



Compressed Natural Gas (CNG) Fuel Fill Receptacle 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 Compressed Natural Gas (CNG) fuel fill receptacle assembly (including a tethered protective cap), herein referred to as the receptacle. The functions, performance, and design constraints for the receptacle are defined in this standard or referenced to an industry standard.

1.2 Applicability. The receptacle is a functional vehicle component that interfaces with a CNG fuel fill station nozzle to receive CNG for subsequent container storage. This standard applies only to Bi-fuel or Dedicated CNG vehicles (i.e., Mono-fuel, Mono-Fuel plus, etc.)

2 References

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

2.1 External Standards/Specifications.

ANSI NGV 1	ISO 7000-2641	NFPA52	UN R110
ANSI NGV 3.1	ISO 14469	SAE J1344	
ANSI NGV4.4	ISO 15500	SAE J1645	

2.2 GM Standards/Specifications.

GMW3059	GMW14333	GMW15311	GMW16955
GMW3116	GMW14334	GMW15357	GMW17758
GMW3172	GMW14573	GMW15570	GMW17759
GMW14089	GMW14650	GMW15862	GMW17867
GMW14234	GMW14872	GMW16331	
GMW14264	GMW15272	GMW16807	

2.3 Additional References.

CG5507: Validation Cross Reference Index (VCRI)

Component Technical Specifications (CTS)

GM1927: Supplier Quality Statement of Requirements

GM Part Number 9986467

3 Requirements

3.1 System/Subsystem/Component/Part Definition. The receptacle is to provide the capability to receive, filter, and supply fuel. The receptacle also includes a manual lock off valve used in some regions of sale where the receptacle is located in the engine compartment. The major component content is illustrated in Figure 1 and 2.

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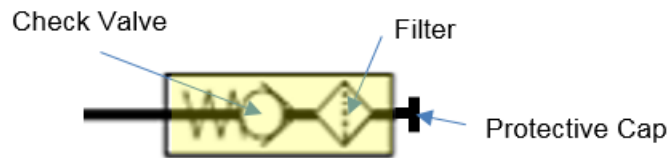
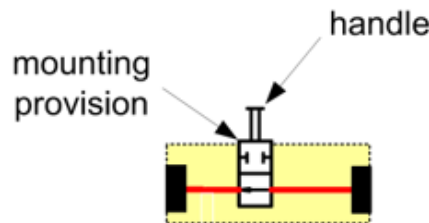


Figure 1: CNG Fuel Fill Receptacle

Figure 2: Supplementary Lock Off Valve
(For Engine Compartment Mounted Applications)**3.1.1 Appearance.****3.1.1.1 For receptacle applications not located in the engine compartment:**

3.1.1.1.1 Receptacle. Stainless steel without coating (1.4404 X2CrNiMo17-12-2).

3.1.1.1.2 Protective Cap:

3.1.1.1.2.1 Ozone resistance Ethylene Propylene Diene Terpolymer (EPDM) – black (see ANSI NGV1).

3.1.1.1.2.2 Cheyenne blue 719 R (see UN R110) with white text CNG; symbol, per ISO 7000-2641.

3.1.1.2 For receptacle applications located in the engine compartment:

3.1.1.2.1 Receptacle. Brass.

3.1.1.2.2 Protective Cap. Brass with double O-ring.

3.1.2 Content.

3.1.2.1 Physical Content. The fuel receptacle consists of the following:

- Fill inlet orifice.
- O-ring sealed refilling nozzle interface profile.
- Filter upstream of the check valve.
- Integrated check valve (spring or magnetic activated).
- Orifice protector (Protective cap secured with tether or alternate protection).
- Manual shutoff valve (for receptacles located in the engine compartment only).

3.1.2.2 Functional Content.

3.1.2.2.1 The primary function of the receptacle is to create a gas-tight seal with the refueling nozzle during transfer of CNG from the filling station to the vehicle. It contains a check valve to prevent flow out of the vehicle after refueling.

3.1.2.2.2 The secondary function of the fuel receptacle assembly is to filter particles from incoming fuel to prevent fuel system contamination if required in the region of sale.

3.1.2.2.3 Additionally, the fuel receptacle assembly prevents intrusion of environmental contaminants to the fill inlet orifice when the fuel door is closed or when the protective cap is engaged.

3.1.2.2.4 For engine compartment mounted receptacles, the assembly includes a manual lock off valve.

3.1.3 Ambient Environment.

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3.1.3.1 See requirements stated in GMW17759, including but not limited to:

- Ambient and extreme operating conditions.
- Solar and ultraviolet radiation.
- Fuel storage system operating pressures.
- Fueling cycle temperatures.
- Pressures (including fill and fast fill).
- Non-operating pressure and temperature.
- Fuel contamination.
- Road splash.
- Car wash and vehicle submersion.

