TEXAS LNG EXAMINATION STUDY GUIDE

Engine Fuel
Employee Level

RAILROAD COMMISSION OF TEXAS

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LNG EXAMINATION STUDY GUIDE
Employee-LEVEL

Engine Fuel
Employee Level

Who should use this guide?

You should use this guide if you plan to take the Railroad Commission's employee-level qualifying examination to perform LNG Engine Fuel activities. The Engine Fuel examination qualifies an individual to install LNG motor fuel containers and LNG motor fuel systems and replace container valves on motorized vehicles licensed to operate on public roadways. The Engine Fuel examination does not authorize an individual to fill LNG motor fuel containers.

What books do I need?

This examination tests your knowledge of the laws and standards that apply to Engine Fuel Employee Level operations in Texas. These laws and standards are found in:

Regulations for Compressed Natural Gas And Liquified Natural Gas (Texas Railroad Commission)
NFPA 52, *Vehicular Natural Gas Fuel Systems Code* (2013 Edition)
NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)* (2013 Edition)

Where do I get this book?

You may download the current edition of the Railroad Commission's *Regulations for Compressed Natural Gas And Liquified Natural Gas* in PDF format free online at www.rrc.state.tx.us. If you need printed copies, they may be purchased for $10.00, tax included, by calling the Railroad Commission's publications office at (512) 463-7309.

You may also order NFPA manuals online at www.nfpa.org; click on "Codes and Standards."

Sections and Topics

Before you take this examination, you should know the definitions found in this study guide and the contents of the sections of the codes and standards listed below. The actual examination questions may not cover all of the listed sections and topics.

Terms and Definitions

NOTE: The list below is not exhaustive. You are responsible for knowing all the terms and definitions that apply to the LNG activities you will perform, as well as the rules and standards highlighted in this guide.

NOTE: Informal terms that are sometimes used in the natural gas industry instead of formal technical terms are given in brackets.

Railroad Commission *Regulations for Compressed Natural Gas And Liquified Natural Gas*

Aggregate water capacity (AWC)--The sum of all individual container capacities as measured by weight or volume of water which are placed at a single installation location.
Regulations for LNG, §14.2007(2)

ASME--American Society of Mechanical Engineers.
Regulations for LNG, §14.2007(4)

Automatic fuel dispenser--A fuel dispenser which requires transaction authorization.
Regulations for LNG, §14.2007(6)

Combustible material--A solid material which, in the form in which it is used and under the conditions anticipated, can be ignited and will burn, support combustion, or release flammable vapors when subjected to fire or heat.
Regulations for LNG, §14.2007(9)

Commercial installation--An LNG equipment installation located on premises other than a single-family dwelling used primarily as a residence.
Regulations for LNG, §14.2007(10)

Container--Any LNG vessel manufactured to the applicable sections of the American Petroleum Institute (API) Code, ASME Code, or DOT requirements in effect at the time of manufacture.
Regulations for LNG, §14.2007(13)

Container appurtenances--Components installed in container openings, including but not limited to pressure relief devices, shutoff valves, backflow check valves, excess flow check valves, internal valves, liquid level gauges, pressure gauges, and plugs.
Regulations for LNG, §14.2007(14)

Conversion--The changes made to a vehicle to allow it to use LNG as a motor fuel.
Regulations for LNG, §14.2007(15)

Ignition source--Any item, substance, or event having adequate temperature and energy release of the type and magnitude sufficient to ignite any flammable mixture of gases or vapors that could occur at a site.
Regulations for LNG, §14.2007(22)

LNG--Natural gas, consisting primarily of methane in liquid or semisolid state.
Regulations for LNG, §14.2007(28)

LNG system--A system of safety devices, containers, piping, fittings, valves, regulators, and other LNG equipment intended for use or used with a motor vehicle fueled by LNG and any system or other facilities designed to be used or used in the sale, storage, transportation for delivery, or distribution of LNG.
Regulations for LNG, §14.2007(29)

LNG transport--Any vehicle or combination of vehicles and LNG containers designed or adapted for use or used principally as a means of moving or delivering LNG from one place to another, including but not limited to any truck, trailer, semi-trailer, cargo tank, or other vehicle used in the distribution of LNG.
Regulations for LNG, §14.2007(30)

