



Specification for Fuel Shutoff Valve

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 Fuel Shutoff Valve (also known as the Fill Limit Vent Valve (FLVV)).

1.2 Applicability. FLVV is typically used in vehicles with Onboard Refueling Vapor Recovery (ORVR) requirements or in some diesel vehicles for fuel fill quality enhancements.

1.3 Remarks. This document must 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.

Note: 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 conflict between this document and the program-specific technical specification, the program-specific technical specification takes precedence.

2 References

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

2.1 External Standards/Specifications.

DIN 45631/A1	ISO 1431-1	SAE J1739	SAE J2044
ISO 179-1	ISO 3167	SAE J1960	SAE J2886
ISO 527-1/2			

2.2 GM Standards/Specifications.

GMW3013	GMW14106	GMW15312	GMW15760
GMW3059	GMW14264	GMW15570	GMW16600
GMW14081	GMW15311	GMW15571	GMW17081

2.3 Additional References. These references are limited to internal use within General Motors and shall not be accessed outside this company. Contact the GM Lead Engineer for further instructions.

CG2009 Flow Limit Vent Valve Validation Cross Reference Index (VCRI)

CG2308 Process Control and Documentation for Injection Molded Parts

10093203 GM End Form Chart

GM1927 Advanced Product Quality Planning

GM1927-03 Supplier Quality Statement of Requirements

2.3.1 Fuels.

GMPT-6-001

GMPT-6-005

GMPT-6-006

GMPT-6-018

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GMPT-6-023

GMPT-5-020

3 Requirements

3.1 System/Subsystem/Component/Part Definition. FLVV shall stop filling the fuel tank at designed fuel level, vent vapor to the canister and prevent fuel leak in case of roll-over.

3.1.1 Appearance. Not applicable.

3.1.2 Content.

3.1.2.1 Physical Content. The FLVV typically includes the following:

- Outer housing.
- Float.
- Spring.
- O-ring.
- Any other hardware, based on the supplier design, to make the component work as per this specification.

3.1.2.2 Functional Content. The FLVV shall be designed to perform the following functions:

- Venting vapor from the fuel tank and sending it to the canister.
- Shutoff the fuel fill when the designed fuel level in tank has been reached.
- Allow fuel tank venting under all conditions except immediately after refuel shutoff. If the FLVV is submerged beyond the buoyant point of the float, while on a grade, a Grade Vent Valve (GVV) will need to be added to the system.
- Keep fuel in the tank during vehicle maneuvering, grade soak and rollover.

3.1.3 Ambient Environment. The ambient environmental conditions that the FLVV may encounter during its life are defined in 3.1.3.1 thru 3.1.3.2.

3.1.3.1 Operating Environment. The FLVV shall withstand all operating environment extremes, as stated in Table 1, and suffer no permanent damage. The FLVV shall exhibit acceptable performance (per this document), once the operating conditions return to normal.

Table 1: Operating Environment

Normal Operating Ambient Temperature	-40 °C to 90 °C
Fuel Temperature	-40 °C to 70 °C
Relative Humidity	1% to 100%
Barometric Pressure	55 kPa to 105 kPa
Grade	≤ 30%
Altitude	-150 m to 4600 m
Wind	≤ 100 km/h (vehicle at rest)
Precipitation	≤ 4.6 cm/minute

3.1.3.2 Corrosives - Chloride Exposure. The typical corrosive agents and concentrations relevant to lower-body/underbody exposure are outlined in 3.1.3.2.1 thru 3.1.3.2.2.

3.1.3.2.1 Calcium chloride (CaCl₂) exposure with concentration 50% aqueous solution (by weight) shall be considered. Refer applicability of materials to test, test procedure and requirements in GMW16600.

3.1.3.2.2 Zinc chloride exposure with 50% aqueous solution (by weight) shall be considered. Refer applicability of materials to test, test procedure and requirements in GMW16600.

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3.1.4 Interfaces.

3.1.4.1 FLVV Interface to Fuel Tank. The FLVV may be mounted to the fuel tank by the hot-plate welding method (i.e., polymer fuel tanks), mounted in a well with a weld cover, or internally snapped. A snap-ring or cam lock fastening method, with an O-ring, may be used on steel fuel tanks. Additional details for these valves may be defined in the program specific Statement of Requirements (SOR) documents.

3.1.4.2 FLVV Interface to Fuel Pump Module. For FLVV mounted in the Fuel Pump Module (FPM), refer to GMW14081 for interface design features. Additional details for these valves may be defined in program specific SOR documents.

3.1.5 Usage Definition. FLVV is required for ORVR vehicles or for some diesel vehicles, as specified by program SOR documents.

3.2 Product Characteristics.

3.2.1 Performance Requirements. GMPT-6-005 shall be used as test fuel for gasoline FLVV, unless an alternative fuel is specifically defined. Diesel FLVV shall be tested with GMPT-5-020. GMPT-6-001 may be used for 65 °C and -40 °C testing only.

3.2.1.1 Air Leak. When air pressure at 6 kPa and 11.2 kPa is applied to Region "B" (refer to Figure 1) at 23 °C, the valve leak shall not exceed 75 cc/minute.

Note: Leak correlation data between fuel and air shall be used to set leak acceptance criteria for process control activities.

3.2.1.2 Liquid Leak. When pressure is applied to Region "B", the valve leak shall not exceed 0.5 cc/minute of test fuel. Refer to Table 2 for test matrix.

