



Fuel Cap 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 specifies the performance and durability requirements for the GM Global Gasoline and Diesel corporate fuel caps.

1.2 Mission/Theme. The fuel cap is used to seal the external opening of the fuel system, into which fuel is filled. During normal operation, the fuel cap prevents leakage of liquid fuel and fuel vapor to the atmosphere. The cap may have a pressure and/or vacuum relief valve to regulate fuel tank pressure in the event of primary venting system malfunction.

1.3 Classification. Fuel caps are to be classified as shown in Table 1. The assigned Universal Product Code (UPC)/Functional Name Address (FNA) for the fuel caps is: 8A/3225A Cap Asm – F/Tnk Fil.

Table 1: Fuel Cap Portfolio ^{Note 4}

Cover/Thread Color	Fuel Type	Interface ^{Note 2, Note 3}	Tether ^{Note 1} (P = Peripheral B = Black R = Red)	Valve (P = Plug V = Vacuum PV = Pressure/Vacuum)	Seal	Fuel System Requirement
Black/White	Gasoline	Full 360 Degree Thread, CMS	177 mm (PB) Pushpin	V	FKM	LEV III
Black/White	Gasoline	Full 360 Degree Thread CMS or SAE	177 mm (PB) Pushpin	PV	NBR+PVC or FKM	EURO VI
Black/White	Gasoline	Full 360 Degree Thread, CMS	177 mm (PB) Pushpin	P	FKM	LEV III
Black/Black With Lock	Gasoline	Full 360 Degree Thread CMS or SAE	177 mm (PB) Pushpin	V	NBR+PVC or FKM	EURO VI
Yellow/White	E85	Full 360 Degree Thread, CMS	177 mm (PB) Pushpin	V	FKM	LEV III
Green/Black	Diesel	Full 360 Degree Thread	177 mm (PR) Pushpin	PV	FKM or NBR	Not Applicable
Black/Black	Diesel	Full 360 Degree Thread	177 mm (PR) Pushpin	PV	FKM or NBR	Not Applicable

Note 1: All tethers shall be 177 mm long when measured from the center of the cap cover to the center of the pushpin. The tether ring around the cap and the tether shall be a one piece design, molded from an elastomeric polymer. The attachment mechanism to the vehicle shall be a separate pushpin. The dimensional interface between the tether ring and the cap cover must provide free and easy motion between the two parts under all operating conditions. When the tether is held horizontally, it must fall by gravity to the vertical position.

Note 2: The complete Corporate Managed Solution (CMS) thread details are available per GM Drawing AMH80509.

Note 3: The SAE International thread details are available with specification SAE J1114 (**not** the alternate shape).

Note 4: FKM = Fluoroelastomers, NBR = Nitrile Rubber, PVC = Polyvinyl Chloride, LEV = Low Emission Vehicles.

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1.3.1 Corporate “1-click” Non-Locking Cap. The fuel cap shall provide audible, tactile or both forms of response or feedback to a customer upon reaching its full stop position at approximately 360 degrees after first thread engagement. The fuel cap handle shall always return to a horizontal position after providing full stop feedback to the customer.

1.3.2 Corporate “3-click” Non-Locking Cap. The fuel cap shall provide audible, tactile or both forms of response or feedback to a customer upon reaching its full stop position at approximately 360 degrees after first thread engagement. The fuel cap handle can continue to be rotated while providing continuous audible or tactile response after providing full stop feedback to the customer.

1.3.3 Locking Cap. The locking fuel cap shall function the same as the non-locking cap, except that the cover shall free-spin 360 degrees when in the locked mode. The normal operation of the locking feature is described in 3.2.1.4.

1.3.4 Valves. Valves labeled **PV** in Table 1 include pressure and vacuum relief. Valves labeled **V** include vacuum relief only. The specific leak and flow requirements are shown in 3.2.1.1.2. Valves labeled **P** have no venting capability to relieve pressure/vacuum levels within the fuel system. All venting caps must include a “tortuous path” to protect the vacuum valve from dirt intrusion or contamination that may impact proper operation of the cap. This can be accomplished through the use of a filter or within the internal flow channels within the cap.