Mass transit vehicle--Any vehicle which is owned or operated by a political subdivision of a state, city, or county, and which is used primarily in the conveyance of the general public.
Regulations for LNG, §14.2007(31)

Mobile fuel container--An LNG container mounted on a vehicle to store LNG as the fuel supply for uses other than the engine to propel the vehicle, including use in an auxiliary engine.
Regulations for LNG, §14.2007(33)

Pressure relief device--A device, including a pressure relief valve, which is designed both to open automatically to prevent a continued rise of internal fluid pressure in excess of a specified value (set pressure) and to close when the internal fluid pressure is reduced below the set pressure.
Regulations for LNG, §14.2007(44)

Pressure vessel--A container or other component designed in accordance with the ASME Code.
Regulations for LNG, §14.2007(45)

PSIG--Pounds per square inch gauge.
Regulations for LNG, §14.2007(47)

Public Transportation Vehicle--A vehicle for hire to transport persons, including but not limited to taxis, buses (excluding school buses, mass transit or special transit vehicles), and airport courtesy cars.
Regulations for LNG, §14.2007(48)

Special Transit Vehicle--A vehicle designed with limited passenger capacity which is primarily used by a mass transit authority for special transit purposes such as transport of mobility impaired individuals.
Regulations for LNG, §14.2007(55)

Trainee--An individual who has not yet taken and passed an employee-level rules examination.
Regulations for LNG, §14.2007(57)

Transfer area–That portion of an LNG refueling station where LNG is introduced into or dispensed from a stationary installation.
Regulations for LNG, §14.2007(58)

Transfer system–All piping, fittings, valves, pumps, meters, hoses, bulkheads, and equipment used in transferring LNG between containers.
Regulations for LNG, §14.2007(59)

Transport--Any container built in accordance with ASME or DOT specifications and used to transport LNG for delivery.
Regulations for LNG, §14.2007(60)

Transport system--Any and all piping, fittings, valves, and equipment on a transport, excluding the container.
Regulations for LNG, §14.2007(61)

Ultimate consumer--The person controlling LNG immediately prior to its ignition.
Regulations for LNG, §14.2007(62)

NFPA 52 (2013)

ASME Code. The American Society of Mechanical Engineers *Boiler and Pressure Vessel Code*.
NFPA 52, §3.3.3

Container A pressure vessel, cylinder, or cylinder(s) permanently manifolded together used to store CNG or LNG.
NFPA 52, §3.3.9

> ***Cargo Transport Container***. A mobile unit designed to transport LNG or CNG.
> ***NFPA 52, §3.3.9.1***
>
> ***Composite Container.*** A container consisting of an inner metal or plastic gas-containing component, reinforced with a filament and resin outer layer.
> ***NFPA 52, §3.3.9.2***
>
> ***Fuel Supply Container***. A container mounted on a vehicle to store LNG or CNG as the fuel supply to the vehicle.
> ***NFPA 52, §3.3.9.3***
>
> ***Fueling Facility Container.*** Primary storage for vehicular fueling.
> ***NFPA 52, §3.3.9.4***

Dispensing Station. A natural gas installation that dispenses CNG or LNG from storage containers or a distribution pipeline into vehicular fuel supply containers or into portable cylinders by means of a compressor, reformer, vaporizer, or pressure booster.
NFPA 52, §3.3.18

DOT. U.S. Department of Transportation.
NFPA 52, §3.3.19

Liquefied Natural Gas (LNG). A fluid in the cryogenic liquid state that is composed predominantly of methane.
NFPA 52, §3.3.30

Piping. A means of transporting natural gas. This term applies to refueling facilities.
NFPA 52, §3.3.42

Point of Transfer. The location where connections and disconnections are made.
NFPA 52, §3.3.43

Pressure.

