

# **TEXAS LNG EXAMINATION STUDY GUIDE**

**Delivery Truck Driver  
(Including Service & Installation,  
Transport Driver, & Motor Fuel  
Dispenser)  
Employee Level**



**RAILROAD COMMISSION OF TEXAS**

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## **LNG EXAMINATION STUDY GUIDE**

### **Employee-LEVEL**

### **Delivery Truck Driver (Including Service & Installation, Transport Driver, & Motor Fuel Dispenser) Employee Level**

#### **Who should use this guide?**

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You should use this guide if you plan to take the Railroad Commission's management-level qualifying examination to perform LNG Delivery Truck Driver activities. The Delivery Truck Driver examination qualifies an individual to operate a transport, load and unload LNG and connect and disconnect transfer hoses, and to perform all activities related to stationary LNG systems, including LNG containers, piping, and equipment.

#### **What books do I need?**

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

*Regulations for Compressed Natural Gas And Liquefied 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?

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You may download or print the current edition of the Railroad Commission's Regulations for Compressed Natural Gas and Liquified Natural Gas in PDF format online at <https://www.rrc.texas.gov/alternative-fuels/alternative-fuels-regulations>. To order additional copies of the LP-Gas Safety Rules, please contact the Railroad Commission's Central Records Section at [PublicSales@rrc.texas.gov](mailto:PublicSales@rrc.texas.gov) or (512) 463-6882.

You may also order NFPA manuals online at [www.nfpa.org](http://www.nfpa.org); click on "Codes and Standards."

## Sections and Topics

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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

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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)***

***Automatic fuel dispenser***--A fuel dispenser which requires transaction authorization.

***Regulations for LNG, §14.2007(6)***

***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)***

***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 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  $1.1 \times 1.25 \times$  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  $1.25 \times$  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 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**

Pressure Vessel is defined as a container or other component designed in accordance with the \_\_\_\_\_ Code.

- A. Railroad Commission
- B. DOT
- C. ASME
- D. Federal

*Answer on last page.*

## Key Topics

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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

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### 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)***

Licenses and manufacturer registrations issued under this chapter expire one year after issuance at midnight on the last day of the month prior to the month in which they are issued.

***Regulations for LNG, §14.2014(d)***

A properly completed LNG Form 2001 listing all names under which LNG-related activities requiring licensing are to be conducted and the applicant's properly qualified company representative, and the following forms or documents as applicable:

(A) LNG Form 2001A for outlets

(B) LNG Form 2007, 2007A, 2007T to register any LNG transports

(C) LNG Form 2019 transfer of ownership

***Regulations for LNG, §14.2014(f)(1)***

### 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)***

## **Designation and Responsibilities of Company Representatives and Operations Supervisors**

An applicant for license shall not engage in LNG activities until it has employed a company representative who meets the requirements of §14.2025 of this title.

### ***Regulations for LNG, §14.2014(b)***

Each licensee shall have at least one company representative for the license and at least one operations supervisor for each outlet.

### ***Regulations for LNG, §14.2025***

A licensee maintaining one or more outlets shall file LNG Form 2001 with AFS listing the physical location of the first outlet and designating the company representative for the license and file LNG Form 2001A designating the physical location and operations supervisor for each additional outlet.

### ***Regulations for LNG, §14.2025(1)***

A licensee may have more than one company representative.

### ***Regulations for LNG, §14.2025(2)***

An individual may be an operations supervisor at more than one outlet provided that:

- (A) each outlet has a designated LNG certified employee responsible for the LNG activities at that outlet;
- (B) the certified employee's and/or operations supervisor's telephone number is posted at the outlet on a sign with lettering at least 3/4 inches high, visible and legible during normal business hours; and
- (C) the certified employee and/or operations supervisor monitors the telephone number and responds to calls during normal business hours.

### ***Regulations for LNG, §14.2025(3)***

The company representative may also serve as operations supervisor for one or more of the licensee's outlets provided that the person meets both the company representative and operations supervisor requirements in this section.

### ***Regulations for LNG, §14.2025(4)***

A licensee shall immediately notify AFS in writing upon conclusion of employment, for whatever reason, of its company representative or any operations supervisor and shall at the same time designate a replacement.

(A) A licensee shall cease all LNG activities if it no longer employs a qualified company representative who complies with the Commission's requirements. A licensee shall not resume LNG activities until such time as it has a properly qualified company representative.

(B) A licensee shall cease LNG activities at an outlet if it no longer employs a qualified operations supervisor at that outlet who complies with the Commission's requirements. A licensee shall not resume LNG activities at that outlet until such time as it has a properly qualified operations supervisor.

### ***Regulations for LNG, §14.2025(5)***

## 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 (9 kg) or greater and shall have a minimum 1 lb/sec (0.45 kg/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***

## **General Rules For All Stationary LNG Installations**

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### **Uniform Protection Requirements**

Fencing at LNG stationary installations shall comply with the following:

- (1) Fencing material shall be solid construction of noncombustible material or chain link type with wire at least 12 ½ American wire gauge in size.
- (2) Fencing shall be at least six feet in height at all points. Fencing may be five feet in height when topped with at least three strands of barbed wire, with the strands four inches apart.
- (3) Uprights, braces, and cornerposts of the fence shall be composed of noncombustible material.
- (4) Uprights, braces, and cornerposts of the fence shall be anchored in concrete a minimum of 12 inches below the ground.
- (5) All fenced enclosures shall have at least one gate suitable for ingress and egress. All gates shall be locked whenever the area enclosed is unattended.
- (6) A minimum clearance of two feet shall be maintained between the fencing and any part of an LNG transfer system, dispensing system, or storage container that is part of a stationary installation.
- (7) Fencing which is located more than 25 feet from any point of the LNG transfer system, dispensing system, or storage containers shall be designated as perimeter fencing. If the LNG transfer system, dispensing system, or storage container is located inside perimeter fencing and is subject to vehicular traffic, it shall be protected against damage according to subsection (c) of this section.
- (8) The storage and compression area must be completely enclosed by fencing.
- (9) Where fencing is not used to protect the installation, then valve locks, a means of locking the electric control for the compressors, or other suitable means shall be provided to prevent unauthorized withdrawal of LNG.