2 References

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

2.1 External Standards/Specifications.

CMVSS 301	JIS D0207	SAE J1114	SAE J1976
FMVSS 301			

2.2 GM Standards/Specifications.

GMW3059	GMW3286	GMW15101 (ID)	GMW15852 (ID)
GMW3172	GMW15100 (ID)	GMW15311	GMW16370

(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.

- CG997 – Fuel Cap Program Specific Component Technical Specification (CTS)
- CG1752 – Hydrocarbon Permeation Measurement Process
- CG1970 – Fuel Cap CTS Validation Cross Reference Index (VCRI)
- Global Labels and Literature Web Site
- GM Drawing AMH80509 – Restrictor – F/Tnk Fil Pipe (CMS Full Turn Cap Interface Geometry)
- GM Part Number 22855246
- Statement of Requirements (SOR) Appendix D7/E7
- Vehicle Technical Specification (VTS)

3 Requirements

3.1 System/Subsystem/Component/Part Definition.

- The fuel cap is used to seal the external opening through which fuel is dispensed into the fuel fill pipe and fuel tank.
- The cap may have a pressure and/or vacuum relief valve to regulate fuel tank pressure in the event of primary venting system malfunction.
- A retention method of cap to vehicle is required for non-locking caps to ensure that the cap does not become separated from vehicle during refueling.
- The fuel cap shall ensure containment of fuel and vapor, along with the rest of the fuel system and evaporative system.
- If required, a locking cap shall prevent access and tampering to the fuel system without the vehicle key.

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3.1.1 Appearance. Fuel cap covers shall be black (Viper-757S), yellow (Pantone 116C) or green (Pantone 347) in color depending on the vehicle application. Examples of the general cap cover color, verbiage and print are defined in Figure 1. Any deviations from Figure 1 must be approved by the Program Engineer and the fuel cap Bill of Material (BOM) Family Owner.

- Preferred type is bold Arial text, size twelve (12) font. Alternative fonts to be approved by Program Engineer and BOM Family Owner.
- Locking caps and applications with non-onboard refueling vapor recovery (ORVR) fuel system requirements may be black with no verbiage.
- Caps for Diesel applications must have the word Diesel legible and right side up above the grip handle when the cap is installed on the filler pipe. If the cap is a ratcheting style with no defined installed orientation, the word Diesel must appear twice, on either side of the grip handle.
- There is a catalog of fuel cap translation labels available in the Global Labels and Literature web site. The UPC/FNA for the translation labels is 8A 3676A Label – Fuel Cap information.

3.1.2 Content. The required physical and functional content for the fuel cap are identified in 3.1.2.1 and 3.1.2.2.

3.1.2.1 Physical Content. See the Program Specific CTS, CG997.

3.1.2.2 Functional Content. The fuel cap assembly shall provide the following functions.

3.1.2.2.1 The fuel cap shall include a seal to ensure acceptable permeation/leak prevention performance through the life of the vehicle.

3.1.2.2.2 The cap may have a pressure (P) and/or vacuum (V) relief valve to regulate fuel tank pressure in the event of primary venting system malfunction. In the event of an impact, the pressure relief valve shall also help alleviate a sudden pressure build in the tank (non-ORVR system) while at the same time resealing to prevent liquid leakage from the fuel system through the cap.

3.1.2.2.3 The cap shall include a device (tether) to ensure retention to the vehicle while refueling. This device shall also prevent the loss of a cap that is not correctly reinstalled after completion of the fueling process. Any design without a tether must be approved by Program Engineer and BOM Family Owner.

3.1.2.2.4 With the inclusion of a locking feature, the cap shall prevent access and/or tampering with the fuel system without the use of the vehicle key.

3.1.2.2.5 In applicable regions, the cap shall include messages to the operator as to the correct fuel for the system and the correct cap installation process.