3.1.3.2 Corrosion. CNG fuel subsystem components shall have no degradation of performance throughout the corrosion and durability target life, when exposed to the severe corrosive environments (e.g., Coastal areas or regions with high road salt usage).

3.1.4 Interfaces. Specific interface requirements to the receptacle are described in the following paragraphs.

3.1.4.1 External-to-Vehicle to Component. The receptacle must meet the interface specification of the standards UN R110, ANSI NVG1, ANSI NGV4.4, NFPA52, and ISO 14469.

3.1.4.1.1 Receptacle Body to Fill Nozzle. The receptacle shall accept fuel from any ANSI NGV 1 (P36 nozzle) or ISO14469 approved fill nozzle.

3.1.4.1.2 Receptacle Tether to Nozzle. The nozzle shall not interfere (i.e., “bottom out”) on the protective cap tether secured to the receptacle circumference. GM acknowledges that this criteria can be fulfilled for the majority of currently available nozzles however, the nozzle industry practice does not necessarily specify nozzle length and as such, meeting this criteria may not be possible for a small subset of unknown or rarely used nozzle designs. The supplier shall provide documentation of meeting this criteria with all commonly known nozzles in the region of sale.

3.1.4.1.3 Receptacle Check Valve to CNG temperature and flow mechanics. The check valve shall not freeze during CNG fill, as described in 3.2.1.4.

3.1.4.2 Component to Other Components/Subsystems.

3.1.4.2.1 Receptacle Mounting. If not located in the engine compartment, the receptacle shall provide a mounting point (i.e., screw mechanism) for a bracket and fill pocket which are attached to the vehicle chassis or body. Typical examples are shown in Figures 3, 4, and 5. The interface thread size shall be a M18 x 1.5 mm.

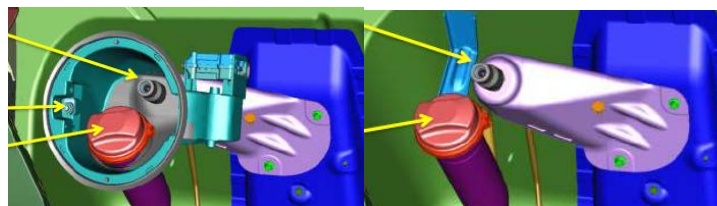


Figure 3: Receptacle to Bracket and Fill Pocket Interface (Example 1)

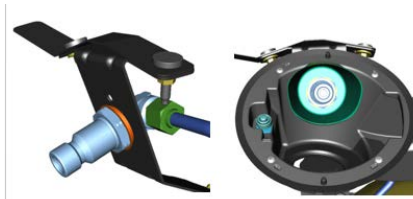


Figure 4: Receptacle to Bracket and Fill Pocket Interface (Example 2)

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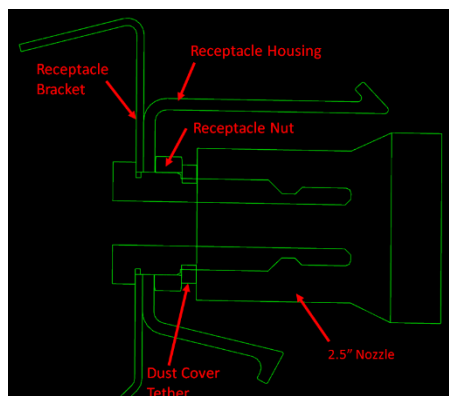


Figure 5: Receptacle to Bracket and Fill Pocket (Cross section)

3.1.4.2.2 If located in the engine compartment, the receptacle shall provide a mounting point (i.e., threaded connection point) for a bracket as shown in Figures 6 and 7.