#### ***Regulations for LNG, §14.2101(b)***

The operating end of each container, including the material handling equipment and the entire dispensing system, and any part of the LNG transfer system, dispensing system, or storage container which is exposed to collision damage or vehicular traffic shall be protected from this type of damage.

#### ***Regulations for LNG, §14.2101(e)***

At least two monitoring sensors shall be installed at all stationary installations to detect hazardous levels of LNG. Sensors shall activate at not more than 25% of the lower flammability limit (LFL) of LNG. If the level exceeds one-fourth of the LFL, the sensor shall either shut the system down or activate an audible and visual alarm. The number of sensors to be installed shall comply with the area of coverage for each sensor and the size of the installation. The sensors shall be installed and maintained in accordance with the manufacturer's instructions.

#### ***Regulations for LNG, §14.2101(g)***

## Testing of Containers

Containers designed for gauge pressures in excess of 15 psi [103 kPa] shall be tested in accordance with the following:

- (1) Shop-fabricated containers shall be pressure tested by the manufacturer prior to shipment to the installation site.
- (2) The inner container shall be tested in accordance with the ASME Boiler and Pressure Vessel Code or with CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
- (3) The outer container shall be leak tested.
- (4) Piping shall be tested in accordance with Section 9.7.
- (5) Containers and associated piping shall be leak tested prior to filling the container with LNG.

### ***NFPA 59A, §7.5.4.1***

Any stationary LNG container previously in LNG service brought into Texas or which has not been subject to continuous LNG pressure or inert gas pressure shall be inspected by a currently licensed Category 15, 20, or 50 licensee to determine if the container shall be leak-tested or re-certified. A copy of the inspector's written report shall be filed with AFS. The container shall not be used until the appropriate leak test or certification process determines the container is safe for LNG service.

### ***Regulations for LNG, §14.2104(b)***

Any stationary LNG container which has been subject to continuous LNG or inert gas pressure may not require testing prior to installation provided the licensee or operator of the container files LNG Form 2023 at the time LNG Form 2500 is submitted for any facility requiring submission of a site plan in accordance with §14.2040 of this title (relating to Filings for Stationary LNG Installations).

### ***Regulations for LNG, §14.2104(c)***

## Stationary LNG Storage Containers

ASME containers shall be identified by the attachment of a corrosion resistant nameplate as required by ASME Boiler and Pressure Vessel Code, Section VIII.

### ***NFPA 59A, §7.3.4.2***

Each container shall be identified by the attachment of a nameplate(s) in an accessible location marked with the information required by the ASME *Boiler and Pressure Vessel Code* and the following:

- (1) Builder's name and date container was built
- (2) Nominal liquid capacity
- (3) Design pressure at the top of the container
- (4) Maximum permitted liquid density
- (5) Maximum filling level
- (6) Minimum design temperature

### ***NFPA 52, §13.3.16***



Markings shall be legible under all conditions.

***NFPA 52, §13.3.18***

Containers designed to operate at a pressure in excess of 15 psi (100 kPa) shall be equipped with a device(s) that prevents the container from becoming liquid-full or the inlet of the relief device(s) from becoming covered with liquid when the pressure in the container reaches the set pressure of the relieving device(s) under all conditions.

***NFPA 52, §13.3.19***

AFS may remove a container from LNG service or require ASME acceptance of a container at any time if AFS determines that the nameplate is loose, unreadable, or detached, or if it appears to be tampered with or damaged in any way and does not contain at a minimum the items specified in subsection (a) of this section.

***Regulations for LNG, §14.2104(d)***

### Sample Question 3

Monitoring sensors shall be installed and maintained in accordance with \_\_\_\_\_.

- A. The Manufacturer's Instructions
- B. The Railroad Commission Safety rules
- C. NFPA 52
- D. NFPA 59A

*Answer on last page*

## LNG Container Installation Distance Requirements

Table 13.5.1 Distances from Containers and Exposures

Container Water Capacity		Minimum Distance from Edge of Impoundment or Container Drainage System to Offsite Buildings and Property Lines That Can Be Built Upon		Minimum Distance Between Storage Containers	
gal	m <sup>3</sup>	ft	m	ft	m
1000–2000	3.8–7.6	15	4.6	5	1.5
2001–18,000	≥7.6–56.8	25	7.6	5	1.5
18,001–30,000	≥56.8–114	50	15	5	1.5
30,001–70,000	≥114–265	75	23	¼ of the sum of the diameters of adjacent containers [5 ft (1.5 m) minimum]	
>70,000	>265	0.7 times the container diameter [100 ft (30 m) minimum]			

[59A: Table 13.6.2.1]

Table 13.5.1.2 Distances from Underground Containers and Exposures

Container Water Capacity		Minimum Distance from Buildings and the Adjoining Property Line That Can Be Built Upon		Distance Between Containers	
gal	m <sup>3</sup>	ft	m	ft	m
<18,000	<15.8	15	4.6	15	4.6
18,000–30,000	15.8–114	25	7.6	15	4.6
30,001–100,000	>114	40	12.2	15	4.6

[59A: Table 13.6.3]

**Transfer of LNG**

Where bulk transfers are made into stationary storage containers, the LNG being transferred shall be compatible in composition or in temperature and density with the LNG already in the container.

