

CNG Repair Facilities

2010 NFPA 10

3.3.40.1 Compressed Natural Gas (CNG). Mixtures of hydrocarbon gases and vapors consisting principally of methane in gaseous form that has been compressed for use as a vehicular fuel.

2009 NFPA 1

30.2.3 General Construction Requirements.

In major repair garages, where CNG-fueled vehicles, hydrogen-fueled vehicles, LNG-fueled vehicles, or LP-Gas-fueled vehicles are repaired, **all applicable requirements of NFPA 52** or NFPA 58, whichever is applicable, shall be met. [30A:7.4.2]

30.2.8 Gas Detection System. Repair garages used for repair of vehicle engine fuel systems fueled by non-odorized gases, such as hydrogen and non-odorized LNG/CNG, shall be provided with an approved flammable gas detection system. [30A:7.4.7]

30.2.8.1 System Design. The flammable gas detection system shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammable limit (LFL). Gas detection shall also be provided in lubrication or chassis repair pits of repair garages used for repairing non-odorized LNG/CNG-fueled vehicles. [30A:7.4.7.1]

30.2.8.2 Operation. Activation of the gas detection system shall result in all of the following:

- (1) Initiation of distinct audible and visual alarm signals in the repair garage
- (2) Deactivation of all heating systems located in the repair garage
- (3) Activation of the mechanical ventilation system, when the system is interlocked with gas detection [30A:7.4.7.2]

30.2.8.3 Failure of the Gas Detection System. Failure of the gas detection system shall result in the deactivation of the heating system and activation of the mechanical ventilation system and, where the ventilation system is interlocked with gas detection, shall cause a trouble signal to sound in an approved location. [30A:7.4.7.3]

30.2.10.6* Where major repairs are conducted on CNG-fueled vehicles or LNG-fueled vehicles, open flame heaters or heating equipment with exposed surfaces having a temperature in excess of 750°F (399°C) shall not be permitted in areas subject to ignitable concentrations of gas. [30A:7.6.6]

42.6.3.6* Where major repairs are conducted on CNG-fueled vehicles or LNG-fueled vehicles, open flame heaters or heating equipment with exposed surfaces having a temperature in excess of 750°F (399°C) shall not be permitted in areas subject to ignitable concentrations of gas. [30A:7.6.6]

2012 NFPA 30A

3.3.12 Repair Garages.

3.3.12.1 Major Repair Garage. A building or portions of a building where major repairs, such as engine overhauls, painting, body and fender work, and repairs that require draining of the motor vehicle fuel tank are performed on motor vehicles, including associated floor space used for offices, parking, or showrooms.

3.3.12.2 Minor Repair Garage. A building or portions of a building used for lubrication, inspection, and minor automotive maintenance work, such as engine tune-ups, replacement of parts, fluid changes (e.g., oil, antifreeze, transmission fluid, brake fluid, air conditioning refrigerants, etc.), brake system repairs, tire rotation, and similar routine maintenance work, including associated floor space used for offices, parking, or showrooms.

7.4.2 General Construction Requirements.

In major repair garages, where CNG-fueled vehicles, hydrogen-fueled vehicles, LNG-fueled vehicles, or LP-Gas-fueled vehicles are repaired, all applicable requirements of NFPA 52, Vehicular Fuel Systems Code, or NFPA 58, Liquefied Petroleum Gas Code, whichever is applicable, shall be met.

7.4.7 Gas Detection System.

Repair garages used for repair of vehicle engine fuel systems fueled by non-odorized gases, such as hydrogen and non-odorized LNG/CNG, shall be provided with an **approved flammable gas detection system.**

7.4.7.1 System Design.

The flammable gas detection system shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammable limit (LFL). Gas detection shall also be provided in lubrication or chassis **repair pits** of repair garages used for repairing non-odorized LNG/CNG fueled vehicles.

7.4.7.2 Operation.

Activation of the gas detection system shall result in all of the following:

- (1) Initiation of distinct audible and visual alarm signals in the repair garage
- (2) Deactivation of all heating systems located in the repair garage
- (3) Activation of the mechanical ventilation system, when the system is interlocked with gas detection

7.4.7.3 Failure of the Gas Detection System.

Failure of the gas detection system shall result in the deactivation of the heating system and activation of the mechanical ventilation system and, where the ventilation system is interlocked with gas detection, shall cause a trouble signal to sound in an approved location.

