



Specification for Integrated Fuel 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 Purpose. This document provides the standard technical requirements for the integrated fuel tank assembly. This document shall only be used when invoked by a program specific technical specification. References to the program specific technical specification are included in this document where program specific requirements are expected to exist.

The program specific technical specification may include additional program specific requirements that are not referenced in this document and may supercede any requirements included in this document. In the case of any conflicts between this document and the program specific technical specification, the program specific technical specification takes precedence.

This specification establishes the integrated fuel tank assembly requirements for General Motors gasoline, gasoline blend, and diesel fueled vehicles. The functions, performance, design constraints, and validation required of the integrated fuel tank assembly are directly defined in this document or a reference is made to another document.

Refer to the Fuel Pump Module (FPM) Component Technical Specification (CTS) for requirements specific to the module.

This document contains component technical specifications common to all programs. Reference the program/vehicle specific document for additional requirements unique to the application.

1.2 Applicability. This specification applies only to gasoline, gasoline blend and diesel fueled vehicles. It includes requirements for both complete and incomplete vehicles, and for specific applications, such as police and taxi use.

1.3 Remarks. The integrated fuel tank assembly is a functional vehicle component for receiving and storing fuel; sensing and signaling fuel quantity; supplying fuel to the engine; and (for gasoline only) managing both refueling vapor and fuel vapor generated during use of the vehicle by the vehicle operator. The integrated fuel tank assembly is to carry out these functions while meeting specific requirements of the customer, the powertrain, other interfaces, mandated safety and emission standards, and company objectives.

2 References

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

2.1 External Standards/Specifications.

R (EC) No. 715/2007	49 CFR Part 393.67	CNCA-C11-11:2014	SAE J2587
40 CFR Part 86	ASTM A463M	GB18296-2001	UN R34.1
49 CFR Part 393.65	ASTM D4169	SAE J1645	

2.2 GM Standards/Specifications.

GMW3059	GMW14802	GMW15017	GMW15986
GMW3086	GMW14842	GMW15272	GMW16331
GMW3116	GMW14846	GMW15311	GMW16434
GMW8518	GMW14847	GMW15357	GMW16443
GMW14507	GMW14848	GMW15359	GMW16740
GMW14081	GMW14849	GMW15449	GMW16776
GMW14234	GMW14850	GMW15450	GMW16848
GMW14291	GMW14851	GMW15451	GMW17085
GMW14475 (ID)	GMW14852	GMW15570	GMW17136
GMW14508	GMW14853	GMW15626	GMW17140 (ID)
GMW14547	GMW14854 (ID)	GMW15646	GMW17152
GMW14555	GMW14872	GMW15839	GMW17536
GMW14573	GMW14889	GMW15862	GMW17537
GMW14638	GMW14911	GMW15926	GMW17799
GMW14800	GMW14992	GMW15971	
GMW14801	GMW15010	GMW15973	

(ID) = This standard is limited to internal distribution within General Motors and shall not be distributed outside this company. Contact the GM Lead Engineer for further instructions.

2.3 Additional References.

- Appendix G3 of the Statement of Requirements (SOR) for the Validation Cross Reference Index
- Appendix C2 of the SOR Appendix: Fuel Storage and Handling Subsystem Technical Specification (SSTS)
- Appendix W5 of the Supplier Quality SOR
- Appendix W6 of the Supplier Quality SOR: Process Control & Documentation For Injection Molded Parts
- Appendix W7 of the Supplier Quality SOR: Process Control & Documentation for Plastic Tank Manufacturing
- California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles
- California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles
- Component Technical Specifications (CTS)
- Evaporative Emissions Interface Document
- Fuel Gauge Calibration Best Practices ENERGY-6, ENERGY-14, ENERGY-17
- Global Legal Database
- GM Best Practices (including ELEC86-S5128)
(https://e2ks.gm.com/e2ks/e2ks_home.jsp;jsessionid=CHFnQL4nB7x9j0Xxh9mhWTPE212RgMexdJ_OOKROvY4VDiaWbyUZ!-128868645!1977902446?ossoPDssv45p=AQIC5wM2LY4Sfcwe8MT8uTChbMYNk55Nh8MWTLfqZ30lwBw%3D%40AAJTSQACMDQAAILAAYtNjk2NTEAAIMxAAIwMQ%3D%3D%23) (ID)
- GM Engineering Materials and Processes Standards
- GM Global Fastening Catalog
- Integrated fuel tank program specific documents as defined in the statement of requirements
- Preferred Material Guidelines FSH-56
- Subsystem Technical Specifications (SSTS)
- Vehicle Technical Specifications (VTS)