***NFPA 59A, §14.6.1***

At least one qualified person shall be in constant attendance while a transfer is in progress.

***NFPA 59A, §14.6.4***

Prior to transfer, gauge readings shall be obtained or inventory established to ensure that the receiving container cannot be overfilled, and levels shall be checked during transfer operations.

***NFPA 59A, §14.6.6.4***

While tank car or tank vehicle loading or unloading operations are in progress, rail and vehicle traffic shall be prohibited within 25 ft of LNG facilities or within 50 ft of refrigerants whose vapors are heavier than air.

***NFPA 59A, §14.6.6.8***

**Transport Vehicle Loading and Unloading Facilities and Procedures**

A rack structure, if provided, shall be constructed of a noncombustible material.

***NFPA 59A, §11.6.3***

A tank vehicle loading and unloading area shall be of sufficient size to accommodate the vehicles without excessive movement or turning of the vehicles. Transfer piping, pumps, and compressors shall be installed with the following protective measures:

***NFPA 59A, §11.6.4***

In addition to NFPA 59A §11.6, transport vehicle loading and unloading facilities shall meet the following requirements:

- (1) Transfer piping, pumps, and compressors shall be installed with the following protective measures:
  - (A) protection from damage from vehicle movements in compliance with the guardrail and fencing requirements of §14.2101 of this title (relating to System Protection Requirements);
  - (B) isolation valves at both ends of containers with less than 2,000 gallon capacity, and a remote operating valve, automatic closure, or check valve to prevent backflow on containers of 2,000 gallons or more capacity;
  - (C) a check valve on piping for liquid transfer to minimize accidental release; and
  - (D) a line relief valve between every pair of isolation valves.

Operating status indicators shall be provided in the transfer area.

- (2) Operating status indicators shall be provided in the transfer area.

***Regulations for LNG, §14.2119***

Isolation valves and bleed connections shall be provided at the loading or unloading manifold for both liquid and vapor return lines so that hoses and arms can be blocked off, drained of liquid, and depressurized before disconnecting.

***NFPA 59A, §11.6.6***

Where multiple products are loaded or unloaded at the same location, loading arms, hoses, and manifolds shall be identified or marked to indicate the product or products to be handled by each system.

***NFPA 59A, §11.7.3***

The operating procedures manual shall be accessible to all plant personnel and shall be kept readily available in the operating control center.

***NFPA 59A, §14.3.2***

Prior to transfer, gauge readings shall be obtained or inventory established to ensure that the receiving container cannot be overfilled, and levels shall be checked during transfer operations.

***NFPA 59A, §14.6.6.4***

The transfer system shall be checked prior to use to ensure that valves are in the correct position.

***NFPA 59A, §14.6.6.5***

Transfer operations shall be commenced slowly and if any unusual variance in pressure or temperature occurs, transfer shall be stopped until the cause has been determined and corrected.

***NFPA 59A, §14.6.6.6***

Pressure and temperature conditions shall be monitored during the transfer operation.

***NFPA 59A, §14.6.6.7***

Truck vehicle engines shall be shut off if they are not required for transfer operations.

***NFPA 59A, §14.6.6.8.3***

Brakes shall be set and wheels chocked prior to connection for unloading or loading.

***NFPA 59A, §14.6.6.8.4***

The engine shall not be started until the truck vehicle has been disconnected and any released vapors have dissipated.

***NFPA 59A, §14.6.6.8.5***

(A) Before LNG is loaded into a tank car or tank vehicle that is not in exclusive LNG service, a test shall be made to determine the oxygen content in the container.

(B) If the oxygen content exceeds 2 percent by volume, the container shall not be loaded until it has been purged to below 2 percent oxygen by volume.

(C) If a tank car or tank vehicle in exclusive LNG service does not contain a positive pressure, it shall be tested for oxygen content.

***NFPA 59A, §14.6.6.9***

Before loading or unloading, a tank vehicle shall be positioned so it can exit the area without backing up, when the transfer operation is complete.

***NFPA 59A, §14.6.6.10***

**Sample Question 4**

At least \_\_\_\_\_ qualified person shall be in constant attendance while a transfer is in progress.

- A. One
- B. Two
- C. Three
- D. Four

*Answer on last page*

**Transfer Systems, Including Piping, Pumps, and Compressors, Used for LNG and Refrigerants**

Isolation valves shall be installed at the extremity of each transfer system.

***NFPA 59A, §11.3.1***

In addition to a locally mounted device for shutdown of the pump or compressor drive, a readily accessible, remotely located device shall be provided a minimum of 25 ft away from the equipment to shut down the pump or compressor in an emergency.

***NFPA 59A, §11.4.1***

The pipeline system shall be designed so that it cannot exceed its temperature or pressure limits.

***NFPA 59A, §11.7.2***

Pipelines used only for liquid unloading shall have a check valve at the manifold adjacent to the manifold isolation valve.

***NFPA 59A, §11.6.9***

**Hoses and Arms**

Hoses or arms used for transfer shall be designed for the temperature and pressure conditions of the loading or unloading system.

***NFPA 59A, §11.8.1***

Hoses shall be approved for the service and shall be designed for a bursting pressure of at least five times the working pressure.

***NFPA 59A, §11.8.2***

Hoses shall be tested at least annually to the maximum pump pressure or relief valve setting and shall be inspected visually before each use for damage or defects.

***NFPA 59A, §11.8.6***

## Communications and Lighting

Communications shall be provided at loading and unloading locations to allow the operator to be in contact with other personnel associated with the loading or unloading operation.

***NFPA 59A, §11.9.1***

Facilities transferring LNG during hours of darkness shall have lighting at the transfer area.

