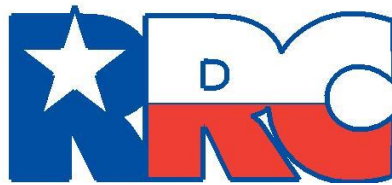


TEXAS LNG EXAMINATION STUDY GUIDE

Transport Outfitter
Management Level



RAILROAD COMMISSION OF TEXAS

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LNG EXAMINATION STUDY GUIDE

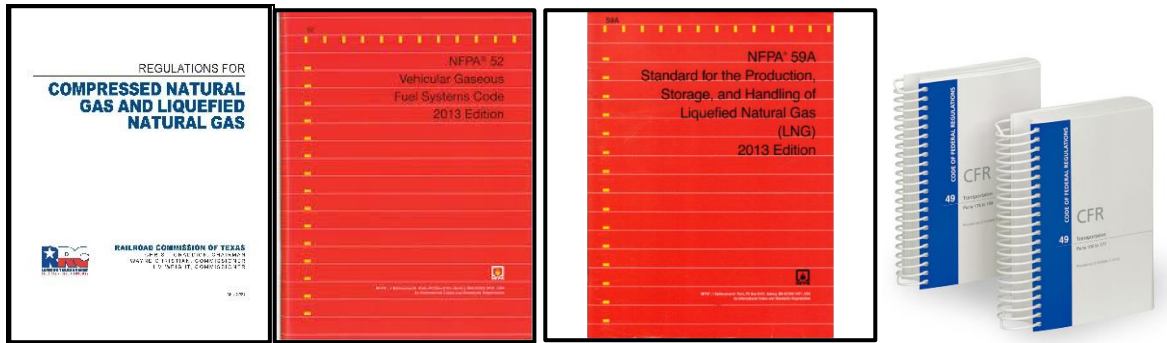
Management-LEVEL

Transport Outfitter Management Level

Who should use this guide?

You should use this guide if you plan to take the Railroad Commission’s management-level qualifying examination to perform LNG Transport Outfitter activities. Category 20 examination qualifies an individual to subframe, test, and sell LNG transport containers, test LNG storage containers, install, test, and sell LNG motor or mobile fuel containers and systems, and install and repair transport systems and motor or mobile fuel systems for use in Texas.

What books do I need?



This examination tests your knowledge of the laws and standards that apply to Carrier Management 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)
- Title 49, Code of Federal Regulations (CFR) Supplement

Where do I get this book?

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

You may also order NFPA manuals online at www.nfpa.org; click on "Codes and Standards." The full current text of 49 CFR can also be viewed online. Go to <http://ecfr.gov> and select "Title 49—Transportation."

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*

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 (16°C) required to fill a container.
NFPA 52, §3.3.63

NFPA 52 (2013)

Components. A part, 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

Water Capacity is defined as the amount of water at ____ °F (16°C) required to fill a container.

- A. 0
- B. 32
- C. 50
- D. 60
- E. 100

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

A Category 20 license for transport outfitters authorizes the subframing, testing, and sale of LNG transport containers; the testing of LNG storage containers; the installation, testing, and sale of LNG motor or mobile fuel containers and systems; and the installation and repair of transport systems and motor or mobile fuel systems. The original license fee is \$400; the renewal fee is \$200.

Regulations for LNG, §14.2013(b)(2)

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

The installation of LNG and CNG systems shall be supervised by _____ personnel with reference to their construction and use.

- A. Qualified
- B. Certified
- C. Licensed
- D. Registered

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

Insulated Cargo Tank Motor Vehicle

General Requirements

Design pressure means the “MAWP” as used in Section VIII of the ASME Code and is the gauge pressure at the top of the tank.

CFR 49, §178.338-1(a)(1)

Design service temperature means the coldest temperature for which the tank is suitable.

CFR 49, §178.338-1(a)(2)

Each cargo tank must consist of a suitably supported welded inner vessel enclosed within an outer shell or jacket, with insulation between the inner vessel and outer shell or jacket, and having piping, valves, supports and other appurtenances as specified in this subchapter. For the purpose of this specification, *tank* means inner vessel and *jacket* means either the outer shell or insulation cover.