Compression Discharge Pressure. The varying pressure at the point of discharge from the compressor.
NFPA 52, §3.3.44.1

Maximum Allowable Working Pressure (MAWP). The maximum pressure to which any component or portion of the pressure system can be subjected over the entire range of design temperatures. This value is 1.1 × 1.25 × the service pressure.
NFPA 52, §3.3.44.2

Operating Pressure. The varying pressure in a fuel supply container during normal container use.
NFPA 52, §3.3.44.3

Maximum Operating Pressure. The steady-state gauge pressure at which a part or system normally operates. This value is 1.25 × the pressure.
NFPA 52, §3.3.44.3.1

Set Pressure. The start-to-discharge pressure for which a relief valve is set and marked.
NFPA 52, §3.3.44.5

Settled Pressure. The pressure in a container after the temperature of the gas reaches equilibrium.
NFPA 52, §3.3.44.6

Storage Pressure. The varying pressure in the storage containers.
NFPA 52, §3.3.44.7

Pressure Regulator. A device, either adjustable or nonadjustable, for controlling and maintaining, within acceptable limits, a uniform outlet pressure.
NFPA 52, §3.3.45

Vaporizer. A device other than a container that receives LNG in liquid form and adds sufficient heat to convert the liquid to a gaseous state, or a device used to add heat to LNG for the purpose of saturating LNG.
NFPA 52, §3.3.59

Water Capacity. The amount of water at 60°F (16°C) required to fill a container.
NFPA 52, §3.3.63

NFPA 52 (2013)

Components. Apart, or a system of parts, that functions as a unit in an LNG plant and could include, but is not limited to, piping, processing equipment, containers, control devices, impounding systems, electrical systems, security devices, fire control equipment, and communication equipment.
NFPA 59A, §3.3.4

Design Pressure. The pressure used in the design of equipment, a container, or a pressure vessel for the purpose of
determining the minimum allowable thickness or physical characteristics of its parts.
NFPA 59A, §3.3.7

LNG Plant. A facility whose components can be used to store, condition, liquefy, or vaporize natural gas.
NFPA 59A, §3.3.16

Overfilling. Filling to a level above the maximum design liquid level.
NFPA 59A, §3.3.21

Sources of Ignition. Appliances or equipment that, because of their intended modes of use or operation, are capable of providing sufficient thermal energy to ignite flammable gas–air mixtures.
NFPA 59A, §3.3.24

Sample Question 1

ASME stands for the _____ .

A. Approved Standards by Mechanical Engineers
B. American Standards for Mechanical Equipment
C. American Society of Mechanical Engineers
D. American Society for Mechanical Equipment

Answer on last page.

Key Topics

NOTE: The list below is **not** exhaustive.
You are responsible for knowing all the facts, rules, standards and procedures that apply to the Natural Gas activities you will perform, as well as the rules and standards highlighted in this guide.

When you take the examination, read each question very carefully.

ADMINISTRATIVE RULES - GENERAL REQUIREMENTS

Company License

No person may engage in any LNG activities until that person has obtained a license from the Commission authorizing the LNG activities.
Regulations for LNG, §14.2014(a)

Licensees, registered manufacturers, company representatives, and operations supervisors at each outlet shall have copies of all current licenses and/or manufacturer registration certificates and certification cards for employees at that location available for inspection during regular business hours.
Regulations for LNG, §14.2014(c)

Application for a New Certificate

No person shall perform work, directly supervise LNG activities, or be employed in any capacity requiring contact with LNG unless that individual:
(A) is a certificate holder who is in compliance with renewal requirements in subsection (g) of this section and is employed by a licensee; or
(B) is a trainee who complies with subsection (f) of this section.
Regulations for LNG, §14.2019(a)(1)

An individual who passes the applicable rules examination with a score of at least 75% will become a certificate holder. AFS will send a certificate to the licensee listed on LNG Form 2016
(A) Successful completion of any required examination shall be credited to the individual.
(B) An individual who has been issued a certificate shall make the certificate readily available and shall present it to any Commission employee or agent who requests proof of certification.
Regulations for LNG, §14.2019(b)(1)