***NFPA 59A, §11.9.2***

## Piping Materials

All piping materials, including gaskets and thread compounds, shall be selected for compatibility with the liquids and gases handled throughout the range of temperatures to which they are subjected.

***NFPA 59A, §9.3.1.1***

Piping insulation used in areas where the mitigation of fire exposure is necessary shall have a maximum flame spread index of 25 when tested in accordance with ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, and shall maintain those properties that are necessary to maintain physical and thermal integrity during an emergency when exposed to fire, heat, cold, or water.

***NFPA 59A, §9.3.1.3***

Threaded pipe shall be at least Schedule 80.

***NFPA 59A, §9.3.2.4***

### Sample Question 5

Hoses shall be approved for the service and shall be designed for a bursting pressure of at least \_\_\_\_ times the working pressure.

- A. Three
- B. Four
- C. Five
- D. Six

*Answer on last page*

**Fittings Used in Piping**

Threaded nipples shall be at least Schedule 80.

***NFPA 59A, §9.3.3.1***

Cast iron, malleable iron, and ductile iron fittings shall not be used.

***NFPA 59A, §9.3.3.2***

**Installation of Piping**

Piping systems and components shall be designed to accommodate the effects of fatigue resulting from the thermal cycling to which the systems are subjected.

***NFPA 59A, §9.2.3***

Provision for expansion and contraction of piping and piping joints due to temperature changes shall be in accordance with ASME B 31.3, Section 319.

***NFPA 59A, §9.2.4***

Pipe joints of 2 in. (50 mm) nominal diameter or less shall be threaded, welded, or flanged.

***NFPA 59A, §9.4.1.1***

Pipe joints larger than 2 in. (50 mm) nominal diameter shall be welded or flanged.

***NFPA 59A, §9.4.1.2***

Where necessary for connections to equipment or components, where the connection is not subject to fatigue producing stresses, joints of 4 in. nominal diameter or less shall be threaded, welded, or flanged.

***NFPA 59A, §9.4.1.6***

Pipe, when buried on land, shall be buried to a minimum of 3 ft. of cover.

***NFPA 59A, §9.11.9.1***

## **Installation of Valves**

Extended bonnet valves shall be installed with packing seals in a position that prevents leakage or malfunction due to freezing.

***NFPA 59A, §9.4.2.1***

Where the extended bonnet in a cryogenic liquid line is installed at an angle greater than 45 degrees from the upright vertical position, it shall be demonstrated to be free of leakage and frost under operating conditions.

***NFPA 59A, §9.4.2.2***

Shutoff valves shall be installed on container, tank, and vessel connections, except for the following:

- (1) Connections for relief valves in accordance with the ASME *Boiler and Pressure Vessel Code*, Section VIII, Division 1, UG-125(d) and Appendix M-5
- (2) Connections for liquid level alarms as required by 10.2.1.3 or 13.15.2 if an ASME container
- (3) Connections that are blind flanged or plugged

***NFPA 59A, §9.4.2.3***

Piping systems shall be designed to limit the contained volume that could be discharged in the event of a piping system failure. Sufficient valves which can be operated both at the installed location and from a remote location to shut down the process and transfer systems in the event of an emergency shall be installed.

***Regulations for LNG, §14.2416***

In addition to the container shutoff valve required in 9.4.2.3, container connections larger than 1 in. nominal diameter and through which liquid can escape shall be equipped with at least one of the following:

- (1) A valve that closes automatically if exposed to fire
- (2) A remotely controlled, quick-closing valve that remains closed except during the operating period
- (3) A check valve on filling connections

***NFPA 59A, §9.4.2.6***

## **Welding at Piping Installations**

Qualification and performance of welders shall be in accordance with subsection 328.2 of ASME B 31.3, and 9.4.3.2 of this standard.

***NFPA 59A, §9.4.3.1***

## **Piping Identification**

Piping shall be identified by color coding, painting, or labeling.

***NFPA 59A, §9.6***



**Sample Question 6**

Threaded pipe shall be at least Schedule \_\_\_\_\_.

- A. 20
- B. 40
- C. 60
- D. 80

*Answer on last page*

**Inspection Examination and Testing of Piping**

Inspection, examination, and testing shall be performed in accordance with Chapter VI of ASME B 31.3 to demonstrate sound construction, installation, and leak tightness. Unless specified otherwise in the engineering design, piping systems for flammable liquids and flammable gases shall be examined and tested per the requirements of ASME B 31.3, Normal Fluid Service.

**NFPA 59A, §9.7**

**Welding Pipe Tests**

Nondestructive examination methods, limitations on defects, and the qualifications of the personnel performing and interpreting the examinations shall meet the requirements of ASME B 31.3, *Process Piping*, Chapter VI, Sections 341 through 344 and the following:

- (1) The requirements of Normal Fluid Service shall apply as a minimum for examination acceptance criteria, unless specified otherwise in the engineering design.
- (2) Personnel performing nondestructive examinations (NDE) shall, as a minimum, be qualified Level I per ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*, or an equivalent qualification standard.
- (3) Personnel interpreting nondestructive examinations shall, as a minimum, be qualified Level II per ASNT SNT-TC-1A or an equivalent qualification standard.
- (4) NDEs shall be performed in accordance with written procedures meeting all the requirements of ASME *Boiler and Pressure Vessel Code*, Section V, as applicable to the specific NDE method.

**NFPA 59A, §9.7.4.1**

Test and examination records and written procedures required within this standard and within ASME B 31.3, Paragraph 345.2.7 and Section 346 respectively, shall be maintained for the life of the piping system by the facility operator or until such time as a re-examination is conducted.

**NFPA 59A, §9.7.5.1**

## **Liquid Level Gauging**

LNG containers shall be equipped with two independent liquid level gauging devices that compensate for variations in liquid density.

