

# *USA PRO Shoreline Technology LLC*

## GENERAL VEHICLE GAS DETECTION SYSTEM MAINTENANCE - VALIDATION

**1.0** Upon receipt of vehicle and prior to putting the vehicle into service, the gas detection system should receive a final check. This insures that the system has not been compromised in some manner during transportation or possibly by the body builder, etc. This recommendation also facilitates one of the three (3) per year validation processes required by CHP Title 13-2008 and NFPA 52-2010. In the final analysis, it is the vehicle owner who provides the ongoing validation for the gas detection system. There are three two basic areas that need to be addressed for validation of the gas detection system:

- A. Same gas and climatic condition under which the vehicle is operated
- B. Audible alarm that can be heard by the driver prior to entering the vehicle
- C. Visual alarm that can be seen prior to the driver entering the vehicle

NFPA 52-2010 and CHP Title 13-2008 are clear in regard to testing and validation as stated: :  
NFPA 52-2010. #11.13.3.2. the testing procedure shall simulate the same gas and climatic conditions for daily use of the system.

CHP Title 13-2008. #935. The testing procedure shall simulate the same gaseous fuel and operating environment in which the vehicle is used.

### **1.1 Audible and visual notification prior to entering the vehicle**

Audible and visual warning prior to entering the vehicle. Audible warning is required in both NFPA and CHP documents. Examples by: California Highway Patrol Title 13-2008 criteria:

At a minimum, the methane gas detection system shall provide a warning before the methane gas concentration reaches 25% of the Lower Flammability Limit.

Such warning shall be plainly audible and visible to the driver before entering the driver's compartment, and while seated in the normal driving position.

#### **Suggestions:**

**Audible:** Audible should be above a minimum of 75 db level outside the vehicle with the windows up and doors closed.

**Visual:** Visual display should be apparent under all conditions, including direct sunlight and tinted windows from outside the vehicle. LED lights are often too small and placed within the cab in areas that have multiple items blocking the lights. Utilization of USA PRO SHORELINE E9000 Series meets all requirements of SAE J2343-2009, NFPA 52-2010, and CHP Title 13 2008.

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## **1.2 SHL 9000 Early Warning Panel System/Component Visual/Audible Validation**

**System/component regulatory validation processes may include the following:**

1. Check to assure that all windows/doors are closed prior to testing.
2. Inside vehicle. Press and master test area on electronic power panel. All lights should be activated and validate system continuity and alarms.
3. Validate audible outside of vehicle:  
Significant - we use less than 80 db as unacceptable for significant  
Trace is represented by panel light only - no audible
4. Validate warning panel LED lights (green and red) can be seen from outside vehicle.  
Validate green system LED on. Green off, Red on at significant alarm w/audible.
5. Validate that warning lights are not blocked by direct sunlight.
6. Tinted windows. Validate that warning lights can be seen.



**1.3 System continuity testing.** Continuity testing does not validate the necessary multi-level performance gas detection such as: 20-30% LEL trace or 50-60% significant requirements found within CHP Title 13-2008 with improved safety exemption, SAE J2343-2009, and NFPA 52-2010. Use of gas streams of: Alcohol mist or wet rag, pure propane, butane, methane gas, or other heavy harsh gases, etc., will not provide an indicator of multiple sensor levels of performance. Using these types of gases and liquids will not validate the performance range of sensor/system's ability to recognize lower explosive level (LEL) 5% of gas. Heavy gases should not be used for validation or to meet the multi-level requirements found within regulatory/safety documents.

**2.0 Gas Odorant.** Gas odorant as primary safety item. We are unable to find any engineering documentation indicating that an odorant added to vehicle fuel should be considered as a primary safety function for vehicle gas systems. We have not been able to find any odorant manufacturer that will provide their odorants specifically for vehicle applications and warrant the odorant as a primary safety item. It should be noted that the primary user groups—transit bus and refuse

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trucks—have gas detection onboard their LNG and CNG vehicles. We strongly recommend using vehicle gas detection, including a comprehensive safety program.