Certificate Renewal

Certificate holders shall pay the nonrefundable $25 annual certificate renewal fee to AFS on or before May 31 of each year. Individuals who hold more than one certificate shall pay only one annual renewal fee.
(A) Failure to pay the nonrefundable annual renewal fee by the deadline shall result in a lapsed certificate.
(i) To renew a lapsed certificate, the individual shall pay the nonrefundable $25 annual renewal fee plus a nonrefundable $20 late-filing fee. Failure to do so shall result in the expiration of the certificate.
(ii) If an individual's certificate lapses or expires, that individual shall immediately cease performance of any LNG activities authorized by the certificate.
(iii) If an individual's certificate has been expired for more than two years from May 31 of the year in which the certificate lapsed, that individual shall comply with the requirements of subsection (b) of this section.
Regulations for LNG, §14.2019(g)(3)

Rules Examination

An individual who files LNG Form 2016 and pays the applicable nonrefundable examination fee may take the rules examination.
Regulations for LNG, §14.2019(b)(3)

Failure of any examination shall immediately disqualify the individual from performing any LNG related activities covered by the examination, which is failed, except for activities covered by a separate examination which the individual has passed.
Regulations for LNG, §14.2019(e)

Trainees

A licensee or ultimate consumer may employ an individual as a trainee for a period not to exceed 45 calendar days without that individual having successfully completed the rules examination.

(A) The trainee shall be directly and individually supervised at all times by an individual who has successfully completed the Commission's rules examination for the areas of work being performed by the trainee.
(B) A trainee who has been in training for a total period of 45 days, in any combination and with any number of employers, shall cease to perform any LNG activities for which the trainee is not currently certified, until the trainee successfully completes the rules examination.
Regulations for LNG, §14.2019(f)

Qualified Personnel

The installation of LNG and CNG systems shall be supervised by qualified personnel with reference to their construction and use.
NFPA 52, §4.2

At least one qualified person shall be in continuous attendance with an unobstructed view of the transfer point while unloading is in progress.
NFPA 52, §10.3.5

The maintenance program shall be carried out by a qualified representative of the equipment owner.
NFPA 52, §10.13.1.1

All persons employed in handling and dispensing LNG shall be trained in handling and operating duties and procedures.
NFPA 52, §12.4.1

Training shall be conducted upon employment and every 2 years thereafter.
NFPA 52, §12.4.3

Training shall include the following:
(1) Information on the nature, properties, and hazards of LNG in both the liquid and gaseous phases
(2) Specific instructions on the facility equipment to be used
(3) Information on materials that are compatible for use with LNG
(4) Use and care of protective equipment and clothing
(5) Standard first aid and self-aid instruction
(6) Response to emergency situations such as fires, leaks, and spills
(7) Good housekeeping practices
(8) Emergency response plan as required in 12.2.3
(9) Evacuation and fire drills
NFPA 52, §12.4.4

Sample Question 2

An individual who files a LNG Form _____and pays the applicable nonrefundable examination fee may take the rules examination.

A. 16
B. 2001
C. 2007
D. 2016
E. 2018B

Answer on last Page

Report of LP-Gas Incident/Accident

At the earliest practical moment or within two hours following discovery, a licensee owning, operating, or servicing equipment or an installation shall notify AFS by telephone of any incident or accident involving LNG which:

(1) involves a single release of LNG during or following LNG transfer or during container transportation. Any loss of LNG which is less than 1.0% of the gross amount delivered, stored, or withdrawn need not be reported. Any loss occurring as a result of a pullaway shall be reported;
(2) caused an estimated damage to the property of the operator, others, or both totaling $50,000 or more, including gas loss;
(3) caused a death or any personal injury requiring hospitalization;
(4) required taking an operating facility out of service;
(5) resulted in an unintentional ignition of LNG requiring an emergency response;
(6) involved the LNG installation on any vehicle propelled by or transporting LNG;
(7) could reasonably be judged as significant because of rerouting of traffic, evacuation of buildings, or media interest, even though it does not meet paragraphs (1) - (6) of this subsection; or
(8) is required to be reported to any other state or federal agency (such as the Texas Department of Public Safety or U.S. Department of Transportation).
Regulations for LNG, §14.2049

Portable or wheeled fire extinguishers shall be recommended for gas fires by their manufacturer.
NFPA 59, §12.6.1

Portable or wheeled fire extinguishers shall be available at strategic locations, as determined in accordance with 12.2.1, within an LNG facility and on tank vehicles.
NFPA 59, §12.6.1.1