3.1.3 Ambient Environment. Per GMW15311 Fuel Subsystem Technical Specification.

3.1.3.1 Ambient Air Temperature. Per GMW15311.

3.1.3.2 Operating Environment. Per GMW15311.

3.1.3.3 Non-Operating Conditions. The fuel cap shall meet all operating performance requirements under the operating environment defined in 3.1.3.2 without loss of function or degradation of service life after exposure to the following non-operating conditions.

3.1.3.3.1 Transport by airplane at altitudes up to 13 700 m.

3.1.3.3.2 Ambient air temperature of -48 °C to 93 °C.

3.1.3.3.3 Transport by ground via haul-away carriers, ship and/or train.

3.1.3.4 Fuels. Test fuels must be purchased from a GM approved test fuel supplier.

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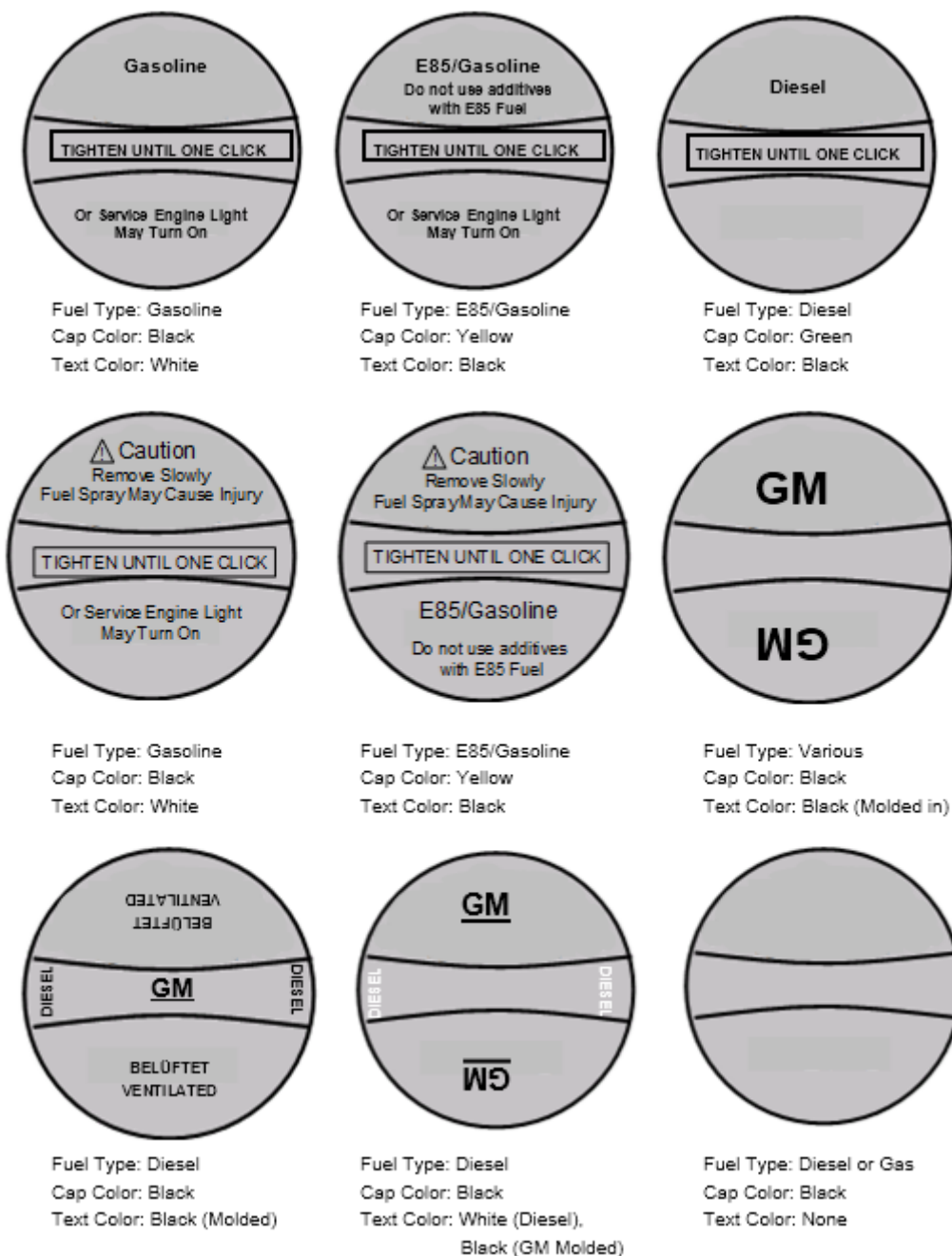