7.5.1* Forced air heating, air-conditioning, and ventilating systems serving a fuel dispensing area inside a building or a repair garage shall not be interconnected with any such systems serving other occupancies in the building. Such systems shall be installed in accordance with NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.

A.7.5.1 Manual control switches for supply and exhaust ventilating systems should be located close to the entrance to the area served. In buildings protected by automatic sprinklers or fire alarm systems, it is recommended that the necessary interlocks be provided to shut down supply and exhaust fans when the sprinklers or fire alarms operate. For service facilities for CNG-fueled vehicles and LNG-fueled vehicles, see NFPA 52, Vehicular Fuel Systems Code.

The requirement in 7.5.1 eliminates the possibility of vapors from a spill of fuel being dispersed to adjacent spaces of the building.

7.6.6* Where major repairs are conducted on CNG-fueled vehicles or LNG-fueled vehicles, **open flame heaters or heating equipment with exposed surfaces having a temperature in excess of 399°C (750°F)** shall not be permitted in areas subject to ignitable concentrations of gas.

A.7.6.6 **Enclosed rooms or spaces storing CNG- or LNG fueled vehicles should prohibit the transmission of gases to other areas of the building.** Other areas outside of the enclosure, if not used for repairing or storing CNG- or LNG-fueled vehicles, can use other heating methods. Note that, according to A.1.1 of NFPA 52, Vehicular Fuel Systems Code, CNG weighs about two-thirds as much as air and, therefore, as a gas, will rise in a room. LNG at a temperature of less than or equal to -112°C (-170°F) is heavier than ambient air [at 15°C (60°F)], but as the LNG's temperature rises, the gas becomes lighter than air. **Determination of the potential for gas accumulation should be based on an engineering analysis.** (Guidance for classification of hazardous locations is available in NFPA 497, Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas.)

8.2 General Requirements.

Electrical wiring and electrical utilization equipment shall be of a type specified by and shall be installed in accordance with NFPA 70, National Electrical Code. Electrical wiring and electrical utilization equipment shall be approved for the locations in which they are installed.

8.2.1* In major repair garages where CNG vehicles are repaired or stored, the **area within 455mm(18 in.) of the ceiling shall be designated a Class I, Division 2 hazardous (classified) location.**

Exception: In major repair garages, where ventilation equal to not less than four air changes per hour is provided, this requirement shall not apply.

A.8.2.1 The intent is that the electrical utilization equipment be **placed below a volume located at the highest area of the building that is equal to 150 percent of the released volume of the largest CNG tank.**

From: Kasper, Tom - DSPS

Sent: Tuesday, September 13, 2011 4:54 PM

To: Verhagen, Mike - DSPS; Merkle, Rick M - DSPS; Nolen, Terry L - DSPS; Quast, Jim - DSPS; Johnson, Bradley - DSPS; Hertel,

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Cc: Andersen, John R - DSPS; Birren, Susan J - DSPS; Frisque, Carl L - DSPS

Subject: RE: existing repair garage wants to add line CNG vehicle repair

From a building code standpoint, this would be considered a **change of use without a change in occupancy classification** per IEBC 901.2 and per IEBC 909 would need to comply with the **current IMC ventilation requirements**. Also per IEBC 908.1.2 it would need to comply with the **gas detection system requirements** of the current IBC repair garage requirements. Beyond that, any alteration work would need to comply with the current codes.

2009 NFPA 54

10.29 Compressed Natural Gas (CNG) Vehicular Fuel Systems)

The installation of compressed natural gas (CNG) fueling (dispensing) systems shall conform to NFPA 52, Vehicular Fuel Systems Code.-----Note the Division's amendment: 2009 IFGC/SPS 365.0400 **Gas Piping Installation**. Substitute the following wording for the requirements and exceptions in IFGC Chapter 4; All gas piping and gas piping installations shall comply with NFPA 54, National Fuel Gas Code."

2009 IBC

406.6.6 Gas detection system.

Repair garages used for repair of **vehicles fueled by no odorized gases**, such as hydrogen and no odorized LNG, shall be provided with an approved flammable gas-detection system.

406.6.6.1 System design.

The flammable gas-detection system shall be calibrated to the types of fuels or gases used by vehicles to be repaired. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower explosive limit. Gas detection shall also be provided in lubrication or chassis repair pits of garages used for repairing no odorized LNG-fueled vehicles.

406.6.6.2 Operation.

Activation of the gas detection system shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the repair garage.
2. Deactivation of all heating systems located in the repair garage.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.