Portable and wheeled fire extinguishers shall conform to the requirements of NFPA 10, *Standard for Portable Fire Extinguishers*.
NFPA 59, §12.6.1.2

Handheld portable dry chemical extinguishers shall contain minimum nominal agent capacities of 20 lb or greater and shall have a minimum 1 lb/sec agent discharge rate.
NFPA 59, §12.6.1.3

Control systems that are used as part of the fire protection system at the LNG plant shall be inspected and tested in accordance with the applicable fire codes.
NFPA 59, §14.8.10.4

Engine Fuel Systems

Vehicle Fuel Containers

Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with the Regulations of DOT Specification 4L or the "Rules for the Construction of Unfired Pressure Vessels," ASME Boiler and Pressure Vessel Code, applicable at the date of manufacture.
NFPA 52, §9.3.1

Container appurtenances shall have a rated working pressure not less than the maximum allowable working pressure of the container.
NFPA 52, §9.3.1.2

Containers shall be equipped with a device or devices that provide an indication of when the container is filled to the maximum allowable liquid level.
NFPA 52, §9.3.2.1

Manual fuel shutoff valves shall be readily accessible, operable without tools, and labeled as to their function.
NFPA 52, §9.12.1.13

Fuel-carrying components (excluding service valves, tubing, and fittings) shall be labeled or stamped with the following:
(1) the manufacturer's name or symbol;
(2) the model designation;
(3) the maximum allowable maximum allowable working pressure;
(4) the design temperature range;
(5) direction of flow of fuel when necessary for correct installation; and
(6) capacity or electrical rating as applicable.
Regulations for LNG, §14.2604

Installation of Vehicle Fuel Containers

Containers shall be located in a place and in a manner so as to minimize the possibility of damage to the container and its appurtenances.
NFPA 52, §9.12.1.2

No part of the container or its appurtenances shall protrude beyond the sides or top of any vehicle to prevent the container from being struck or punctured.
NFPA 52, §9.12.1.5.1

In addition to NFPA 52 §9.12.1.2, vehicle fuel containers on school buses, mass transit vehicles, and other public transportation vehicles shall be installed on the underside of the vehicle, except as specified in subsection (c) of this section. Fuel containers on special transit vehicles shall be installed in a location which will not interfere with vehicle operation.
Regulations for LNG, §14.2610(a)

Non-roof-mounted containers shall not be mounted ahead of the front axle or beyond the rear bumper on motor vehicles.
NFPA 52, §9.12.1.5.2

The minimum clearance from the road to the container, its housing, or its fittings, whichever is lowest, shall not, with the vehicle loaded to its gross weight rating, be less than that defined by the vehicle manufacturer's design, or allow any component to touch the surface should the vehicle have a flat tire or require the removal of any tire.
NFPA 52, §9.12.1.6.1

If fuel or container vent piping containing fuel is installed within 8 in. of engine or exhaust system components that exceed 250°F, it shall be shielded against direct heating.
NFPA 52, §9.12.1.2.2

Containers shall be mounted to prevent their jarring loose, slipping, or rotating.
NFPA 52, §9.12.1.7

The mounting system shall minimize fretting corrosion between the container and the mounting system.
NFPA 52, §9.12.1.10

Containers shall not be installed so as to affect adversely the operating characteristics of the vehicle.
NFPA 52, §9.12.1.11

Containers shall be installed and fitted so that no gas from fueling operations can be released inside the passenger compartment, by permanently installing the fueling receptacle outside the passenger compartment of the vehicle in a location protected from physical damage and dislodgment.
NFPA 52, §9.12.2.1

Enclosures, structures, seals, and conduits used to vent enclosures shall be fabricated of materials designed to resist damage, blockage, or dislodgment caused by the movement of articles carried in the vehicle or by the closing of luggage compartment enclosures or vehicle doors.
NFPA 52, §9.12.2.2

Enclosures shall require the use of tools for removal.
NFPA 52, §9.12.2.2.1

Roof-mounted containers are allowed if the vehicle was originally designed and manufactured to have roof-mounted containers or if the original manufacturer approves the design of the structure mounting. Vehicles shall not be modified to have roof-mounted containers.
Regulations for LNG, §14.2610(c)

