GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW16288

Hybrid (Low Temperature) Coolant Surge Tank

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 low temperature coolant surge tank typically used on hybrid vehicles provides a pressurized reservoir for keeping the permanent coolant system pressure during the engine operation, coolant/air separation, 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 fully separated air/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.

1.2 Applicability. Bill of Material (BOM) Row 344 Surge Tank.

1.3 Remarks. This standard establishes the requirements for a Hybrid 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.

2 References

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

2.1 External Standards/Specifications.

ASTM D5798	ASTM D6751	EN 14214	SAE J1344

2.2 GM Standards/Specifications.

GMW3059	GMW15310	GMW15862
GMW3116	GMW15758	GMW16594
GMW3420	GMW15760	

2.3 Additional References.

- CG2991 Surge Tank (High and Low Pressure) ADVPR
- GM Part Number 13579349/13597035 Fill Neck Drawing
- GM1738 Packaging and Identification Requirements for Production Parts
- SOR Appendices B and C
- SOR Appendix C1
- SSTS

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

3.1.1 Appearance. The tank shall not have any noticeable dents, scratches, twists or warping. The tank surface color and finish (as grain or gloss) shall be shown on the SOR Appendix C or the GM authorized drawing.

3.1.2 Content. See SOR Appendix C1.

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3.1.2.1 Physical Content. See SOR Appendix C1.

3.1.2.2 Functional Content. See SOR Appendix C1.

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

a. Normal Operating Range: -40 °C to +125 °C.

b. Maximum Underhood Temperature Excursions: -50 °C to +150 °C.

c. Humidity Range: 0% to 100%.

d. Altitude: -150 m to +4600 m.

3.1.3.1 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 GMW3420.

b. Deionized (DI) water.

c. Fuels: Gasoline, E85, Ethanol, Diesel, Bio-Diesel (EN 14214, ASTM D5798, ASTM D6751).

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. Filler neck as GM Drawing 13579349 or 13597035 - mandatory.

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 and shall be maintained as part of the vendor records of the Design Validation (DV) and Product Validation (PV). 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.

3.2 Product Characteristics.

3.2.1 Performance Requirements.

a. Validation of surge tanks will be done through vendor laboratory tests and vehicle durability and performance testing at GM Laboratory and Proving Ground facilities (see Figure A1 in Appendix A for the Sequence Test Chart). Specific validation tests include, but are not limited to, the following tests defined in this specification.

b. The tank shall be filled during the bench tests (except the creep test) with coolant volume comprised of 50% by volume anti-freezing agent to GMW3420 and 50% volume DI water.

c. The tank shall be filled to mark indicated on the front of the coolant surge tank. Fill level tolerance: +5 mm.

d. The medium/fluid flow direction shall be the same as in the car cooling circuit.

e. Temperature tolerances for all bench test values: ± 2 °C.

f. Pressure tolerances for all bench test values: ± 5 kPa.

g. The tank shall be install on a rigid frame, in vehicle position, using representative mounting and fasteners.

3.2.1.1 Fixed-Value Performance Testing Requirements.

3.2.1.1.1 Flow Capacity/Characteristic.

3.2.1.1.1.1 Install the tank and the coolant circulation as follows:

a. Tank position: Horizontal and tilted ± 16° in-and-across the drive direction.

b. Liquid flow rate: Minimum 0.05 dm^3/minute (3 L/minute). If otherwise specified: See SSTS (SOR Appendix C1) 3.1.

3.2.1.1.1.2 Acceptance Criteria.

a. Not foaming allowed by fluid injection.

b. No swirl or low coolant level in outlet/return fitting chamber, no suction from air bubbles through the outlet/return spigot allowed.

c. Not more than 3 mm of coolant height difference in chambers, (only horizontal tank position).

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3.2.1.1.2 Internal/External Dryness/Cleanliness. All assemblies shall be thoroughly dry, prior to shipment. Parts shall not include any debris and not be exposed to 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.

3.2.1.1.3 Production Qualification. Surge tank must comply with the following functional requirements:

a. The surge tank shall be capable of sustaining a GM Plant Fill flow rate of 0.5 dm^3/s (30 L/minute) at 200 kPa for a period of 2 minutes without experiencing any form of failure, damage or loss of function.

b. The surge tank shall be capable of sustaining GM Plant Fill vacuum of 1.5 kPa (absolute pressure) for the duration of 1 minute without experiencing failure, damage or loss of function.

c. The surge tank fill neck shall be capable of withstanding a torque of 12 N·m minimum without failure, damage or loss of function.

3.2.1.2 Endurance Testing Requirements. Following requirements shall be fulfilled as design confirmation and approval.

3.2.1.2.1 Pre-test and Post-test. The following tests shall be performed on all samples before and after each test series.

3.2.1.2.1.1 Leak Test.

3.2.1.2.1.1.1 Drain the tank completely.

3.2.1.2.1.1.2 Increase tank inlet fitting air pressure from 0 kPa to 200.0 kPa over 30 s and hold.

3.2.1.2.1.1.3 Acceptance Criteria. Tank must not leak at a rate > 0.005 L/minute (5 cm^3/minute).

3.2.1.2.1.2 Torque-ON/Torque-OFF Test.

3.2.1.2.1.2.1 Install cap onto tank, recording the torque required to reach the stop point, (highest withstand reading on the signal hump, before the stop is reached is not relevant). Immediately remove the cap, recording the breakaway torque required.

3.2.1.2.1.2.2 Acceptance Criteria. The torque on/off result shall be between 1.0 N·m -0.3 N·m and 3.0 N·m +1.0 N·m.

3.2.1.2.1.3 Visual Inspection.

3.2.1.2.1.3.1 Samples and Checks.

a. Outside surface, welding seam, spigots.

b. Cross sections at critical areas. Samples after the tests affected only.

3.2.1.2.1.3.2 Acceptance Criteria. No visible cracks, damage or deformations allowed on the inside or outside surface, spigots and filler neck, which are significant enough to affect a normal fit, function or durability. No significant discoloration allowed.

3.2.1.2.1.4 Coolant Level Sensor and Float Test (if Equipped). Refer to 3.2.1.1.3 in GMW15310.

3.2.1.2.2 Life Cycle Test/Pressure (Creep) Test. The following test shall be performed on six (6) samples.

3.2.1.2.2.1 Place the surge tank in the test fixture in the test chamber. Heat the test liquid up to +90 °C, before flow through the surge tank starts.

3.2.1.2.2.2 Test Conditions.

a. Test liquid: Coolant by 100% agent to GMW3420 for Polypropylene tank material.

b. Tank fill level: Cold marking.

c. Coolant pressure: 100 kPa.

d. Coolant temperature cycle 10 h: 7.5 h at 90 °C, 0.25 h heat up to 110 °C, 2.0 h at 110 °C and 0.25 h cool down to 90 °C.

e. Coolant flow rate: 2.0 L/minute (2.0 dm^3/minute).

f. Chamber temperature: 80 °C.

3.2.1.2.2.3 Repeat (complete) the cycles as long as a leakage failure does not occur.

3.2.1.2.2.4 Allow the tank to return to +23 °C.

3.2.1.2.2.5 Acceptance Criteria.

a. Surge tank shall meet the requirements of the pre-test and post-test according to Section 3.2.1.2.1.

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