406.6.6.3 Failure of the gas detection system.

Failure of the gas detection system shall result in the deactivation of the heating system, activation of the mechanical ventilation system when the system is interlocked with the gas detection system and cause a trouble signal to sound in an approved location.

2009 IMC

[F] 502.16 Repair garages for natural gas- and hydrogen-fueled vehicles. Repair garages used for the repair of natural gas- or hydrogen-fueled vehicles shall be provided with an **approved mechanical ventilation system**. The mechanical ventilation system shall be in accordance with Sections 502.16.1 and 502.16.2.

Exception: Where approved by the code official, natural ventilation shall be permitted in lieu of mechanical ventilation.

☞ Repair garages that **install and repair CNG or hydrogen motor fuels** must be equipped with ventilation and gas detection systems in accordance with Sections 502.16.1 and 502.16.2. The intent of this section is to prevent the accumulation of lighter-than-air flammable and combustible gases inside the repair garage. An example of natural ventilation that a code official may approve at his or her discretion is a repair garage with at least two opposite sides open all the way to the ceiling. The two opposite sides would allow for cross ventilation. Having the walls open to the ceiling would prevent lighter-than-air gases from accumulating at the ceiling level. **The ceiling would have to be sealed to prevent gasses from entering the attic space; otherwise, mechanical ventilation would be required.**

[F] 502.16.1 Design. Indoor locations shall be ventilated utilizing air supply inlets and exhaust outlets arranged to provide uniform air movement to the extent practical. **Inlets shall be uniformly arranged on exterior walls near floor level. Outlets shall be located at the high point of the room in exterior walls or the roof.**

Ventilation shall be by a continuous mechanical ventilation system or by a mechanical ventilation system activated by a continuously monitoring natural gas detection system, or for hydrogen, a continuously monitoring flammable gas detection system, each activating at a gas concentration of 25 percent of the lower flammable limit (LFL). In all cases, the system shall shut down the fueling system in the event of failure of the ventilation system.

The ventilation rate shall be at least 1 cubic foot per minute per 12 cubic feet [0.00138 m³/(s • m³)] of room volume.

∞ The intent of this requirement is to provide uniform ventilation throughout the garage area that will exchange at least 1 cubic foot of air for every 12 cubic feet of room volume every minute (0.00139 m³/s • m³). A detection system must be able to recognize hydrogen where hydrogen-fueled vehicles are involved.

[F] 502.16.2 Operation.

The mechanical ventilation system shall operate continuously.

Exceptions:

1. Mechanical ventilation systems that are interlocked with a gas detection system designed in accordance with the *International Fire Code*.
2. Mechanical ventilation systems in garages that are used only for the repair of vehicles fueled by liquid fuels or odorized gases, such as CNG, where the ventilation system is electrically interlocked with the lighting circuit.

∞ The intent of this section is to prevent the accumulation of lighter-than-air gases inside vehicle repair garages by requiring the ventilation system to operate continuously. Exceptions allow intermittent operation of the ventilation system where it is interlocked with one of the systems specified. Exception 2 does not apply to hydrogen.

2009 IFGC

(NOTE THAT THIS SECTION IS NOT ENFORCEABLE DUE TO THE ADOPTION OF SPS 365.0400)

[F] 413.9 Discharge of CNG from motor vehicle fuel storage containers.

The discharge of CNG from motor vehicle fuel cylinders for the purposes of maintenance, cylinder certification, calibration of dispensers or other activities shall be in accordance with this section. The discharge of CNG from motor vehicle fuel cylinders shall be accomplished through a closed transfer system or an approved method of atmospheric venting in accordance with Section 413.9.1 or 413.9.2.

[F] 413.9.1 Closed transfer system.

A documented procedure which explains the logical sequence for discharging the cylinder shall be provided to the code official for review and approval. The procedure shall include what actions the operator will take in the event of a low-pressure or high-pressure natural gas release during the discharging activity. A drawing illustrating the arrangement of piping, regulators and equipment settings shall be provided to the code official for review and approval. The drawing shall illustrate the piping and regulator arrangement and shall be shown in spatial relation to the location of the compressor, storage vessels and emergency shutdown devices.

[F] 413.9.2 Atmospheric venting.

Atmospheric venting of motor vehicle fuel cylinders shall be in accordance with Sections 413.9.2.1 through 413.9.2.6.

[F] 413.9.2.1 Plans and specifications.

A drawing illustrating the location of the vessel support, piping, the method of grounding and bonding, and other requirements specified herein shall be provided to the code official for review and approval.

[F] 413.9.2.2 Cylinder stability.