Container markings shall be visible after the container's permanent installation on a vehicle.
NFPA 52, §9.12.1.3.1

Engine Fuel Delivery Equipment

Pressure gauges shall be designed for the maximum pressure and temperature conditions to which they can be subjected, with a minimum burst pressure safety factor of 4.
NFPA 52, §9.5.2

Dials shall be graduated to indicate at least 1.2 times the pressure at which the pressure relief device incident to the pressure gauge is set to function.
NFPA 52, §9.5.3

A gauge opening shall not exceed 0.055 in. (No. 54 drill size) at the inlet connection.
NFPA 52, §9.5.4

Vaporizers shall have the capacity to vaporize the LNG completely and heat the vapor to the design temperature of the downstream components prior to entry of the vapor into the pressure regulator when the vaporizer is subjected to the maximum vehicular fuel flow rate.
NFPA 52, §9.10.1

Vaporizers shall be marked permanently at a readily visible point to indicate the maximum allowable working pressure of the fuel-containing portion of the vaporizer.
NFPA 52, §9.10.2

Engine exhaust gases shall not be used as a direct source of heat to vaporize fuel.
NFPA 52, §9.10.5

Where engine exhaust is used to vaporize fuel, it shall be used via an indirect heating system.
NFPA 52, §9.10.6

The engine pressure regulator inlet and each chamber shall have a design operating pressure not less than the maximum pressure of the container.
NFPA 52, §9.6

Piping, tubing, and fittings shall be designed, installed, inspected, and tested in accordance with ANSI/ASME B31.3, *Process Piping*.
NFPA 52, §9.7

Sample Question 3

Container markings shall be visible _____on a vehicle.

A. after the container's permanent installation
B. prior to the container's permanent installation
C. from all sides and each end
D. in 3/4 inch lettering

Answer on last page

Installation of Venting Systems and Monitoring Sensors

All safety relief devices on vehicular fuel containers that discharge to the atmosphere shall vent outside of the vehicle.
NFPA 52, §9.4.4

All discharge lines and outlets shall be installed in accordance with 9.4.5.1 through 9.4.5.11.
NFPA 52, §9.4.5

The discharge lines shall be able to withstand the pressure of the relief vapor discharge when the PRD is in the full-open position.
NFPA 52, §9.4.5.4

The detection system shall activate a visual alarm within the driver's compartment of the vehicle at a gas concentration not exceeding 20 to 30 percent of the LFL and sound an audible and visual alarm at a gas concentration not greater than 50 to 60 percent of the LFL.
NFPA 52, §9.13.3.1

Sensor locations shall include at a minimum the engine and driver's compartment and any enclosed fuel container or installation within a compartment.
NFPA 52, §9.13.3.1.1

Motor vehicles equipped with a gas detection system shall provide warnings at two different levels in accordance with 9.13.3.1 and the following:
(1) At the 50 percent to 60 percent LFL level, a warning that is audible and visible to the driver outside the vehicle
(2) An 87 dBA warning that is audible outside the vehicle with windows up and doors closed
(3) A visual warning that is visible in direct sunlight
NFPA 52, §9.13.3.1.2

Onboard methane detection, fire suppression, and fire protection systems shall be installed, inspected, validated, and maintained in accordance with the system OEM written recommendations and shall be maintained as a permanent vehicle record.
NFPA 52, §9.13.3.2

Periodic testing shall be done at a minimum of three times per year.
NFPA 52, §9.13.3.2.1

Installation of Piping

(a) Fuel lines shall be supported at least every 21 to 27 inches.
(b) Joint compound or tape acceptable for use with LNG shall be applied to all male pipe threads prior to assembly.
(c) Piping and fittings shall be clean and free from cutting or threading burrs and scaling. The ends of all piping shall be reamed.
(d) Bends in piping or tubing are prohibited if the bend weakens the pipe or tubing. Bends shall be made by bending tools designated for this purpose.
(e) Joints or connections shall be located only in an accessible location.
Regulations for LNG, §14.2619

Manifolds connecting fuel containers shall be fabricated and installed to minimize vibration and shall be installed in a protected location or shielded to minimize damage from unsecured objects.
NFPA 52, §9.12.3.1