Figure 6: Typical Engine Compartment Mounted Receptacle

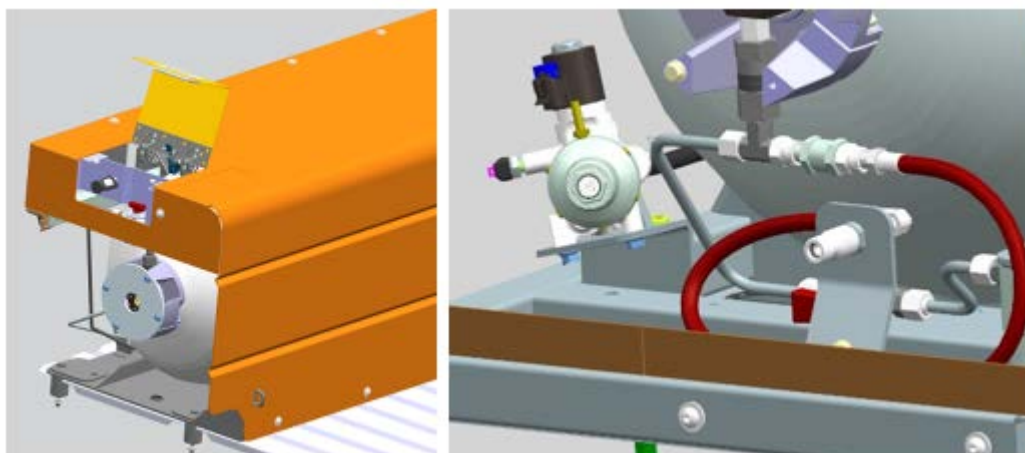


Figure 7: Typical Receptacle Mounting For Truck Applications

3.1.4.2.3 For truck applications, the receptacle may be mounted to a dedicated bracket near the container assembly. For cab chassis applications where final truck assembly does not include a rear compartment, a flexible line is used to allow the subsequent truck manufacturer flexibility in receptacle location according to the rear body configuration.

3.1.5 Usage Definition.

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3.1.5.1 The receptacle shall meet all other vehicle level usage requirements, per GMW17759, as tested at a subsystem level and partial system per GMW17758.

3.1.5.2 Real Refueling Cycles. The CNG fuel storage system testing shall have 1650 filling cycles per service life. Of the 1650 cycles, 1000 full filling cycles shall be tested from < 2 MPa to a temperature compensated service pressure, and 650 filling cycles shall be tested with different elevated storage system pressures according to Table 1.

Table 1: Refueling Cycle Fill Properties

Storage System Pressure Range	% Total Cycles	Cycles
Empty to full	61%	1000
25% to full	14%	225
50% to full	14%	225
75% to full	12%	200

3.2 Product Characteristics.

3.2.1 Performance Requirements.

3.2.1.1 The receptacle shall meet all operational performance requirements, without loss of function or degradation when subjected to at least the number of CNG filling cycles defined in 3.1.5.

The receptacle shall meet specific durability requirements according to the applicable regional standards (i.e., UN R110, ANSI NGV 3.1 or National Fire Protection Association (NFPA52)). Special vehicle, operational, or ambient conditions may be identified in the performance requirements paragraphs.

Note: All fuel flow measurement testing, unless otherwise specified, shall use a qualified calibration gas. The supplier shall define the test gas used, and provide correlation to the actual gaseous fuel. The test gas temperature for all CNG fuel flow measurements shall be measured at the receptacle inlet. The receptacle temperatures at the start of all fuel flow measurements shall be stabilized and documented. Any changes in either test gas or receptacle temperature shall be monitored and documented throughout the test and the data shall be used in the fuel correlation calculation.

3.2.1.2 External Leakage (100% Methane, 0 °C). The receptacle leakage shall not exceed 5 mbar × l/s × 10⁻⁵ mbar × l/s over total service life at the region specific operating pressure.

3.2.1.3 Shutoff Function Leak Requirement. The receptacle shall be capable of providing a bubble tight seal (see 6.1 "Glossary" for definition) to the ambient over the requested durability cycles and the defined operating ambient temperature range and the expected CNG temperatures, as defined in this specification and GMW17759.

3.2.1.4 Minimum Fill Rate. The receptacle shall meet CNG Subsystem minimum fill requirements testing per GMW17759 namely, the CNG fuel subsystem, and hence the receptacle, shall accept fuel from a NGV 1 or UN R110 approved fill nozzle at ambient temperatures of -40 °C to 50 °C (-40 °F to 122 °F) with an initial container pressure of 0.5 MPa (73 psi) and a final container pressure of 24.8 MPa (3600 psi) compensated for ambient temperature of 21 °C (70 °F) with an average fast fill rate of ≥ 6.0 GGE/minute for North America and a final container pressure of 20 MPa compensated for ambient temperature of 15 °C with an average fast fill rate of ≥ 10 kg/minute for UN R110 regions. Other regions may require country specific fill rates. Refer to the Program Specific Documents.

The requirement shall be tested at a CNG fill station with a three (3) bank system capable of a storage pressure of 30 MPa (4350 psi). The measurement shall be conducted via the pressure reading of the high pressure sensor in the CNG storage system during the fill. Final fuel density, multiplied by the nominal storage volume, divided by the refueling time shall reveal a mass flow equal or exceeding the requirements in this paragraph. This test shall be performed with the system and the filling station at -40 °C, -30 °C, 20 °C, and 50 °C.

Higher moisture content in the CNG may affect check valve functionality during fast fill as the significant temperature drop associated with fast fill may freeze the check valve in the open position. This is more prevalent

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