2.3.1 CG References.

CG1752	CG3547	CG3548	CG4191
--------	--------	--------	--------

2.3.2 Fuels.

GMPT-6-013B	GMPT-6-025
-------------	------------

2.3.3 GM Part Numbers (Drawings).

10325851	15256371	15776434	94553807
10325852	15776431	15776438	94553808
10336924	15776432	22682111	94553810
15224665	15776433	25764424	94556450

3 Requirements

3.1 System/Subsystem/Component/Part Definition. The integrated fuel tank assembly is to provide the capability to receive and store fuel. Reference the Fuel Storage and Handling Subsystem Technical Specification GMW15311, for a complete listing of system definitions, including the integrated fuel tank assembly.

3.1.1 Appearance. Not applicable.

3.1.2 Content.

3.1.2.1 Physical Content. The integrated fuel tank assembly consists of:

- Tank shell - as molded (polymer) or welded (steel).
- FPM.
- FPM mounting hardware.
- Shielding when Part of Assembly (POA) of the tank.
- Vent valves - fill limit and/or grade venting (where applicable).
- Fill limiter/dip tube (where applicable).
- Filter/regulator (where not POA of the FPM).
- Diesel fuel filter/water separator (where applicable).
- Plumbing – for liquid or fuel vapor handling and connection to the chassis bundle.
- Fuel fill pipe spud or inlet (with check valve where applicable).
- Fuel reservoir (where not POA of the FPM).
- Pressure or relief valves (where applicable).
- Baffles (either molded in or assembled to the interior of the tank after or during the molding/assembly of the tank).
- Fuel vapor pressure sensor and mounting hardware (where applicable).
- Fuel vapor canister (where applicable).
- Fresh air solenoid (where applicable).
- Wiring harness (where applicable).
- Clips - plumbing mount.
- Vehicle assembly assist handles.
- Labeling.

3.1.2.2 Functional Content. The fuel tank assembly is to provide the functions as in 3.1.2.2.1 through 3.1.2.2.9.

3.1.2.2.1 The tank assembly shall receive and store fuel.

3.1.2.2.2 The tank assembly shall capture refueling vapor, in applications where the vapor canister is POA to the integrated assembly and onboard refueling vapor recovery is a design requirement (gasoline only).

3.1.2.2.3 The tank assembly shall store fuel in a safe manner.

3.1.2.2.4 The tank assembly shall be constructed in such a manner as to reduce Hydrocarbon (HC) emissions as required.

3.1.2.2.5 The tank assembly shall support the FPM function in sensing fuel level and provide a signal of stored fuel quantity.

3.1.2.2.6 The tank assembly shall sense tank pressure and enable vapor leak detection, in applications where the tank pressure sensor is required by On Board Diagnostics (OBD) and POA to the integrated assembly (gasoline only).

3.1.2.2.7 The tank assembly shall support the FPM function of supplying clean fuel to the engine upon demand according to the pressure and flow requirements of the powertrain.

3.1.2.2.8 The tank assembly shall manage heat buildup in the fuel, from ambient and underbody conditions.

3.1.2.2.9 The tank assembly shall filter purge air (where the purge air filter is POA of the integrated fuel tank assembly).