Piping and tubing shall be installed, supported, protected, and secured in such a manner as to minimize the possibility of damage, corrosion, or breakage due to expansion, contraction, vibration, strains, or wear and to preclude any loosening while in transit.
NFPA 52, §9.12.3.2

Piping and tubing passing through a panel or structural member shall be protected by grommets or similar devices that shall snugly fit the piping or tubing and the hole in the panel or structural member.
NFPA 52, §9.12.3.3

If fuel or container vent piping containing fuel is installed within 8 in. of engine or exhaust system components that exceed 250°F, it shall be shielded against direct heating.
NFPA 52, §9.12.1.2.2

Piping or tubing passing through the floor of a vehicle shall be installed to enter the vehicle through the floor directly beneath, or adjacent to, the container.
NFPA 52, §9.12.3.4

If a branch line is required, the tee connection shall be located in the main fuel line under the floor and outside the vehicle.
NFPA 52, §9.12.3.4.1

A fuel connection between a tractor and trailer or other over-the-road vehicle units shall not be permitted.
NFPA 52, §9.12.3.5

A PRV shall be installed in each section of piping or tubing in which LNG can be isolated between shutoff valves so as to relieve the trapped fuel pressure to a safe atmosphere.
NFPA 52, §9.12.3.6

The PRV shall not have a setting greater than the maximum allowable working pressure of the line it protects.
NFPA 52, §9.12.3.7

Sample Question 4

Monitoring Sensors shall have periodic testing done at a minimum of _____.

A. Once per year
B. Three times per year
C. Four times per year
D. Once every two years
E. Once every four years

Answer on last page

Installation of Valves

Valves, valve packing, gaskets, and seats shall be designed for the intended service.
NFPA 52, §9.8.1

All parts of container shutoff valves shall be stainless steel, brass, or copper except gaskets, packing, and seats.
NFPA 52, §9.8.2.1

Valves shall be mounted securely and shielded or installed in a protected location to prevent damage from vibration, shock, and unsecured objects.
NFPA 52, §9.12.4.1

Valves shall be installed so that their weight is not placed on, or supported by, the attached lines.
NFPA 52, §9.12.4.2

A positive shutoff valve shall be installed in the fuel supply line.
NFPA 52, §9.12.4.3

Where multiple fuel systems or containers are installed on a vehicle, automatic valves shall be provided to shut off the container that is not being utilized.
NFPA 52, §9.12.4.5

The vehicular fueling system shall be equipped with a backflow check valve to prevent the return flow of LNG from the container(s) to the filling connection.
NFPA 52, §9.12.4.6

Installation of Pressure Gauges

A pressure gauge located within a driver or passenger compartment shall be installed in such a manner that no gas flows through the gauge in the event of gauge failure.
NFPA 52, §9.12.6.1

Pressure gauges installed outside driver or passenger compartments shall be equipped with a limiting orifice, a shatter-proof dial lens, and a body relief.
Regulations for LNG, §14.2625

Gauges shall be mounted securely, shielded, and installed in a protected location to prevent damage from vibration and unsecured objects.
NFPA 52, §9.12.6.2

Installation of Pressure Regulators

Other components that are not in contact with LNG shall be designed for service over a temperature range of −40°F to 180°F.
NFPA 52, §9.11.3.2

On fuel delivery systems that have operating pressures that exceed the engine operating pressure requirements, automatic pressure regulating equipment shall be installed between the vehicular fuel container and the engine to regulate the pressure of the fuel delivered to the engine.
NFPA 52, §9.12.5.1

Pressure regulating equipment shall be installed so that its weight is not placed on, or supported by, the attached lines.
NFPA 52, §9.12.5.2

Electrical Wiring

Wiring shall be installed, supported, and secured in a manner to prevent damage due to vibration, shock, strains, wear, or corrosion.
NFPA 52, §9.12.7.1

All conductors shall be sized for the maximum anticipated load and shall be protected by overcurrent protection devices.
NFPA 52, §9.12.7.2

Vehicle Fueling Connection

Vehicle fueling connections shall provide for the reliable and secure connection of the fuel system containers to a source of LNG.
Regulations for LNG, §14.2634(a)