**2.1 CNG - Propane Gas Detection:** There are no specific requirements for CNG or Propane vehicle gas detection. However, we suggest vehicle gas detection for all gaseous fuels with two pre-determined ranges of detector sensitivity, and sensor located, at a minimum, in drivers and engine compartments. It is our opinion that a CNG -Propane industrial user should incorporate gas detection. All industrial automotive vehicle gaseous fuel utilization should incorporate gas detection testing validation and appropriate record keeping.

## **2.1 Regulations and Safety Documents in Part General Gaseous Fuel Information**

Current safety/regulatory documents call for a minimum of two sensor locations: drivers cab, and engine; and another, if there are passenger compartments for some applications. We emphasize that this is only a minimum, and may not be adequate to meet an applicable hazard analysis. In addition, maintaining and regularly updating records, conducting validation testing three (3) times per year, and utilizing appropriate test gases and climate conditions are now mandatory in California (CHP Title 13-2008) and for those who adhere to NFPA 52-2010 requirements.

### **NFPA 52-2010 This document includes the following gases: LNG, CNG, and Hydrogen**

11.13.3 Onboard methane detection, fire suppression, and fire protection systems shall be installed, inspected, validated, and maintained per the system OEM written recommendations and shall be maintained as a permanent vehicle record.

11.13.3.1 Periodic testing shall be done at a minimum of three times per year.

11.13.3.2 The testing procedure shall simulate the same gas and climatic conditions for daily use of the system.

Please keep in mind that compliance includes meeting every line item within the safety or regulatory document and manufacturer warranty data. Warranty and safety documents may not be interrelated. Safety Compliance should always be the number one consideration.

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## **California Title 13 -2008**

CHP CAL Title 13 BARCLAYS OFFICIAL CALIFORNIA CODE OF REGULATIONS

TITLE 13. MOTOR VEHICLES

DIVISION 2. DEPARTMENT OF THE CALIFORNIA HIGHWAY PATROL

CHAPTER 4. SPECIAL EQUIPMENT

ARTICLE 2. COMPRESSED AND LIQUEFIED GAS FUEL SYSTEMS

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§ 935. Liquefied Natural Gas.

(a) NFPA and SAE Standards. This section incorporates by reference the National Fire Protection Association (NFPA) Standard 57, "Liquefied Natural Gas Vehicular Fuel Systems Code," 1996 edition, NFPA Standard 57, "Liquefied Natural Gas Vehicular Fuel Systems Code," 2002 edition, and NFPA Standard 52 "Vehicular Fuel Systems Code," 2006 edition. This section also incorporates by reference the Society of Automotive Engineers (SAE) Standard J2343 Jan 1997.

(1) All liquefied natural gas (LNG) fuel systems installed after January 1, 2000, shall comply with one of the identified standards noted above, in addition to requirements of subsection (b) of this section.

(2) Grandfather Clause. LNG fuel systems installed before January 1, 2000, shall comply with either one of the identified standards noted above, including the additional requirements listed in subsection (b), or with Sections 935.1 and 936 of this title.

b) Additional Requirements. All LNG fuel systems complying with the NFPA Standard 57, 1996 edition, NFPA Standard 57, 2002 edition, NFPA Standard 52, 2006 edition, or the SAE Standard J2343 Jan 1997, shall also comply with the following:

(1) Wherever the word "should" appears in either the NFPA Standard 57, 1996 edition, NFPA Standard 57, 2002 edition, NFPA Standard 52, 2006 edition, or the SAE Standard J2343 Jan 1997, it shall be understood to set forth mandatory requirements.

(2) Every motor vehicle equipped with an LNG fuel system shall be equipped with a methane gas detection system which shall warn of the presence of methane in the engine compartment, driver's compartment and any passenger compartments. At a minimum, the methane gas detection system shall provide a warning before the methane gas concentration reaches 25% of the Lower Flammability Limit. Such warning shall be plainly audible and visible to the driver before entering the driver's compartment and while seated in the normal driving position. The gas detection system shall function continuously at all times, whether or not the engine is operating, when the vehicle is operated or parked on public roadways or other areas open to the public. At a minimum, the gas detection system shall be tested three times per calendar year at equal intervals. The testing procedure shall simulate the same gaseous fuel and operating environment in which the vehicle is used. Test results, validating the performance of the gas detection system within the parameters established by the component manufacturer(s), shall be

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maintained as a permanent part of the vehicle service history records.