3.1.3 Ambient Environment. The ambient environmental conditions that the integrated fuel tank assembly may encounter during its life are defined in GMW15311. Reference that document for definitions of the ambient environment.

3.1.3.1 Fuels. The fuels and/or fuel characteristics that shall be successfully accommodated by the fuel tank assembly are identified in 3.1.3.1.1 through 3.1.3.1.3.

3.1.3.1.1 Test Fuels. The fuels identified in CG3547 encompass the characteristics of fuels that are defined by federal regulations and company requirements. These test fuels shall be purchased from an approved supplier. Some of these fuels will be used in the validation of the integrated fuel tank assembly.

3.1.3.1.2 Component Test and Other Fuels. The fuels identified in CG3547 encompass the characteristics of additional fuels that may be experienced in vehicle use in North America and/or during integrated fuel tank assembly development and validation. These test fuels shall be purchased from an approved supplier. These fuels should be considered in component design and analysis.

3.1.3.1.3 Fuel Quality. The tank assembly shall accommodate fuels with an average particulate contaminant level, as described in CG3547 Particulate Fuel GMPT-6-013B.

3.1.3.2 Contamination. Reference GMW15311 for a complete table of contaminants.

3.1.3.3 Corrosives. Reference GMW15311 section on Corrosives.

3.1.3.4 Ultraviolet Radiation. Reference GMW15311 for Ultraviolet (UV) radiation exposure requirements.

3.1.4 Interfaces. The fuel tank assembly interfaces with several physical entities that will affect or constrain its functionality and design. A complete listing of system interfaces exists in GMW15311. Specifics to the integrated fuel tank assembly are described in 3.1.4.1 and 3.1.4.2.

3.1.4.1 Integrated Fuel Tank Assembly to Other Subsystems. Interfaces between the other subsystems and the integrated fuel tank assembly are depicted at a high level in GMW15311. These interfaces may constrain or drive the design of the fuel tank assembly and, therefore, shall be addressed during fuel tank assembly design and development. The fuel tank assembly implementation and operation in the vehicle shall also successfully accommodate the identified interfaces.

3.1.4.1.1 Fuel tank interface to vehicle, assembly. The integrated fuel tank assembly shall include features to locate the tank to the vehicle during assembly, to within ± 5 mm from nominal design position. This shall be accomplished by either providing angled surfaces to nest against a mating surface on the vehicle, or by dedicated locating tabs/bolt holes.

3.1.4.1.2 Fuel tank interface to vehicle, dynamic. The integrated fuel tank assembly shall include features to minimize the dynamic movement of the tank against the vehicle mounting surface. This shall be accomplished by either providing angled surfaces to nest against a mating surface on the vehicle, or by dedicated locating tabs/bolt holes. The maximum allowable movement during G-loading (six (6) directions) is to be determined by Computer Aided Engineering (CAE) analysis based on component clearances and strap/bracket fatigue limits.

3.1.4.2 Component to Component. Generic component to component interface requirements for the fuel tank assembly are identified in 3.1.4.2.1 through 3.1.4.2.5.

3.1.4.2.1 Crashworthiness. The fuel tank assembly and its components shall not create any leak that causes the system to fail crashworthiness requirements. Components shall be designed to prevent disconnection and damage to adjacent components.

3.1.4.2.2 Noise. Component to component connections shall minimize transmission of noise.

3.1.4.2.3 Electrostatic Discharge (ESD). Components shall not create ESD related failures in adjacent or downstream components.

3.1.4.2.4 Corrosion. The interfaces between components shall satisfy the Vehicle Technical Specification (VTS) relative to cosmetic corrosion and GMW15272.

3.1.4.2.5 Fuel Transfer Within Tank Chambers. For transfer hose requirements, reference the FPM technical specification GMW14081.