***NFPA 59A, §10.2.1.1***

Gauging devices shall be designed and installed so that they can be replaced without taking the container out of operation.

***NFPA 59A, §10.2.1.2***

Each container shall be provided with two independent high-liquid-level alarms, which shall be permitted to be part of the liquid level gauging devices.

(A) The alarm shall be set so that the operator can stop the flow without exceeding the maximum permitted filling height and shall be located so that they are audible to personnel controlling the filling.

(B) The high-liquid-level flow cutoff device required in 10.2.1.4 shall not be considered as a substitute for the alarm.

***NFPA 59A, §10.2.1.3***

Gauging devices shall be designed and installed so that they can be replaced without taking the container out of operation.

***NFPA 59A, §10.2.1.2***

## **Pressure Gauging**

Each container shall be equipped with a pressure gauge connected to the container at a point above the maximum intended liquid level.

***NFPA 59A, §10.3***

## **Vacuum Gauges**

Vacuum-jacketed equipment shall be equipped with instruments or connections for checking the absolute pressure in the annular space.

***NFPA 59A, §10.4***

## **Emergency Shutdown**

Instrumentation for liquefaction, storage, and vaporization facilities shall be designed so that, in the event that power or instrument air failure occurs, the system will proceed to a fail-safe condition that is maintained until the operators can take action either to reactivate or to secure the system.

***NFPA 59A, §10.6***

## Electrical Equipment

Electrical equipment and wiring shall be in accordance with NFPA 70, National Electrical Code, or CSA C22.1, Canadian Electrical Code.

### ***NFPA 59A, §10.7.1***

Fixed electrical equipment and wiring installed within the classified areas specified in Table 10.7.2 shall comply with Table 10.7.2 and Figure 10.7.2(a) through Figure 10.7.2(f) and shall be installed in accordance with *NFPA 70, National Electrical Code*, for hazardous locations.

### ***NFPA 59A, §10.7.2***

Electrically classified areas shall be as specified in Table 10.7.2.

(A) The extent of the electrically classified area shall not extend beyond an unpierced wall, roof, or solid vapor tight partition.

(B) The extent of the electrically classified areas shall be measured in accordance with Table 10.7.2.

### ***NFPA 59A, §10.7.3***

Each interface between a flammable fluid system and an electrical conduit or wiring system, including process instrumentation connections, integral valve operators, foundation heating coils, canned pumps, and blowers, shall be sealed or isolated to prevent the passage of flammable fluids to another portion of the electrical installation.

### ***NFPA 59A, §10.7.5***

Each seal, barrier, or other means used to comply with 10.7.5 shall be designed to prevent the passage of flammable fluids through the conduit, stranded conductors, and cables.

### ***NFPA 59A, §10.7.5.1***

A primary seal shall be provided between the flammable fluid system and the electrical conduit wiring system.

(A) If the failure of the primary seal allows the passage of flammable fluids to another portion of the conduit or wiring system, an additional approved seal, barrier, or other means shall be provided to prevent the passage of the flammable fluid beyond the additional device or means if the primary seal fails.

(B) Each primary seal shall be designed to withstand the service conditions to which it can be exposed.

(C) Each additional seal or barrier and interconnecting enclosure shall be designed to meet the pressure and temperature requirements of the condition to which it could be exposed in the event of failure of the primary seal unless other approved means are provided to accomplish the purpose.

### ***NFPA 59A, §10.7.5.2***

## **Electrical Grounding and Bonding**

Electrical grounding and bonding shall be provided.

***NFPA 59A, §10.8.1***

Static protection shall not be required where tank cars, tank vehicles, or marine equipment are loaded or unloaded and where both halves of metallic hose couplings or pipe are in contact.

***NFPA 59A, §10.8.2***

If stray currents can be present or if impressed currents are used on loading and unloading systems (such as for cathodic protection), protective measures to prevent ignition shall be taken.

***NFPA 59A, §10.8.3***

Lightning protection ground rods shall be provided for tanks supported on nonconductive foundations.

***NFPA 59A, §10.8.4***

## **Fire Protection**

The emergency procedure manual required in NFPA 59A §13.18.3.1 shall be available in the operating area and shall be updated as required by changes in equipment or procedures.

***Regulations for LNG, §14.2131(a)***

Each facility shall have a written manual of emergency procedures that shall include the types of emergencies that are anticipated from an operating malfunction, structural collapse of part of the facility, personnel error, forces of nature, and activities carried on adjacent to the facility, including the following:

(1) Procedures for responding to controllable emergencies, including notification of personnel and the use of equipment that is appropriate for handling of the emergency and the shutdown or isolation of various portions of the equipment and other applicable steps to ensure that the escape of gas or liquid is promptly cut off or reduced as much as possible

(2) Procedures for recognizing an uncontrollable emergency and for taking action to ensure that harm to the personnel at the facility and to the public is minimized

(3) Procedures for the prompt notification of the emergency to the appropriate local officials, including the possible need to evacuate persons from the vicinity of the facility

(4) Procedures for coordinating with local officials in the preparation of an emergency evacuation plan that sets forth the steps necessary to protect the public in the event of an emergency

***NFPA 59A, §13.18.3.1***

Facility operators shall prepare and implement a maintenance program for all plant fire protection equipment.

***NFPA 59A, §12.7***

In addition to NFPA 59A §12.7, safety and fire protection equipment shall be visually inspected at least once a month and tested at least once a year. Documentation shall be maintained on inspections and tests for at least two years or consistent with other safety record retention schedules, whichever is greater.

***Regulations for LNG, §14.2131(b)***

## **Maintenance Manual**

Each operating company shall have a documented plan that sets out inspection and maintenance program requirements for each component used in its LNG plant that is identified as requiring inspection and maintenance.

