

TEXAS LNG EXAMINATION STUDY GUIDE

General Installation and Repair
Employee Level



RAILROAD COMMISSION OF TEXAS

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LNG EXAMINATION STUDY GUIDE

Employee-Level

General Installation and Repair 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 general installation and repair activities. The Service and Installation Technician examination qualifies an individual to perform all LNG activities related to stationary LNG systems, including LNG containers, piping and equipment. The Service and Installation examination does not authorize an individual to fill containers or operate an LNG transport.

What books do I need?



This examination tests your knowledge of the laws and standards that apply to General Installation and Repair 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?

You may download or print the current edition of the Railroad Commission's Regulations for Compressed Natural Gas and Liquefied 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 or (512) 463-6882.

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.

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

ASME--American Society of Mechanical Engineers.

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)

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.

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 (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

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

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 an 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

General Rules For All Stationary LNG Installations

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

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)

Containers designed for gauge pressures in excess of 15 psi 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

Stationary LNG Storage Containers

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

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 ³	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 ³	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]

In addition to NFPA 52 §13.5, stationary LNG containers and piping shall not be placed in the area directly beneath or above an electric transmission, distribution, or customer service line and the area six feet to either side of that line. If this distance is not adequate to prevent the line and the associated voltage from contacting the LNG container in the event of breakage of any conductor, then other suitable means of protection designed and constructed to prevent such contact with the container may be used if approval is received from AFS.

The request for approval shall be in writing and shall specify the manner in which the container will be protected from contact, including specifications for the materials to be used. If AFS does not approve the proposed protection, then the container shall be located a sufficient distance from the line to prevent such contact.

Regulations for LNG, §14.2110(b)

Container Relief Devices

All LNG tank systems shall be equipped with vacuum and pressure relief valves as required by the code or standard of manufacture.

Regulations for LNG, §7.3.6.1

Each pressure and vacuum safety relief valve for LNG tank systems shall be able to be isolated from the tank systems for maintenance or other purposes by means of a manual fullopening stop valve.

(A) The stop valve(s) shall be lockable or sealable in the fully open position.

(B) Pressure and vacuum relief valves shall be installed on the LNG tank system to allow each relief valve to be isolated individually while maintaining the required relieving capacity.

(C) Where only one relief device is required, either a fullport opening three-way valve connecting the relief valve and its spare to the container or two relief valves separately connected to the container, each with a valve, shall be installed.

(D) No more than one stop valve shall be closed at one time.

(E) Safety relief valve discharge stacks or vents shall be designed and installed to prevent an accumulation of water, ice, snow, or other foreign matter and shall discharge vertically upward.

Regulations for LNG, §7.3.6.4

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

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. (100 mm) nominal diameter or less shall be threaded, welded, or flanged.

NFPA 59A, §9.4.1.6

Underground and submerged piping shall be protected and maintained in accordance with the principles of NACE SP 0169, *Control of External Corrosion of Underground or Submerged Metallic Piping Systems*.

NFPA 59A, §9.10.1

Pipe, when buried on land, shall be buried to a minimum of 3 ft. (0.9 m) 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(b)

In addition to the container shutoff valve required in 9.4.2.3, container connections larger than 1 in. (25 mm) 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

Sample Question 4

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

- A. 1
- B. 2
- C. 3
- D. 4

Answer on last page

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

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

Leak Testing

Leak testing shall be conducted in accordance with ASME B 31.3, Section 345.

NFPA 59A, §9.7.1.1

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

Safety and Relief Valves

Safety relief systems (piping and valves) shall be designed, installed, and tested in accordance with ASME B 31.3, subsection 322.6, and Section 9.9 of this standard in its entirety.

NFPA 59A, §9.9.1.1

The means for adjusting relief valve set pressure shall be sealed.

NFPA 59A, §9.9.2

A thermal expansion relief valve shall be installed to prevent overpressure in any section of a liquid or cold vapor pipeline that can be isolated by valves.

NFPA 59A, §9.9.3

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

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

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

Sample Question 5

Welding pipe test and examination records shall be maintained for the _____ by the facility operator or until such time as a re-examination is conducted.