3.1.5 Usage Definition. Reference GMW15311 for specific usage conditions that the fuel tank assembly may encounter in a vehicle.

3.2 Product Characteristics. The required product characteristics for the fuel tank assembly are identified in several different categories in 3.2.1 and 3.2.2.

3.2.1 Performance Requirements. The functional performance requirements for the fuel tank assembly are specified in 3.2.1.1 through 3.2.1.8. All requirements apply for the conditions specified in 3.1.3 and 3.1.4, except where noted otherwise. Special vehicle, operational, or ambient conditions may be identified in 3.2.1.1 through 3.2.1.8.

3.2.1.1 Receive Fuel. The fuel tank assembly shall receive fuel for filling the tank according to 3.2.1.1.1 through 3.2.1.1.6.

3.2.1.1.1 Shutoff and Spitback. The integrated fuel tank assembly shall support all of the requirements related to nozzle automatic shutoff and fuel spitback for gasoline and diesel, as defined in GMW15311. Reference GMW15311 and CG4191 for a complete listing of the specific shutoff and spitback tests, and system requirements.

3.2.1.1.1.1 Advertised Capacity. After initial shutoff per fill condition G1, the integrated fuel tank assembly shall permit fuel to be dispensed, using two (2) additional nozzle shutoffs, to bring the fuel level up to the advertised fuel capacity.

3.2.1.1.1.2 Initial Shutoff. The integrated fuel tank shall provide for nozzle initial shutoff at 95% to 100% of advertised fuel capacity (see capacity definition in the Fuel Storage and Handling Subsystem Technical Specification (SSTS)) for fill condition G1.

3.2.1.1.1.3 Shutoff Failure. Fuel fill shall be accomplished without causing automatic shutoff failure under all customer fill conditions defined in GMW15311.

3.2.1.1.1.4 Tank Venting. A minimum of 7% vapor space shall exist (without fuel expansion) when overfilled per condition G2 or D2 of GMW14508. A design study shall show that at least one (1) vent valve is open on level ground at 7% vapor space, and with the fuel expanded 4% (3% vapor space remaining).

For sealed tanks (i.e., Plug-in Hybrid Electric Vehicle (PHEV) or Extended Range Electric Vehicle (EREV)), the fuel tank shall vent under all conditions and grades, with a stuffed tank and 4% expansion to prevent liquid from accumulating in the venting system and contaminating the canister. This is to protect for the tank remaining full for an extended period of time (i.e., all electric driving) and considering the allowable vent valve leakage specifications.

3.2.1.1.1.5 Liquid Carryover. The maximum liquid fuel carryover to the vapor canister during refueling (per GMW14508) shall not exceed that defined in CG4191.

3.2.1.1.1.6 Fuel Inlet. The fuel inlet spud or check valve trajectory during refueling shall not interfere with the fuel tank's fuel fill limiter function (e.g., incoming fuel shall not cause the fuel limiting valve to close prematurely causing a premature shutoff).

3.2.1.2 Store Fuel. The integrated fuel tank assembly shall provide for fuel storage capacity and integrity according to 3.2.1.2.1 through 3.2.1.2.9.

3.2.1.2.1 Fuel Tank Usable Capacity. The fuel tank assembly shall be designed to provide a usable fuel capacity per a platform specific requirement. This capacity value shall comprehend installation into the vehicle, including strap up conditions.

3.2.1.2.2 Fuel Tank Vapor Space. The tank vapor space shall be 10% of total tank capacity (advertised capacity, plus unusable, plus vapor space) to allow for 4% thermal expansion up to 6% grade. Reference CG4191 G1 fill conditions for the advertised fuel tank capacity.

Federal Motor Carrier Safety Regulations (FMCSR) 49 CFR Part 393.67 requires a minimum of 5% expansion for side mounted tanks. The capacity definitions are illustrated in the Fuel Storage and Handling SSTs.