Fueling connections shall prevent escape of gas when the connector is not properly engaged or becomes separated.
Regulations for LNG, §14.2634(b)

The fueling receptacle on the vehicular fuel system shall be supported and meet all the following requirements:
(1) Receive the fueling connector and accommodate the service pressure of the vehicle fuel system
(2) Incorporate a means to minimize the entry of dust, water, and other foreign material
(3) Be designed for any corrosive conditions that are anticipated
NFPA 52, §9.12.9.1

Signs and Labeling

(a) Signs or labels shall be readily visible before and during transfer operations, shall be weather-resistant, and shall be located as specified in Table 1 of this section.
(b) Upon completion of a vehicle conversion, the licensee making the conversion shall affix to the vehicle an identification tag or decal in a location that is easily readable. The tag or decal shall contain letters that indicate the licensee's name, current license number, and the year and month the conversion was made.
(c) Each school bus, special transit vehicle, mass transit vehicle, and public transportation unit shall be marked with the manual shutoff valve's location with the words "Manual Shutoff Valve." Decals or stencils are acceptable.
Regulations for LNG, §14.2637(a)

Sample Question 5

All parts of container shutoff valves except gaskets, packing, and seats shall be _____.

A. Stainless steel
B. Brass
C. Copper
D. All of the above
E. Only B and C

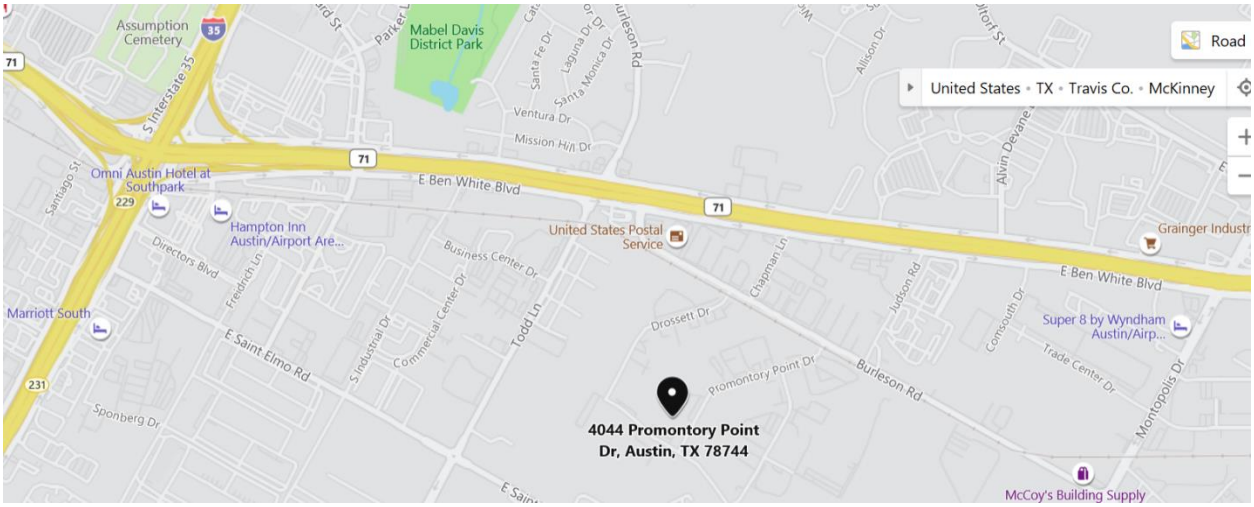
Answer on last page

Figure: 16 TAC §14.2637(a)
Table 1

Requirements for Signs or Labels	Fueling Connection Receptacle	Engine Compartment
Capital letters at least 2" high (any color letters with contrasting background): LNG FUELED VEHICLE	*	*
Any color letters with contrasting background: Name of Licensee and License Number (not required for systems installed by OEM or OEM's subcontractor)		*
Any color letters and numbers with contrasting background: Maximum allowable working pressure _____	*	
Any color letters with contrasting background: Container Capacity ___ Gallons	*	

ALTERNATIVE FUELS TRAINING CENTER

4044 Promontory Point Austin Texas 78744



Sample Question Answers
1. C 2. D 3. A 4. B 5. D