- A. 1 year
- B. 2 years
- C. 5 years
- D. The life of the piping system

Answer on last page

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.

NFPA 59A, §14.2131(b)

Emergency Shutdown Systems

Each LNG facility shall have an ESD system(s) to isolate or shut off a source of LNG, flammable liquids, flammable refrigerant, or flammable gases, and to shut down equipment whose continued operation could add to or sustain an emergency.

NFPA 59A, §12.3.1

The ESD system(s) shall be of a fail-safe design or shall be otherwise installed, located, or protected to minimize the possibility that it will become inoperative in the event of an emergency or a failure at the normal control system.

NFPA 59A, §12.3.4

ESD systems that are not of a fail-safe design shall have all components that are located within 50 ft of the equipment controlled in either of the following ways:

- (1) Installed or located where they cannot be exposed to a fire
- (2) Protected against failure due to a fire exposure of at least 10 minutes duration.

NFPA 59A, §12.3.5

Sample Question 6

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 _____.

- A. conduit
- B. stranded conductors
- C. cables
- D. all of the above

Answer on last page

General Rules For LNG Fueling Facilities

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

Points of transfer shall be located not less than 25 ft from the nearest important building not associated with the LNG facility, from the line of adjoining property that is able to be built upon, or from fixed sources of ignition.

NFPA 52, §10.2.2.5

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 (3.1 m) 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

Such a device shall be installed and maintained in accordance with the OEM component manufacturer's maintenance/safety instructions.

NFPA 52, §10.4.5.1

When not in use, hose shall be secured to protect it from damage.

NFPA 52, §10.4.6

Where a hose or arm of nominal 3 in. (76 mm) diameter or larger is used for liquid transfer or where one of nominal 4 in. (100 mm) 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 (3.1 m) 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)

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

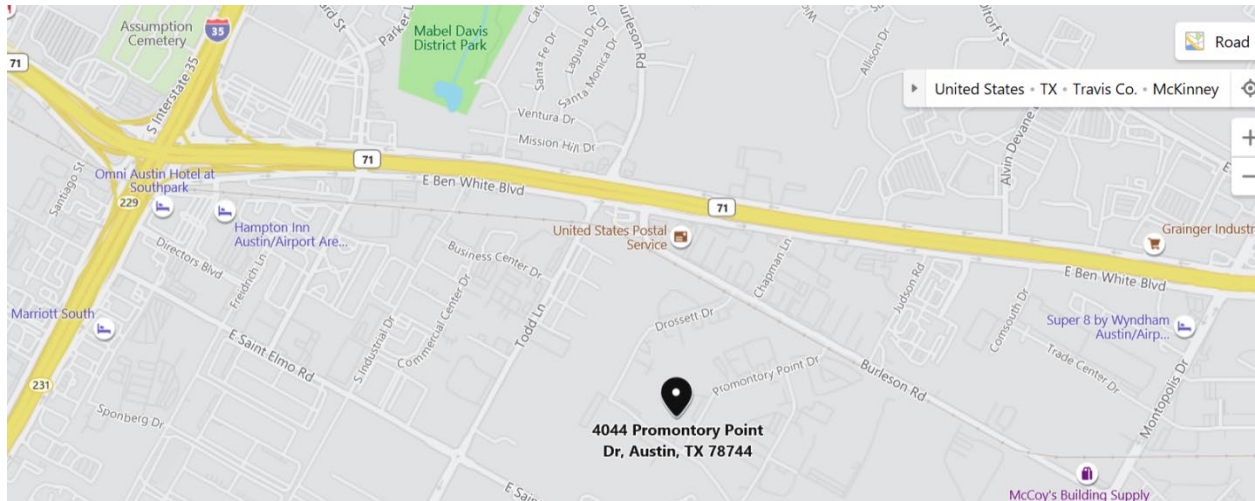
_____ operated container valves shall be provided for each container.

- A. Automated
- B. Manually
- C. Remote
- D. Electronically

Answer on last page.

ALTERNATIVE FUELS TRAINING CENTER

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Sample Question Answers

1. C
2. D
3. A
4. C
5. D
6. D
7. B