3.2.1.2.3 Fire Resistance. A non-metallic fuel storage tank, if used, shall not leak fuel by visual inspection after being subjected to the conditions of GMW14849 and UN R34.1. Also, fuel shall not siphon out of the tank from a fuel line after test. Openings in the tank above the initial fuel level that result from the test procedure are permitted. Fuel tank preparation shall include a 100 mm grid pattern marked on the tank shell with the minimum wall thickness value identified within each grid. Tank grids (all sides of tank) are to be photographed prior to test start, and documented in the test report.

3.2.1.2.4 Unusable Capacity. See the program specific document for fuel tank unusable capacity requirements.

3.2.1.2.5 Fuel Containment. The fuel containment requirements are:

3.2.1.2.5.1 Valve Function On Grades. There shall be no fuel spillage due to thermal expansion as defined in GMW15017. See 3.7.2.1.13 for venting requirements.

3.2.1.2.5.2 Tank Overturn. There shall be no fuel spillage due to tank overturn, as defined in GMW14852.

3.2.1.2.5.3 Tank Cold Roll. The fuel tank shall meet the requirements of GMW14800. The same fixture method shall be used for Pressure/Vacuum testing and serial production audits.

3.2.1.2.6 Fuel Expulsion Due to Tank Pressures. For non-Onboard Refueling Vapor Recovery (ORVR) equipped vehicles, the integrated fuel tank assembly shall not expel any liquid when tested per all phases of GMW14802.

3.2.1.2.7 Fuel Level Indication. The integrated fuel tank assembly shall be designed to support fuel level indication requirements as defined in the Fuel Pump Module CTS. Also reference the Fuel Gauge Calibration Best Practices ENERGY-6, ENERGY-14, ENERGY-17 (the supplier shall work with the GM Design Responsible Engineer to comprehend these requirements), and the Evaporative Emissions Interface Document. Data provided per the Validation Cross Reference Index (VCRI), referenced in integrated fuel tank program specific document, <https://gmsupplypower.covisint.com/web/portal/document-library> should include a sufficient number of samples to provide a nominal and +3 sigma signal, with statistical significance. In addition, the integrated assembly shall be capable of detecting customer usable fuel capacity (at worst case 3 sigma signal) as follows:

- Buoyancy of the float at full shall be located at the G1/D1 refueling condition, per GMW14508.
- Unmeasurable at empty shall be ≤ 3 L of fuel (sum of both chambers if a saddle tank).
- Intermediate fuel level dead bands (i.e., for saddle tanks) shall be ≤ 3 L of fuel.
- Volume vs resistance values shall be within $\pm 3.5\%$ of nominal.

In the development of the fuel gauge calibration, consideration should be given, but not limited to:

- Manufacturing variation of the tank.
- Fuel tank strap pull up during vehicle assembly.
- Fuel tank deflection due to the mass of fuel.
- Fuel tank deflection over time.
- Fuel tank deflection due to engine purge cycling.
- Fuel tank deflection due to diurnals and fuel consumption, particularly within the diesel cap pressure and vacuum relief set points.

3.2.1.2.8 Diagnostic and Purge Pressures. The integrated fuel tank assembly shall be designed to be robust to pressure and vacuum conditions as it interfaces with the powertrain diagnostics and purge.

- Standard Gasoline Powered Applications: -4.10 kPa to 1.86 kPa.
- Evaporative Leak Check Pump (ELCP) type diagnostic -4.55 kPa to 3.5 kPa.

The fuel system components shall be robust to these pressure levels to avoid undue warranty and/or customer complaints (e.g., excessive tank deflection which may cause a perceptible shift in the fuel gauge Instrument Panel (IP) position or fuel tank capacity). Permanent deformation of the fuel tank is not allowed.