Figure 1: Fuel Cap Cover Examples

3.1.3.4.1 Soak Fuels. The fuel cap shall be capable of withstanding exposure to the fuels identified in Table 1. Reference GMW15311 for the complete list of fuels applicable to the fuel subsystem and its components. Note that GMW15311 will be updated to include world fuels.

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Table 2: Soak Fuels

Fuel Number	Fuel Name
GMPT-5-020	US Ultra Low Sulfur B20 Biodiesel
GMPT-5-036	Severe Bio Diesel 80/20 SME Acidic bio-diesel/diesel
GMPT-6-019	Oxidized gasoline
GMPT-6-022	Corrosive E22 gasoline with corrosive salts and water
GMPT-6-030	Conventional Gasoline
GMPT-6-037	Conductive E100

3.1.3.4.2 Permeation Fuels. Table 3 identifies the fuel that shall be used for permeation tests.

Table 3: Permeation Fuels

Fuel Number	Fuel Name
GMPT-6-025	CE10 Fuel C with ethanol (LEV III)

3.1.3.5 Potential Contaminants. The following list identifies the potential contaminants that the fuel cap shall withstand prolonged exposure to, or be located, packaged, or protected from, to assure no degradation from its design function.

- Engine oil
- Transmission fluid
- Power steering fluid
- Coolant/Antifreeze
- Brake fluid
- Windshield washer fluid, ammonia glass cleaner
- Gasoline, other fuels
- Transaxle or differential lube
- Wheel bearing lube
- Air Conditioning (A/C) refrigerant
- Battery acid
- Water
- Snow, ice
- Acid rain
- Deicing and dust control chemicals, Sodium Chloride (NaCl)
- Calcium Magnesium Acetate (CMA)
- Calcium Lignosulfonate
- Dirt, grit, sand
- Dust

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- Mud
- Road tar, oil
- Rust proofing/undercoating
- Ozone
- Biological (sap, leaves, insects, bird droppings)
- Biological (mold, fungus)
- Car wash chemicals, detergents, tar remover
- Waxes, paint sealants
- Steam cleaning
- Tire cleaners
- Engine cleaners
- Diesel exhaust fluid

3.1.3.6 Corrosives. Reference GMW15311.

3.1.3.7 Ultraviolet Radiation. Reference GMW15311.

3.1.4 Interfaces. The component interfaces with several physical entities that shall affect or constrain its functionality and designs. These interfaces are described in 3.1.4.1 thru 3.1.4.2.4.2.

3.1.4.1 External to Vehicle to Component.

3.1.4.1.1 Assembly Plant Usages. The design and operation of the component shall accommodate the assembly plant installation requirements.

3.1.4.2 Component to Component. Generic and specific component to component interface requirements for the fuel cap are identified in the following paragraphs.

3.1.4.2.1 Crashworthiness. The fuel cap and the components that it interfaces with shall not create any leak that causes the system not to meet crashworthiness requirements. Components shall be designed to prevent disconnection and damage to adjacent components. Components shall meet GMW15100, GMW15101 and GMW15852.

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

3.1.4.2.3 Corrosion. The interfaces between components shall satisfy the VTS representative paragraphs relative to corrosion.