***NFPA 59A, §14.7.1***

Each maintenance program shall be conducted in accordance with its documented plan for LNG plant components identified in the plan as requiring inspection and maintenance.

***NFPA 59A, §14.7.2***

Each operating company shall perform the periodic inspections, tests, or both, on a schedule that is included in the maintenance plan on identified components and its support system identified as requiring inspection and maintenance that is in service in its LNG plant.

***NFPA 59A, §14.7.3***

The maintenance manual shall refer to maintenance procedures, including procedures for the safety of personnel and property while repairs are carried out, regardless of whether the equipment is in operation.

***NFPA 59A, §14.7.4***

## **General Rules for LNG Fueling Facilities**

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### **General Facility Design**

LNG fueling facilities that are permitted to be unattended shall be designed to secure all equipment from tampering.

***NFPA 52, §10.2.1.1***

LNG fueling facilities transferring LNG during the night shall have permanent, adequate lighting at points of transfer and operation.

***NFPA 52, §10.2.1.4***

If other combustible or hazardous liquids are able to encroach on the LNG fueling facility, means shall be provided to protect the LNG facility.

***NFPA 52, §10.2.2.3***

Buried and underground containers shall be provided with means to prevent the 32°F (0°C) isotherm from penetrating the soil.

***NFPA 52, §13.5.2***

All buried or mounded components in contact with the soil shall be constructed from material resistant to soil corrosion or protected to minimize corrosion.

***NFPA 52, §13.5.4***

LNG shall not be vented to the atmosphere under normal operations unless the vent leads to a safe point of discharge. Vent pipes or stacks shall have the open end suitably protected to prevent entrance of rain, snow, and other foreign material. Vent stacks shall have provision for drainage.

***Regulations for LNG, §14.2304(a)***

Temperature monitoring systems shall be provided where the foundations supporting cryogenic containers and equipment could be adversely affected by freezing or frost heaving of the ground.

***Regulations for LNG, §14.2304(b)***

## **Fuel Dispensing Systems**

The dispensing device shall be protected from vehicle collision damage.

***NFPA 52, §10.4.1***

An ESD shall be provided that includes a shutoff valve for stopping liquid supply and shutting down transfer equipment.

***NFPA 52, §10.4.2***

An ESD actuator, distinctly marked for easy recognition with a permanently affixed, legible sign, shall be provided within 10 ft of the dispenser and also at a safe, remote location.

***NFPA 52, §10.4.3***

The maximum delivery pressure at the fueling nozzle shall not exceed the maximum allowable pressure of the vehicle fuel tanks.

***NFPA 52, §10.4.4***

Hose and arms shall be equipped with a shutoff valve at the fuel end and a breakaway device to minimize release of liquid and vapor in the event that a vehicle pulls away while the hose remain connected.

***NFPA 52, §10.4.5***

Where a hose or arm of nominal 3 in. diameter or larger is used for liquid transfer or where one of nominal 4 in. diameter or larger is used for vapor transfer, an emergency shutoff valve shall be installed in the piping of the transfer system within 10 ft from the nearest end of the hose or arm.

***NFPA 52, §10.4.7***

Where the flow is away from the hose, a check valve shall be permitted to be used as the shutoff valve.

***NFPA 52, §10.4.7.1***

Where either a liquid or vapor line has two or more legs, an emergency shutoff valve shall be installed either in each leg or in the feed line before the legs.

***NFPA 52, §10.4.7.2***

Where excess-flow check valves are used, the closing flow shall be greater than the maximum system design flow rate and less than the flow rating of the piping system that results from a complete line failure between the excess-flow valve and the equipment downstream of the excess-flow check valve.

***NFPA 52, §7.11.3***

A fueling connector and mating vehicle receptacle shall be used for reliable, safe, and secure transfer of LNG or gas vapor to or from the vehicle, with minimal leakage.

***NFPA 52, §10.4.9***

The fueling connector either shall be equipped with an interlock device that prevents release while the line is open or have self-closing ends that automatically close upon disconnection.

***NFPA 52, §10.4.10***

The licensee or operator of the appurtenance or equipment shall maintain documentation sufficient to substantiate any claims made regarding the safety of any valves, fittings, and equipment and shall, upon request, furnish copies to AFS.

***Regulations for LNG, §14.2313(d)***

Manually operated container valves shall be provided for each container.

***Regulations for LNG, §14.2313(e)***

Manually operated shutoff valves shall be installed in manifolds as close as practicable to a container or group of containers.

***Regulations for LNG, §14.2313(f)***

### **Automatic Fuel Dispensing Systems**

Automatic fuel dispensers shall be fabricated of material suitable for LNG and resistant to the action of LNG under service conditions. Pressure containing parts shall be stainless steel, brass, or other equivalent cryogenic material. Aluminum may be used for approved meters.

***Regulations for LNG, §14.2319(a)***

Electric installations within dispenser enclosures and the entire pit or open space beneath dispensers shall comply with NEC, Class 1, Group D, Division 1, except for dispenser components located at least 48 inches above the dispenser base which NEC states are intrinsically safe.

***Regulations for LNG, §14.2319(b)***

A device shall be installed in the liquid piping so that displacement of an automatic dispenser will result in the displacement of such piping on the downstream side of the device.

***Regulations for LNG, §14.2319(e)***

The fueling nozzle shall prevent LNG from being discharged unless the nozzle is connected to the vehicle.

***Regulations for LNG, §14.2319(f)***

A key, card, or code system shall be used to activate the automatic dispenser.

***Regulations for LNG, §14.2319(g)***

Automatic dispensers shall incorporate cutoff valves with opening and closing devices which ensure the valves are in a closed position when dispensers are deactivated.