3.2.1.2.9 Tank Deformation Due to Pressure. All components of the integrated fuel tank assembly must be robust enough to withstand tank shell expansion/deformation from internal pressure up to 18 kPa (2.6 psi). The fuel tank assembly must be mounted in a vehicle or representative fixture and contain the GN-1 fuel volume (or representative mass of water) during this evaluation. All connection and attachment points must remain intact. The tank shell must not contact any moving components (i.e., prop, suspension).

Note: This procedure is intended to represent a plugged canister vent and thermal expansion. If the fuel system contains a relief function, then the relief value shall be used. The component containing the relief valve must be included in the test.

3.2.1.3 Supply Fuel. The integrated fuel tank assembly shall support the FPM in supplying fuel forward in the vehicle according to 3.2.1.3.1 through 3.2.1.3.4.

3.2.1.3.1 Low Fuel Starting Performance. The integrated fuel tank assembly shall require not more than 3785 mL of fuel above dynamic unusable fuel to enable engine start, as defined in GMW14475. Reference the FPM CTS for additional requirements related to this performance objective.

3.2.1.3.2 Low Fuel Performance. See the program specific document for low fuel performance requirements.

3.2.1.3.2.1 Low Fuel Performance During Lateral and Longitudinal Accelerations. The integrated fuel tank shall deliver the program specific fuel flow and pressure during the acceleration conditions defined in GMW15311.

3.2.1.3.3 Electrostatic Discharge (ESD). The integrated fuel tank assembly shall not create ESD related failure at any point within the integrated fuel tank assembly.

3.2.1.3.4 Fuel Supply for Onboard Equipment. For applications designed to accommodate onboard equipment (i.e., generators, heaters, etc.) which access fuel from the vehicle's primary fuel supply, the integrated fuel tank assembly shall limit the fuel accessible to the onboard equipment. A minimum of 20% usable fuel capacity shall remain in the vehicle's primary fuel tank, at a point where the onboard equipment can no longer access fuel from the integrated fuel tank assembly.

3.2.1.4 Manage Fuel Vapor. The integrated fuel tank assembly shall manage fuel vapor according to the limits and conditions of 3.2.1.4.1.

3.2.1.4.1 Vapor Emissions.

3.2.1.4.1.1 North America. The integrated fuel tank assembly (including the FPM) shall be designed to support the evaporative emission requirements of the "California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles," the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," the Environmental Protection Agency (EPA) Federal Register 40 CFR Part 86, Subparts B and S and the "Emissions for Motor Vehicles 715/2007 (Euro V and VI)". Reference GMW17140 and CG1752.

3.2.1.4.1.1.1 Diurnal. The integrated fuel tank assembly shall be designed to the targets for diurnal plus hot soak emissions, shown in Appendix A, Table A1.

3.2.1.4.1.1.2 Thermal Expansion. The subsystem shall limit vapor generation so as to ensure no vapor loss under the thermal expansion conditions of GMW15017.

3.2.1.4.1.1.3 Emission. Reference the program specific document, if the emission requirements are not driven by North America, European, or Asian market testing/partitioning.

3.2.1.4.1.2 European and Asian Market.

3.2.1.4.1.2.1 The subsystem shall be designed to meet the Euro V or VI (per program specific requirements) HC emission targets, stated in R (EC) No. 715/2007. The fuel tank assembly allocation is 495 mg. Canisters are not part of the fuel tank assembly emission allocation.

3.2.1.4.1.2.2 Test per GMW16776 and GMW14846.

3.2.1.4.1.2.3 The fuel system allocation shall be 600 mg. Reference program specific documents for allocations.

3.2.1.4.1.2.4 Preconditioning of 20 weeks at 40 °C.

3.2.1.4.1.2.5 Fuel change interval per procedure.

3.2.1.5 Manage Heat. The integrated fuel tank assembly shall manage bulk fuel temperature buildup so as not to exceed 80 °C for diesel applications or 50 °C for gasoline or gasoline blends in the tank, under the operating environment defined in the Fuel Storage and Handling SSTs. Reference the program specific document for the

maximum fuel inlet temperature to the injection pump for diesel applications. Bulk fuel temperature shall be evaluated when performing GMW14555, GMW14854 and GMW14507 (government mandated gasoline tests for emissions). Internally, GM limits the temperature build in the fuel tank to avoid boiling, which will cause an emission default.

