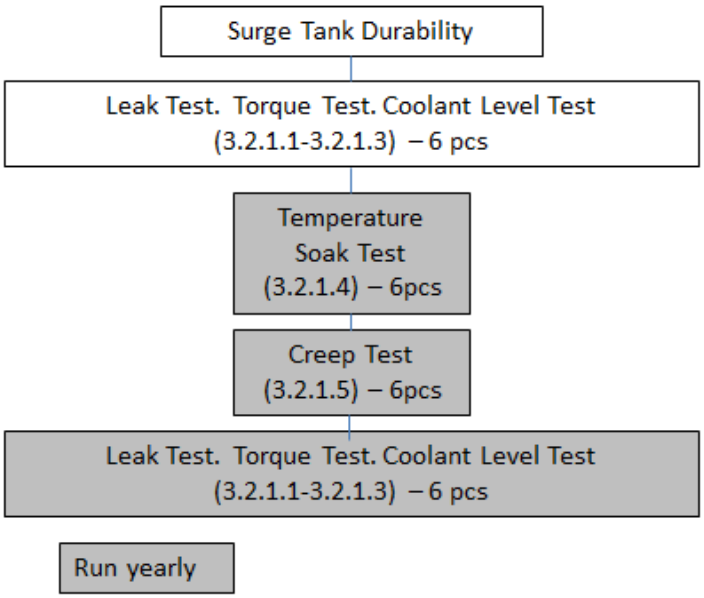
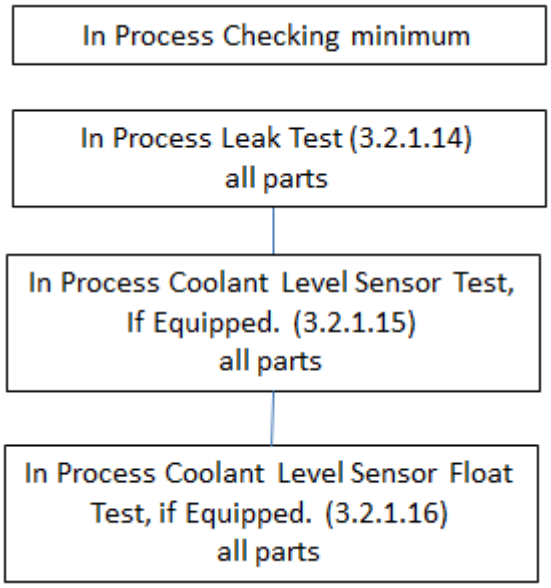


Figure A4: Sequence Test Chart – In Process Test



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