A method of rigidly supporting the vessel during the venting of CNG shall be provided. The selected method shall provide not less than two points of support and shall prevent the horizontal and lateral movement of the vessel. The system shall be designed to prevent the movement of the vessel based on the highest gas-release velocity through valve orifices at the vessel's rated pressure and volume. The structure or appurtenance shall be constructed of noncombustible materials.

[F] 413.9.2.3 Separation.

The structure or appurtenance used for stabilizing the cylinder shall be separated from the site equipment, features and exposures and shall be located in accordance with Table 413.9.2.3.

**[F] TABLE 413.9.2.3
SEPARATION DISTANCE FOR
ATMOSPHERIC VENTING OF CNG**

EQUIPMENT OR FEATURE	MINIMUM SEPARATION (feet)
Buildings	25
Building openings	25
Lot lines	15
Public ways	15
Vehicles	25
CNG compressor and storage vessels	25
CNG dispensers	25

For SI: 1 foot = 304.8 mm

[F] 413.9.2.4 Grounding and bonding.

The structure or appurtenance used for supporting the cylinder shall be grounded in accordance with the ICC Electrical Code. The cylinder valve shall be bonded prior to the commencement of venting operations.

[F] 413.9.2.5 Vent tube.

A vent tube that will divert the gas flow to the atmosphere shall be installed on the cylinder prior to the commencement of the venting and purging operation. The vent tube shall be constructed of pipe or tubing materials approved for use with CNG in accordance with the International Fire Code.

The vent tube shall be capable of dispersing the gas a minimum of 10 feet (3048 mm) above grade level. The vent tube shall not be provided with a rain cap or other feature which would limit or obstruct the gas flow.

At the connection fitting of the vent tube and the CNG cylinder, a listed bidirectional detonation flame arrester shall be provided.

[F] 413.9.2.6 Signage.

Approved NO SMOKING signs shall be posted within 10 feet (3048 mm) of the cylinder support structure or appurtenance. Approved CYLINDER SHALL BE BONDED signs shall be posted on the cylinder support structure or appurtenance.

2009 IFC

908.5 Repair garages. A flammable-gas detection system shall be provided in repair garages for vehicles fueled by no odorized gases in accordance with Section 2211.7.2.

As indicated in Section 2211.7.2, an approved flammable-gas detection system is required for garages used for repair of vehicles fueled by no odorized gases, such as hydrogen and no odorized LNG. To prevent a hazardous potential buildup of flammable gas caused by normal leakage and use conditions, the flammable-gas detection system is required to activate when the level of flammable gas exceeds 25 percent of the lower explosive limit (LEL) (see commentary, Section 2211.7.2).

2208.8 Discharge of CNG from motor vehicle fuel storage containers.

The discharge of CNG from motor vehicle fuel cylinders for the purposes of maintenance, cylinder certification, calibration of dispensers or other activities shall be in accordance with Sections 2208.8.1 through 2208.8.1.2.6.

2208.8.1 Methods of discharge.

The discharge of CNG from motor vehicle fuel cylinders shall be accomplished through a closed transfer system in accordance with Section 2208.8.1.1 or an approved method of atmospheric venting in accordance with Section 2208.8.1.2.

2208.8.1.1 Closed transfer system.

A documented procedure that explains the logical sequence for discharging the cylinder shall be provided to the fire code official for review and approval. The procedure shall include what actions the operator will take in the event of a low-pressure or high-pressure natural gas release during the discharging activity. A drawing illustrating the arrangement of piping, regulators and equipment settings

shall be provided to the fire code official for review and approval. The drawing shall illustrate the piping and regulator arrangement and shall be shown in spatial relation to the location of the compressor, storage vessels and emergency shutdown devices.

2208.8.1.2 Atmospheric venting.

Atmospheric venting of CNG shall comply with Sections 2208.8.1.2.1 through 2208.8.1.2.6.

2208.8.1.2.1 Plans and specifications.

A drawing illustrating the location of the vessel support, piping, the method of grounding and bonding, and other requirements specified herein shall be provided to the fire code official for review and approval.

2208.8.1.2.2 Cylinder stability.

A method of rigidly supporting the vessel during the venting of CNG shall be provided. The selected method shall provide not less than two points of support and shall prevent the horizontal and lateral movement of the vessel. The system shall be designed to prevent the movement of the vessel based on the highest gas-release velocity through valve orifices at the vessel's rated pressure and volume. The structure or appurtenance shall be constructed of noncombustible materials.