***Regulations for LNG, §14.2319(h)***

LNG fuel storage installations which include automatic dispensers shall be equipped with an emergency shut-down device for the entire LNG installation located at least 20 feet from the nearest dispenser or storage area. The emergency shut-down device shall be distinctly marked for easy recognition.

***Regulations for LNG, §14.2319(i)***



If automatic dispensers are to be used during hours of darkness, permanent adequate lighting shall be provided to facilitate proper operations.

***Regulations for LNG, §14.2319(j)***

Fuel dispensers, including automatic dispensers, may be operated only by an individual who has been properly trained.

(1) The licensee owning, operating, or servicing a CNG fuel dispensing facility shall ensure the safe operation of the system and provide training to users.

(2) Step-by-step operating instructions provided by the manufacturer shall be posted at or on each automatic dispenser, readily visible to the operator during transfer operations. The instructions shall describe each action necessary to operate the automatic dispenser and include the location of and procedure for activating emergency shutoff equipment.

(3) Each person or entity who operates a fuel dispenser, excluding an automatic dispenser, shall be provided with written instructions and safe operating procedures by the licensee. The person operating the dispenser should be cautioned to study and preserve such instructions and procedures.

***Regulations for LNG, §14.2319(k)***

**Sample Question 7**

A \_\_\_\_\_ shall be used to activate the automatic dispenser.

- A. Key
- B. Card
- C. Code system
- D. Any of the above

*Answer on last page.*

## **Engine Fuel Systems**

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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***

## **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***

Pumps and compressors shall be provided with a PRD to limit the discharge pressure to the maximum working pressure of the casing and downstream piping and equipment, unless these are designed for the maximum discharge pressure of the pumps or compressors.

***NFPA 52, §9.9.1***

Pumps shall be provided with a vent, a relief valve, or both that prevent overpressuring the pump case.

***NFPA 52, §9.9.2***

Pumps used for transfer of LNG shall be provided with means for precooling to reduce the effect of thermal shock and overpressure.

***NFPA 52, §9.9.3***

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 8

Roof-mounted containers are allowed if the \_\_\_\_\_ approves the design of the structure mounting.

- A. Original Manufacturer
- B. Texas Railroad Commission
- C. National Fire Protection Association
- D. Department of Transportation

*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 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***

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***

**Sample Question 9**

Monitoring Sensors shall have periodic testing shall be 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*

## **LNG Transports**

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### **Registration and Transfer of LNG Transports**

A person who operates a transport equipped with LNG cargo tanks or any container delivery unit, regardless of who owns the transport or unit, shall register the transport with AFS in the name or names under which the operator conducts business in Texas prior to the unit being used in LNG service.

- (1) To register a cargo tank unit previously unregistered in Texas, the operator of the unit shall:
- (A) pay to AFS the \$270 registration fee for each LNG transport;
  - (B) file a properly completed LNG Form 2007;
  - (C) file a copy of the manufacturer's data report;
  - (D) file a copy of the DOT compliance sheet; and
  - (E) file a copy of the test required by §14.2707 of this title (relating to Testing Requirements), unless that unit was manufactured within the previous five years.

#### ***Regulations for LNG, §14.2704(a)***

When all registration or transfer requirements have been met, AFS shall issue LNG Form 2004 which shall be properly affixed in accordance with the placement instructions on the form. LNG Form 2004 shall authorize the licensee or ultimate consumer to whom it has been issued and no other person to operate such unit in the transportation of LNG and to fill the transport containers.

- (1) A person shall not operate an LNG transport in Texas unless the LNG Form 2004 has been properly affixed or unless its operation has been specifically approved by AFS.
- (2) A person shall not introduce LNG into a transport container unless that transport bears an LNG Form 2004 or unless specifically approved by AFS.
- (3) LNG Form 2004 shall not be transferable by the person to whom it has been issued but shall be registered by any subsequent licensee or ultimate consumer prior to the unit being placed into LNG service.

#### ***Regulations for LNG, §14.2704(c)***

### **DOT Requirements**

(a) This subchapter applies to LNG transports as defined in this chapter used in the transportation and distribution of LNG.

(b) LNG transports shall comply with the requirements of DOT specification MC-338 and the applicable parts of Title 49, Code of Federal Regulations, Parts 171 – 180.

#### ***Regulations for LNG, §14.2701***



## Testing Requirements

Transports required to be registered with AFS shall be tested at least once every five years by a Category 15, 20, or 50 licensee.

- (1) Documentation of the required testing shall be filed by the Category 15, 20, or 50 licensee.
- (2) The results of any test required under this section shall clearly indicate whether the transport container unit is safe for LNG service. The Category 15, 20, or 50 licensee shall send LNG Form 2008 to AFS within 30 calendar days of the due date of any tests required under this section.
- (3) If evidence of any unsafe condition is discovered as a result of any tests performed under this section, the transport container unit shall be immediately removed from LNG service and shall not be returned to LNG service until AFS notifies the licensee in writing that the transport container unit may be returned to LNG service.

### ***Regulations for LNG, §14.2707(a)***

Containers shall be tested in accordance with 49 CFR §180.407.

### ***Regulations for LNG, §14.2707(b)***

Containers shall be inspected for corroded areas, dents, or other conditions (including leakage under test pressure) which could render the container unsafe for LNG service.

### ***Regulations for LNG, §14.2707(c)***

## Marking

LNG transports shall be marked on each side and the rear with the name of the licensee or the ultimate consumer operating the unit.

Such lettering shall be legible and at least two inches in height and in sharp color contrast to the background. AFS will determine whether the name marked on the transport is sufficient to properly identify the operator.

### ***Regulations for LNG, §14.2710***

## Pressure Gauge

Transport containers shall be equipped with a pressure gauge for LNG service which shall be maintained in good operating condition at all times. An isolation valve shall be installed between the container and the pressure gauge.