3.1.4.2.4 Fuel Cap to Fuel Fill Pipe Assembly Interface. The choice of fuel cap to Fuel fill pipe assembly interface is determined by the type of fuel system and vehicle evaporative system On Board Diagnostics (OBD).

3.1.4.2.4.1 Corporate Managed Solution (CMS) Full-Turn Thread Interface. Gasoline and flex fuel systems for vehicles having evaporative system OBD leak detection shall use the CMS fuel cap with full-turn thread. The fuel fill pipe side of the interface is defined in GM Drawing AMH80509. This interface may also be used for diesel and non-OBD gasoline or flex fuel vehicles. The CMS fuel cap interface requirements are valid for steel as well as plastic fuel filler assembly designs.

3.1.4.2.4.2 SAE Interface (Optional). Vehicles without evaporative system OBD leak detection may alternatively use a fuel cap and fuel fill pipe interface that complies with SAE J1114 (do not use **alternate shape**). The interface may be either formed into the fuel fill pipe or a separate piece attached to the fuel fill pipe as shown in SAE J1114.

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3.1.4.2.5 Restrictor to Fuel Fill Cap. The maximum distance between the bottom edge of the cap sealing surface, on the valve body, and the barrel end of the valve body is 27 mm. Refer to Figure 2.

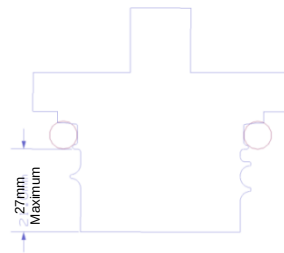
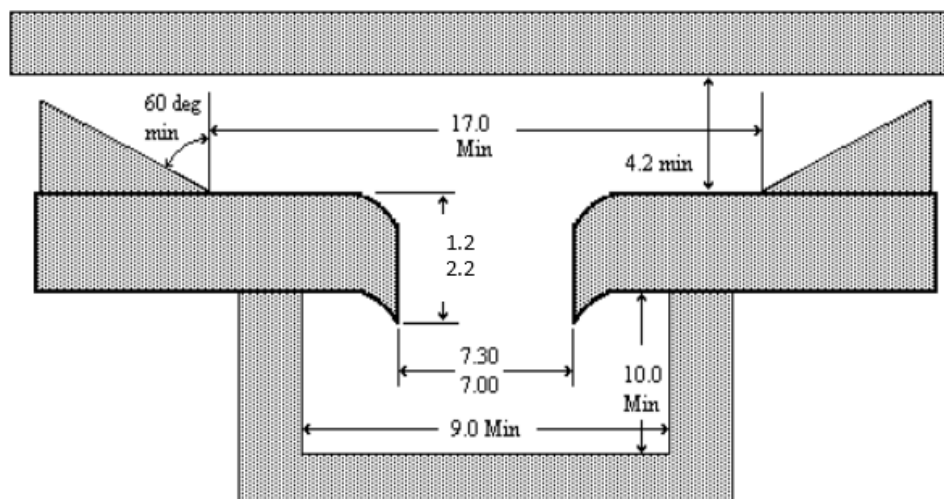


Figure 2: Maximum Distance Between Bottom Edge of Cap Sealing Surface and Barrel End of Valve Body

3.1.4.2.6 Fuel Cap Tethering to Vehicle. The tether must attach to a vehicle using a hole 7.00 mm to 7.30 mm in diameter in a panel with 1.2 mm to 2.2 mm thickness as shown in Figure 3. The mounting surface must have a flat surface with a minimum diameter of 17.0 mm and 360 degrees freedom of rotation for ease of tether use. The pushpin assembly is defined by GM Part Number 22855246.



Note: Min = Minimum, Deg = Degrees.

Figure 3 Tether Anchor Interface

3.1.4.2.7 Validation Testing. The following tests are expected to be completed after assembly of the pin and grommet to the tether (no fuel cap required), and assembled in the maximum and minimum metal hinge and the plastic Corporate Common Component (CCC) hinge, where specified.

