



# RFP System Specification Guidelines

## 1.0 Purpose

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The objective of this guide is to provide assistance in the specification and requirements of automotive alternative fuel systems to assure that converted, upfitted and modified vehicle safety, quality, reliability and durability meet or exceed Original Equipment Manufacturer (OEM) expectations resulting in total customer satisfaction.

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## 2.0 Responsibility

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It is the responsibility of the requesting agency to confirm that the guidelines conform to all local, state, and federal regulations. This guide is intended for reference use only by agencies looking for OEM conversion or aftermarket conversion provided by commercial up fitters with expertise in their field. It is not intended to be a complete “how-to” authority, or a substitute for sound engineering and other judgment. The conversion and modification of vehicles requires skills and knowledge not covered in this guide.

## 3.0 Guidelines

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### 3.1 System Compliance

- Systems shall be EPA or CARB Compliant as applicable
- The overall vehicle shall conform to FMVSS
- Fuel Storage shall conform to:
  - The CNG Subsystem and its installation shall conform to NFPA 52
  - The LPG Subsystem and its installation shall conform to NFPA 58



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### 3.2 OEM Compliance

- OEM options and OEM Authorized Conversions (Example: Ford QVM) shall be selected when available

### 3.3 Vehicle Integration

- The alt-fuel system shall comprehend excessive powertrain motion
- Packaging of additional hardware shall consider thermal, dynamic and service access clearances when being developed. In addition, packaging of hardware shall not impede engine and transmission cooling nor impede airflow through the vehicle radiator, evaporator or HVAC plenum.
- Subsystem components shall be mounted, braced, and supported to minimize vibration and shall be protected against damage, corrosion, or breakage due to expansion, contraction, strain or wear, and preclude any loosening.
- The alt-fuel system shall meet underhood and underbody packaging minimum clearance constraints as follows:
  - 35 mm clearance to exhaust pipe (includes engine roll)
  - 25 mm clearance to engine (including engine roll)
  - 75 mm clearance to propshafts and other rotating components
  - 10 mm clearance body to frame
  - 10 mm clearance body to drivetrain (includes engine roll)
  - 25 mm clearance shock to frame / crossmember
  - 25 mm clearance rear leaf / coil spring to frame
  - 70 mm clearance battery terminal bolt end to adjacent components
  - 25 mm clearance to flexible components (wires, hoses, etc.).

### 3.4 Body Structure

- Any hole or cutout added to the body shall be grommeted and sealed.
- Any modification to the body which results in bare metal being exposed shall be treated in order to prevent corrosion.

### 3.5 Electrical

- Ensure all electrical connections are appropriately protected from water-entry/corrosion, exhaust and powertrain thermal heat.
- Electrical connections exposed to the elements shall be sealed and appropriately protected including stone impingement.
- Harness routing shall not introduce any potential pinch points, sharp edges, abrasion surfaces, and shall protect from exhaust and powertrain thermal heat that may be proximate to wiring harnesses.
- For exterior routing, clip to clip dimension shall be 200.00+10.00/-0.00mm.
- For interior routing, clip to clip dimension shall be 150.00+10.00/-0.00mm.
- Electrical circuits should be designed in consideration of the appropriate fusing protection.



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### **3.6 System Installation & Mounting**

- All components shall be packaged in an area which is:
  - Serviceable
  - Protected from road hazards and jacking
  - Protected during crash situations
- CNG fuel containers shall be packaged in the front end of the truck box. The fuel containers shall be protected at the top and rear with a shield having a minimum steel thickness of 1.6 mm. The shield shall not seal the CNG fuel container from truck box. CNG fuel containers and all associated hardware shall also package within front of box and the rear shield.
- The CNG tank surface shall have sufficient ventilation space around the surface to allow condensed moisture to vent away.
- Subsystem fasteners and attachments shall be robust enough to retain the fuel container during an impact or collision.
- All Subsystem components shall be routed away from sharp objects, and shall be retained adequately to prevent movement against such objects.
- The CNG fuel container surface shall not have contact to any components other than its mounting straps/brackets and the CNG tank valves.

### **3.7 Fuel Lines**

- CNG fuel line material shall conform to NGV 3.1.
- Rigid lines to be 316L SS.
- CNG fuel hoses shall conform to NGV 4.2, Hoses for Natural Gas Vehicles and Dispensing Systems.
- CNG fuel lines & fittings, pressure regulator and labels & markings shall conform to NGV 3.1, Fuel System Components for Natural Gas Powered Vehicles.
- Tubes and lines shall be routed away from and not attached to members likely to move during normal vehicle operation or significantly deform in the event of an impact or collision.
- Tubes and lines shall have flexibility to help avoid rupture or disconnection resulting from movement of the engine relative to the vehicle during an impact or collision.
- When crimping elastomeric hose material to rigid tubing or quick connects, a double crimp ferrule design shall be used.
- Tubes and lines shall be routed away from sharp objects, and shall be retained adequately to prevent movement into such regions or against such objects.
- No fuel lines or components shall be mounted outside of the frame rail outer plane.

### **3.8 Fuel Fill System**

- Fuel fill connection or receptacle shall be capped and tethered.
- CNG fuel fill connection or receptacle shall conform to NGV 1, Compressed Natural Gas Vehicle Fueling Connection Devices.
- The backflow check valve shall be mounted to withstand the breakaway force specified in NFPA 52, section 8.11.6.2.
- The fuel fill system shall be designed to contain fuel in an impact or collision.



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- Whenever possible, the fuel fill system shall pass under the body rather than through it. Where passing through floors and sides, the fuel fill system shall be shielded and have adequate clearance to surrounding structure.
- Fuel fill lines shall meet NGV 4.2.

### **3.9 Valves, Fittings, and Fasteners**

- CNG Valves and fittings shall meet NFPA 52.
- CNG HP System must have a ¼ turn manual shutoff valve per NFPA 52.
- All fasteners shall be of OEM Automotive specification
- OEM

### **3.10 Serviceability**

- All relevant service documentation shall be included in a vehicle's Owners/ Operators Manual.
- Requesting Agency shall be able to obtain service and warranty authorization if a local service provider is not available within reasonable distance.
- Online access to service training, and service documents must be made available.

### **3.11 Terms and Abbreviations**

FMVSS – Federal Motor Vehicle Safety Standards

NFPA – National Fire Protection Agency

CARB – California Air Resource Board

EPA – Environmental Protection Agency

Underhood- Components located in engine compartment

Underbody- Components located inside the frame, under the body of the vehicle

High Pressure Components (HP) – Items after/ rear of CNG regulator

Low Pressure Components (LP) – Items forward of and including CNG pressure regulator