(3) The LNG container shall meet the drop test requirements of SAE J2343 Jan 97 or equivalent.

(4) Fuel tanks shall be oriented and mounted in accordance with the tank manufacturer's recommendations and in a location designated by the vehicle manufacturer, in the location normally utilized for liquid (gasoline or diesel) fuel containers for that make and model of vehicle, or as determined by a qualified engineer. Fuel tanks shall not be mounted above any driver or passenger compartment, unless a spill pan is installed between the fuel tanks and the compartment, with a liquid capacity equal to at least the capacity of the largest single fuel tank of a multiple tank installation consisting of three or more fuel tanks, but not less than one-quarter the fuel capacity of the containers located above the compartment and capable of preventing liquid from entering the interior or dripping into any window, door or emergency exit way. Spill pans shall be designed in such a manner that rain water is not retained. The spill pan drain shall not be directed into any confined space, the engine compartment, muffler area, battery box or other hazardous location.

(5) The NFPA Standard specifies that certain systems and components shall be approved by the authority having jurisdiction. The Department of California Highway Patrol has jurisdiction over these regulations but does not approve individual systems or components. Users and installers are responsible for use of proper components and for their proper installation as specified in the NFPA Standard.

<General Materials (GM) - References, Annotations, or Tables>

Note: Authority cited: Section 2402.6, Vehicle Code. Reference: Section 2402.6, Vehicle Code.

## RESOURCE BACKGROUND DATA

### Olfactory Perception in Humans -NeuroScience Second Edition

In humans, olfaction is often considered the least acute of the senses, and a number of animals are obviously superior to humans in their olfactory abilities. This difference is probably explained by the larger number of olfactory receptor neurons. The threshold concentrations for odorant detection and identification nonetheless vary greatly. Ethanol, for example, cannot be identified until its concentration reaches approximately 2 mM. Small changes in molecular structure can also lead to large perceptual differences: The molecule *d-carvone* smells like caraway seeds, whereas *l-carvone* smells like spearmint!

Since the number of odorants is very large, there have been several attempts to classify them in groups. One useful classification was developed in the 1950s by John Amoore, who divided odors into categories based on their perceived quality, molecular structure, and the fact that some people, called anosmics, have difficulty smelling one or another group. The categories Amoore described were pungent, floral, musky, earthy, ethereal, camphor, peppermint, ether, and putrid, and these are still used to describe odors, to study the cellular mechanisms of olfactory transduction, and to discuss the central representation of olfactory information. Nevertheless, this classification remains entirely empirical. A further complication in rationalizing the perception of odors is that their quality may change with concentration. Psychologists and neurologists have developed a variety of tests that measure the ability to detect common odors. Although most people are able to consistently identify a broad range of test odorants, others fail to identify one or more common smells. Such chemosensory deficits, called anosmias, are often restricted to a single odorant, suggesting that a specific element in the olfactory system, mostly likely an olfactory receptor type, is missing. For example, about 1 person in 1000 is insensitive to butyl mercaptan, the foul-smelling odorant released by skunks. More serious is the inability to detect hydrogen cyanide (1 in 10 people), which can be lethal, or ethyl mercaptan, the chemical added to natural gas to aid in its detection from leaks.

The ability to identify odors normally decreases with age. If otherwise healthy subjects are challenged to identify a large battery of common odorants, people between 20 and 40 years of age can typically identify about 50–75% of the odors, whereas those between 50 and 70 correctly identify only about 30–45%. A more radically diminished or distorted sense of smell can accompany eating disorders, psychotic disorders, diabetes, taking certain medications, and Alzheimer's disease (all for reasons that remain obscure). Although the loss of human olfactory sensitivity is not usually a source of great concern, it can diminish the enjoyment of food and, if severe, can affect the ability to identify and respond appropriately to potentially dangerous odors such as spoiled food, smoke, or natural gas.

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