Note: For leaks to the atmosphere, the valve shall satisfy the leak requirements found in GMW15311 and GMW14106.

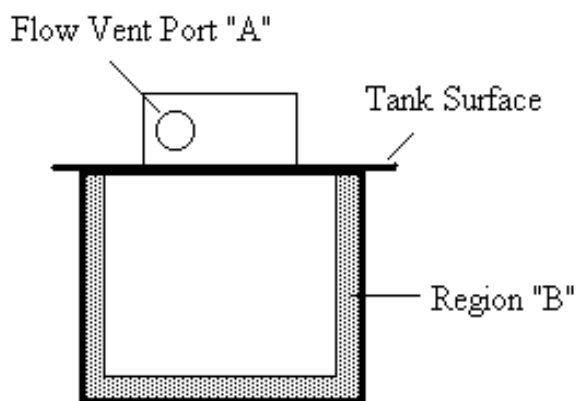


Figure 1: Leak Test

Table 2: Liquid Leak Test Matrix

Valve Position	Test Temperature	Pressure
Upright	-40 °C, 23 °C and 65 °C	0.5 kPa, 6 kPa and 11.2 kPa
90° from Upright	-40 °C, 23 °C and 65 °C	0.5 kPa, 6 kPa and 11.2 kPa
180° from Upright	-40 °C, 23 °C and 65 °C	0.5 kPa, 6 kPa and 11.2 kPa

3.2.1.3 Shut Off Height. The supplier shall provide the shut off height (refer to Figure 2), measured from a convenient point (e.g., cover weld surface, valve interface top, etc.), with statistical significance. This shut off height shall meet the requirement listed in the program specific SOR documents.

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Note: Shut off point is defined as point in space where the valve shuts due to a rising liquid column over the valve body (region "B").

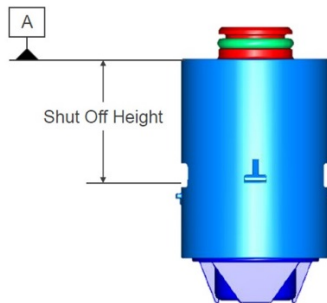


Figure 2: FLVV Shut Off Height

3.2.1.4 Reopening. With the valve closed via exposure to increasing fuel level and 3.0 kPa pressure maintained in Region "B" of the closed valve (Figure 1), the first stage of the valve shall open fully due to the gradual lowering of the fuel level. After gradual lowering of the fuel level, the second stage of the valve shall open fully with 0.5 kPa pressure maintained in Region "B".

3.2.1.5 Pressure Drop. With flow of 70 standard L/minute of air through the valve out of Port "A" (Figure 1), the pressure drop across the valve shall not exceed 0.25 kPa for flange mounted FLVV. For FLVV with barbed end or quick connector, the pressure drop shall not exceed 0.5 kPa.

3.2.1.6 Liquid Discrimination. Liquid flow out of Port "A" (Figure 1) shall not exceed 10 ml with the tank pressurized to generate a 7.55 L/minute flow out of the valve. GMPT-6-001 may be used. Test conditions are as follows:

- Two (2) different rectangular tanks with approximate inside dimensions: 800 mm length, 200 mm width, 400 mm height and 1200 mm length, 300 mm width, 250 mm height.
- Two (2) different fill levels: fill level inside the tank at the closure point of the valve and 25 mm below the shut-off level of the valve.
- Two (2) different grades: total ten (10) slosh cycles on horizontal table (five (5) cycles in length direction and five (5) cycles in width direction) and a total ten (10) slosh cycles on 30% grade (five (5) cycles in length direction and five (5) cycles in width direction). Each cycle is defined as: travel from stop A to stop B at 457 mm in 0.5 s, dwell time of 5.5 s, return to stop A in 0.5 s and dwell time of 5.5 s. In grade testing, point A is on horizontal plane and point B is at the aforementioned angle.

3.2.1.7 Evaporative Emissions. Refer to GMW14106 for fuel vapor emission requirements at the fuel tank assembly level. Also review the program specific SOR documents for details on allowable permeation at the component level. The component shall be designed to meet this allowable permeation.

3.2.1.8 Audible Noise. With the FLVV mounted in a production representative manner and shaken in free air at 1 Hz, to make the valve to go from full closed, to full open, to full closed condition, the peak loudness of the valve at a distance of 500 mm shall be ≤ 28 Sones per DIN 45631/A1 calculation. Also, the audible noise subjective rating of the valve shall be $\geq$ eight (8), per GMW14264, in vehicle level system evaluations (refer to GMW15311).

3.2.1.9 Anti-Corking. The fully assembled valve shall continue to flow with up to 210 standard L/minute of air flowing through the valve from Region "B" and out of Port "A".

3.2.1.10 Vapor Line Connections. Vapor line connections to the valve shall be of either the quick-connect type or the push-on type as defined in 3.2.1.10.1 and 3.2.1.10.2.

3.2.1.10.1 Quick-Connect End-form. Quick-connect end-form dimensions shall conform to 5/8" size listed in SAE J2044.

3.2.1.10.2 Push-On Connections. Push-on end-form dimensions shall conform to 5/8" size listed in GM End-form Chart 10093203. The end-form shall not crack, break or create leak until a force of 450 N or during installation of the hose.

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