3.2.1.6 Manage Noise. The integrated fuel tank assembly shall manage noise as defined in 3.2.1.6.1 and 3.2.1.6.2.

3.2.1.6.1 Pressure-Vacuum Related Noise. Pressure-vacuum cycling related oil-canning noise from the fuel tank shall not result in a subjective rating of less than nine (9) at the driver and passenger ear levels in the front, and shall not be less than eight (8) in the rear seating areas of the vehicle.

3.2.1.6.2 Fuel Slosh Noise. Reference program-specific documents for noise requirements. Baffles (if required) shall incorporate retention features robust to fuel tank slosh testing and pressure vacuum testing. Different levels of fuel tank manufacturing technology are required in order to meet the Noise, Vibration, Harshness (NVH) A, B, C, D, hybrid, and stop-with-engine-off ratings.

- **Level A, hybrid and stop-with-engine-off ratings hardware and manufacturing equipment requirements:** Fuel tank touch points shall be to Body Frame Integral (BFI) primary body or Body On Frame (BOF) frame structure. For strapped BFI tanks, isolation pads shall be used between the fuel tank and each body touch point. The fuel tank shell is to include isolation pad retention features. Tank assemblies are to include integrated baffles to meet the specified noise targets. The fuel tank manufacturing process shall use three dimensional (3D) baffles for plastic tanks. Steel tanks must have full width horizontal and vertical baffles.
- **Level B, hardware and manufacturing equipment requirements:** Fuel tank touch points shall be to BFI primary body or BOF frame structure. For strapped BFI tanks, isolation pads shall be used between the fuel tank and each body touch point. The fuel tank shell is to include isolation pad retention features. The fuel tank manufacturing process shall use 3D baffles for plastic tanks. Steel tanks must have full width horizontal and vertical baffles.
- **Level C, hardware and manufacturing equipment requirements:** Fuel tank touch points shall be to BFI primary body or BOF frame structure. For strapped BFI tanks, isolation pads shall be used between the fuel tank and each body touch point. The fuel tank shell is to include isolation pad retention features. The fuel tank manufacturing process shall be capable of producing 3D baffles. Baffles are required on diesel applications.
- **Level D, hardware and manufacturing equipment requirements:** Fuel tank touch points shall be to BFI primary body or BOF frame structure.

3.2.1.6.2.1 Vehicle Subjective Noise Rating. The NVH A, B, C, D, hybrid, and stop-with-engine-off ratings are located in the SSTS GMW15311 and Appendix C2 of the Statement of Requirements (SOR) Appendix: Fuel Storage and Handling SSTS.

3.2.1.6.2.2 Vehicle Level Quantitative Noise Rating. The NVH A, B, C, D, hybrid, and stop-with-engine-off ratings are located in the SSTS GMW15311 and Appendix C2 of the SOR Appendix: Fuel Storage and Handling SSTS.

3.2.1.6.2.3 Tank Assembly Component Level NVH A and B, Hybrid, Stop-with-Engine-Off Quantitative Noise Rating. The fuel tank radiated sound pressure level, when measured and analyzed in accordance with procedure GMW16434, shall not exceed the limits defined in Table 1.

Table 1: Radiated Sound Pressure Level Targets (A and B Targets) ^{Note}

Time (seconds)	Maximum Stop	Moderate Stop	Light Stop
0	67.5	65	62.5
1	62.5	58	52.5
2	50	50	50
3	49	49	47
4	47.5	47.5	45

Time (seconds)	Maximum Stop	Moderate Stop	Light Stop
5	47	46	45
6	45	45	45
7	45	45	45
8	45	45	45
9	45	45	45
10	45	45	45
15	45	45	45

Note: Overall Sound Pressure Level dB(A) Re: 20 x 10⁻⁶ Pa.