- Humidity (3.2.1.24)
- Tether Strength (3.2.1.27)

3.1.5 Usage Definition. Reference GMW15311.

3.1.5.1 Underbody Wash. Reference GMW15311.

3.1.5.2 Vehicle Wash. Reference GMW15311.

3.1.5.3 Road Splash. Reference GMW15311.

3.2 Product Characteristics.

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3.2.1 Performance. All tests shall be conducted at the soak temperature specified.

3.2.1.1 Room Temperature Performance.

3.2.1.1.1 Installation and Removal Torque. Installation torque to cap positive stop shall be from 0.8 N·m to 1.3 N·m (positive stop), 0.8 N·m to 1.5 N·m (click). Removal torque shall be 0.3 N·m to 1.5 N·m. Re-initiation of installation or removal torque shall be equivalent to the torque at each pause.

3.2.1.1.2 Leakage and Flow. Flow measurements shall be conducted on a cap installed to full stop. Positive pressure represents fuel fill pipe pressure greater than atmospheric. Negative pressure represents fuel fill pipe pressure less than atmospheric. Positive pressure requirements apply only to caps with pressure and vacuum relief valves. Cap must meet requirements in Table 4.

3.2.1.1.3 Audible Feedback. The cap shall provide audible feedback to customer indicating that the fuel cap has reached the full stop position. This feedback sound shall remain consistent with an axial load up to 150 N (without audible or physical distortion of the “click”, damage to internal components, or delay in return of cap cover to horizontal position).

3.2.1.2 Cold Performance (-40 °C and -10 °C).

3.2.1.2.1 Installation and Removal Torque. Installation torque to cap positive stop shall be from 0.8 N·m to 2.4 N·m. Removal torque shall be 0.3 N·m to 2.4 N·m.

3.2.1.2.2 Leakage and Flow. Flow measurements shall be conducted on a cap installed to full stop.

- Positive pressure represents fuel fill pipe pressure greater than atmospheric.
- Negative pressure represents fuel fill pipe pressure less than atmospheric.

Positive pressure requirements apply only to caps with pressure and vacuum relief. Cap must meet requirements in Table 4.

3.2.1.3 Hot Performance.

3.2.1.3.1 Installation and Removal Torque (at 60 °C). Installation torque to cap positive stop shall be from 0.5 N·m to 1.5 N·m. Removal torque shall be 0.3 N·m to 1.6 N·m.

3.2.1.3.2 Leakage and Flow (at 60 °C). Flow measurements shall be conducted on a cap installed to full stop.

- Positive pressure represents fuel fill pipe pressure greater than atmospheric.
- Negative pressure represents fuel fill pipe pressure less than atmospheric.

Positive pressure requirements apply only to caps with pressure and vacuum relief. Cap must meet requirements in Table 4.

3.2.1.4 Locking Cap. The key torque shall be less than 0.8 N·m for locking and unlocking the cap. Key shall not be removable at the unlock position. Based on regional requirements, a locking cap may not require a tether.

3.2.1.5 Ambient Temperature Exposure. The cap shall meet the installation, removal, and leak/flow requirements of 3.2.1.1 when tested at 20 °C to 23 °C.

During testing, the cap shall be rotated until achieving full stop (one click). Installation and removal torques shall be measured three times per cap, with the average value used to determine compliance. Leak/Flow measurements shall be conducted at the pressures shown in Table 4.

Installation interval torque test procedure shall be conducted as follows:

1. Insert cap into fill cup.
2. Turn cap clockwise 122 degrees at one revolution per second measuring torque.
3. One second dwell.
4. Turn cap clockwise 122 degrees (122 degrees to 244 degrees) at one revolution per second measuring torque.
5. One second dwell.
6. Turn cap clockwise to full stop and through click while measuring torque.
7. Verify leak/flow measurements and record values.

Torque measurements for Steps 1 through 6 shall all be reported on a single graph.

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