2208.8.1.2.3 Separation.

The structure or appurtenance used for stabilizing the cylinder shall be separated from the site equipment, features and exposures and shall be located in accordance with Table 2208.8.1.2.3.

**TABLE 2208.8.1.2.3
SEPARATION DISTANCE FOR ATMOSPHERIC VENTING OF CNG**

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CNG compressor and storage vessels	25
CNG dispensers	25

For SI: 1 foot = 304.8 mm.

2208.8.1.2.4 Grounding and bonding.

The structure or appurtenance used for supporting the cylinder shall be grounded in accordance with the ICC Electrical Code. The cylinder valve shall be bonded prior to the commencement of venting operations.

2208.8.1.2.5 Vent tube.

A vent tube that will divert the gas flow to atmosphere shall be installed on the cylinder prior to commencement of the venting and purging operation. The vent tube shall be constructed of pipe or tubing materials approved for use with CNG in accordance with Chapter 30.

The vent tube shall be capable of dispersing the gas a minimum of 10 feet (3048 mm) above grade level. The vent tube shall not be provided with a rain cap or other feature which would limit or obstruct the gas flow.

At the connection fitting of the vent tube and the CNG cylinder, a listed bidirectional detonation flame arrester shall be provided.

2208.8.1.2.6 Signage.

Approved "No Smoking" signs complying with Section 310 shall be posted within 10 feet (3048 mm) of the cylinder support structure or appurtenance. Approved CYLINDER SHALL BE BONDED signs shall be posted on the cylinder support structure or appurtenance.

2211.7 Repair garages for vehicles fueled by lighter-than-air fuels.

Repair garages for the conversion and repair of vehicles which use CNG, liquefied natural gas (LNG), hydrogen or other lighter-than-air motor fuels shall be in accordance with Sections 2211.7 through 2211.7.2.3 in addition to the other requirements of Section 2211.

Exception: Repair garages where work is not performed on the fuel system and is limited to exchange of parts and maintenance requiring no open flame or welding.

2211.7.1 Ventilation.

Repair garages used for the repair of natural gas- or hydrogen-fueled vehicles shall be provided with an **approved mechanical ventilation system**. The mechanical ventilation system shall be in accordance with the International Mechanical Code and Sections 2211.7.1.1 and 2211.7.1.2.

Exception: Repair garages with natural ventilation when approved.

2211.7.1.1 Design.

Indoor locations shall be ventilated utilizing air supply inlets and exhaust outlets arranged to provide uniform air movement to the extent practical. Inlets shall be uniformly arranged on exterior walls near floor level. Outlets shall be located at the high point of the room in exterior walls or the roof.

Ventilation shall be by a continuous mechanical ventilation system or by a mechanical ventilation system activated by a continuously monitoring natural gas detection system or, for hydrogen, a continuously monitoring flammable gas detection system, each activating at a gas concentration of not more than 25 percent of the lower flammable limit (LFL). In all cases, the system shall shut down the fueling system in the event of failure of the ventilation system.

The ventilation rate shall be at least 1 cubic foot per minute per 12 cubic feet (0.00139 m³ / m³) of room volume.

2211.7.1.2 Operation.

The mechanical ventilation system shall operate continuously.

Exceptions:

1. Mechanical ventilation systems that are interlocked with a gas detection system designed in accordance with Sections 2211.7.2 through 2211.7.2.3.
2. Mechanical ventilation systems in repair garages that are used only for repair of vehicles fueled by liquid fuels or odorized gases, such as CNG, where the ventilation system is electrically interlocked with the lighting circuit.

2211.7.2 Gas detection system.

Repair garages used for repair of vehicles fueled by no odorized gases, such as hydrogen and no odorized LNG, shall be provided with an **flammable gas detection system**.

Some gases contain additives that produce pungent odors for easy recognition. If the vehicle contains fuel systems that do not use these odorized gases, a gas detection system must be installed.

2211.7.2.1 System design.

The flammable gas detection system shall be listed or approved and shall be calibrated to the types of fuels or gases used by vehicles to be repaired. Gas detectors or sensors shall be listed in accordance with UL 2075 and shall indicate the gases they are intended to detect. The gas detection system shall be designed to activate when the level of flammable gas exceeds 25 percent of the lower flammable limit (LFL). Gas detection shall also be provided in lubrication or chassis service pits of repair garages used for repairing no odorized LNG-fueled vehicles.

This provision will require quick-lube-type facilities that change oil and lubricate vehicles to install gas detection systems in the pit area if they service vehicles that are equipped with LNG fuel systems.