3.2.1.6.2.4 Tank Assembly Component Level NVH C and D Quantitative Noise Rating. The fuel tank radiated sound pressure level when measured and analyzed in accordance with procedure GMW16434, shall not exceed the limits defined in Table 2.

Table 2: Radiated Sound Pressure Level Targets (C and D Targets) ^{Note}

Time (seconds)	Maximum Stop	Moderate Stop	Light Stop
0	72.5	70	67.5
1	67.5	65	57.5
2	62.5	58	55
3	57.5	53	52
4	53	50	50
5	50	49	48
6	48	48	48
7	48	48	48
8	48	48	48
9	48	48	48
10	48	48	48
15	48	48	48

Note: Overall Sound Pressure Level dB(A) Re: 20 x 10⁻⁶ Pa.

3.2.1.6.2.5 Tank Assembly Component Level NVH A and B Hybrid, Stop-with-Engine-Off Contact Point Quantitative Acceleration Levels. The fuel tank contact point acceleration level when measured and analyzed in accordance with procedure GMW16434, shall not exceed the limits defined in Table 3.

Table 3: Contact Point Acceleration Level Targets (A and B Targets) ^{Note}

Time (seconds)	Maximum Stop	Moderate Stop	Light Stop
0	15	15	10
1	5	5	0
2	-10	-10	-15
3	-15	-17.5	-25
4	-20	-25	-25
5	-25	-25	-25

6	-25	-25	-25
7	-25	-25	-25
8	-25	-25	-25
9	-25	-25	-25
10	-25	-25	-25
15	-25	-25	-25

Note: Overall Contact Point Vibration Level dB Re: 1 m/s².

3.2.1.6.2.6 Tank Assembly Component Level NVH C and D Hybrid, Stop-with-Engine-Off Contact Point Quantitative Acceleration Levels. The fuel tank contact point acceleration level, when measured and analyzed in accordance with procedure GMW16434, shall not exceed the limits defined in Table 4.

Table 4: Contact Point Acceleration Level Targets (C and D Targets) ^{Note}

Time (seconds)	Maximum Stop	Moderate Stop	Light Stop
0	25	25	20
1	20	15	10
2	15	5	0
3	10	0	-5
4	5	-5	-10
5	0	-10	-15
6	-5	-15	-20
7	-10	-20	-20
8	-15	-20	-20
9	-20	-20	-20
10	-20	-20	-20
15	-20	-20	-20

Note: Overall Contact Point Vibration Level dB Re: 1 m/s².

3.2.1.6.3 Squeaks and Rattles.

3.2.1.6.3.1 The integrated fuel tank assembly shall not cause or contribute to any squeak and rattle sound annoyances when subjected to the static and dynamic test conditions specified in GMW8518.

3.2.1.6.3.2 The squeak and rattle performance of the integrated fuel tank assembly shall not degrade over the first 40% of the durability test schedule specified in the platform specific VTS.

3.2.1.6.4 Refueling Noise. During refueling, the integrated fuel tank assembly shall not generate objectionable noise at the refueling operator's ear level that results in a subjective rating of less than nine (9), per G10 and G13, GMW14508 conditions, specified in the Fuel Storage and Handling SSTs. The vehicle's ignition is to be off during refueling.

3.2.1.7 Safety and Crashworthiness. The integrated fuel tank assembly shall conform to the fuel spillage requirements defined in VTS section titled Crash Protection, relative to fuel system performance by country.

For those applications where the Federal Motor Carrier Safety Regulations apply, the integrated fuel tank assembly shall conform to requirements for fuel tank drop and safety venting as defined in the 49 CFR Part 393.65 and 393.67.