### ***Regulations for LNG, §14.2713***

## Electrical Equipment and Lighting

LNG transports and container delivery units shall not be equipped with an artificial light other than electrical. Lighting circuits shall have suitable overcurrent protection (fuses or automatic circuit breakers). Wiring shall have sufficient current capacity and mechanical strength, and shall be secured, insulated, and protected against physical damage.

### ***Regulations for LNG, §14.2719***

**Liquid Level Gauging Devices**

Truck and trailer containers shall be equipped with a liquid level gauging device of approved design, such as a fixed tube device.

Fixed tube devices shall be arranged so that the maximum liquid level to which the container may be filled is set at the maximum permitted for the container based on an initial liquid temperature not to exceed 40 degrees Fahrenheit. An isolation valve shall be installed between the container and the liquid level gauging device.

*Regulations for LNG, §14.2722*

**Extinguishers Required**

Transport power units shall be equipped with at least one fire extinguisher having a UL rating of 10 B:C or more and shall be labeled or marked with that rating.

*Regulations for LNG, §14.2728(a)*

Fire extinguishers shall be fully charged, in good mechanical condition, and accessible for use. Fire extinguishers shall be mounted with a mounting bracket which will allow visual determination of being fully charged.

*Regulations for LNG, §14.2728(b)*

**Manifests**

Manifests or bills of lading shall be covered by permanent shipping papers authorized by the DOT.

*Regulations for LNG, §14.2731*

**Transfer of LNG on Public Highways, Streets, or Alleys**

Transferring LNG on public highways, streets, or alleys is prohibited except in an emergency or where the containers are on machinery being used for the construction or maintenance of such public highways, streets, or alleys.

*Regulations for LNG, §14.2734*

**Parking of LNG Transports and Container Delivery Units and Use of Chock Blocks**

LNG transport or container delivery units shall not be parked on any public street, highway, or alley, except in an emergency, or when in connection with normal duties, meals, or rest stops. Such units shall not be parked in a congested area and shall be parked a minimum distance of 50 feet from any building, except buildings devoted exclusively to LNG activities.

*Regulations for LNG, §14.2737 (a)*

LNG transports shall carry at least two chock blocks designed to effectively prevent the movement of the transport. These blocks shall be used any time the transport is parked and during the transfer of fuel regardless of the level of the surrounding terrain.

*Regulations for LNG, §14.2737(b)*

**Uniform Protection Standards**

LNG transport units and container delivery units, including appurtenances, shall be maintained in a safe operating condition at all times.

***Regulations for LNG, §14.2740(a)***

Any transport unit or container delivery unit discovered to be in an unsafe condition while being operated on a public roadway may be continued in operation only to the nearest place where repairs can safely be made. Such operation shall be conducted only if it is less hazardous to the public than to permit the transport unit or container delivery unit to remain on the public roadway.

***Regulations for LNG, §14.2740(b)***

**Delivery of Inspection Reports to Licensee**

The transport driver of any transport unit receiving an inspection report from AFS shall deliver that report to the licensee in whose name the transport unit is registered.

***Regulations for LNG, §14.2746***

**Sample Question 10**

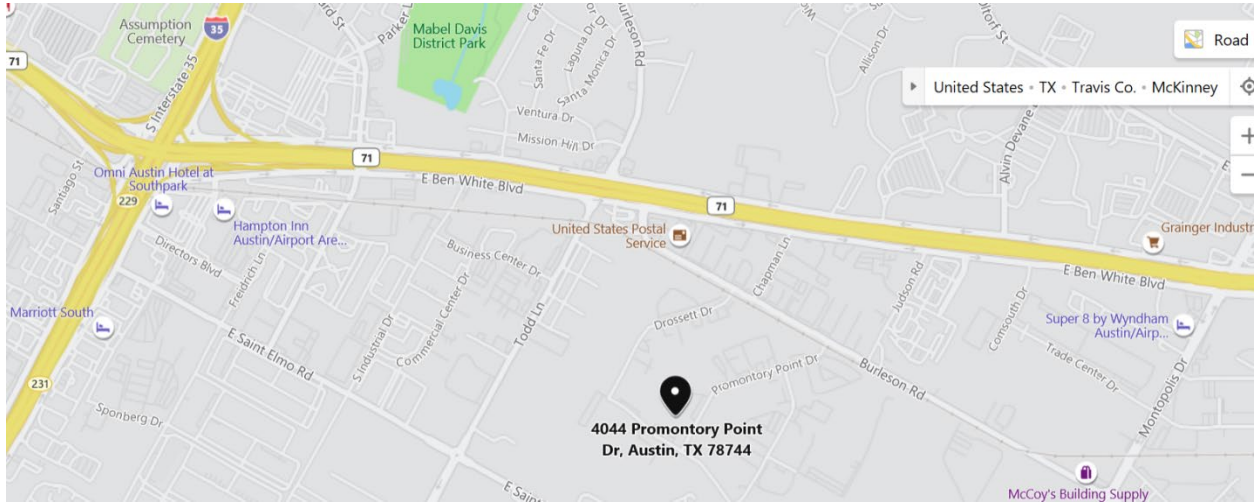
LNG transports shall be marked \_\_\_\_\_ with the name of the licensee or the ultimate consumer operating the unit.

- A. in the Front
- B. in the rear
- C. on each side
- D. on the front and rear
- E. on each side and the rear

***Answer on last page***

# ALTERNATIVE FUELS TRAINING CENTER

## 4044 Promontory Point Austin Texas 78744



### Sample Question Answers

1. C
2. D
3. A
4. A
5. C
6. D
7. D
8. A
9. B
10. E