CFR 49, §178.338-1(b)

Each tank must be designed, constructed, certified, and stamped in accordance with Section VIII of the ASME Code

CFR 49, §178.338-1(c)

The exterior surface of the tank must be insulated with a material compatible with the lading.

CFR 49, §178.338-1(d)

Each vacuum-insulated cargo tank must be provided with a connection for a vacuum gauge to indicate the absolute pressure within the insulation space.

CFR 49, §178.338-1(d)(3)

An evacuated jacket must be designed to sustain a minimum critical collapsing pressure of 30 psig.

CFR 49, §178.338-1(f)(1)

Material

All Material used in the construction of a tank and its appurtenances that may come in contact with the lading must be compatible with the lading to be transported. All material used for tank pressure parts must conform to the requirements in Section II of the ASME

CFR 49, §178.338-2(a)

All tie-rods, mountings, and other appurtenances within the jacket and all piping, fittings and valves must be of material suitable for use at the lowest temperature to be encountered.

CFR 49, §178.338-2(b)

Impact tests are required on all tank materials, except materials that are excepted from impact testing by the ASME Code, and must be performed using the procedure prescribed in Section VIII of the ASME Code

CFR 49, §178.338-2(c)

The direction of final rolling of the shell material must be the circumferential orientation of the tank shell.

CFR 49, §178.338-2(d)

Each tank constructed in accordance with part UHT in Section VIII of the ASME Code must be postweld heat treated as a unit after completion of all welds to the shell and heads.

CFR 49, §178.338-2(e)

The fabricator shall record the heat and slab numbers and the certified Charpy impact values of each plate used in the tank on a sketch showing the location of each plate in the shell and heads of the tank. A copy of the sketch must be provided to the owner of the cargo tank and a copy must be retained by the fabricator for at least five years and made available, upon request, to any duly identified representative of the Department.

CFR 49, §178.338-2(f)

Sample Question 3

Each tank must be designed, constructed, certified, and stamped in accordance with _____

- A. The Railroad Commission of Texas LNG regulations
- B. Code of Federal Regulations
- C. ASME Code
- D. DOT

Answer on last page

Structural Integrity

Except as permitted in paragraph (d) of this section, the maximum calculated design stress at any point in the tank may not exceed the lesser of the maximum allowable stress value prescribed in Section VIII of the ASME Code (IBR, see § 171.7 of this subchapter), or 25 percent of the tensile strength of the material used.

CFR 49, §178.338-3(a)(1)

The relevant physical properties of the materials used in each tank may be established either by a certified test report from the material manufacturer or by testing in conformance with a recognized national standard. In either case, the ultimate tensile strength of the material used in the design may not exceed 120 percent of the minimum ultimate tensile strength specified in either the ASME Code or the ASTM standard to which the material is manufactured.

CFR 49, §178.338-3(a)(2)

Static Design and Construction

Stress concentrations in tension, bending, and torsion which occur at pads, cradles, or other supports must be considered in accordance with appendix G in Section VIII of the ASME Code.

CFR 49, §178.338-3(b)(2)

For a cargo tank constructed of stainless steel, the maximum design stress may not exceed 75 percent of the ultimate tensile strength of the type steel used.

CFR 49, §178.338-3(d)

Structural members, the suspension subframe, accident protection structures and external circumferential reinforcement devices must be used as sites for attachment of appurtenances and other accessories to the cargo tank, when practicable.

CFR 49, §178.338-3(g)(1)

A lightweight attachment to the cargo tank wall such as a conduit clip, brakeline clip, skirting structure, lamp mounting bracket, or placard holder must be of a construction having lesser strength than the cargo tank wall materials and may not be more than 72 percent of the thickness of the material to which it is attached.

The lightweight attachment may be secured directly to the cargo tank wall if the device is designed and installed in such a manner that, if damaged, it will not affect the lading retention integrity of the tank. A lightweight attachment must be secured to the cargo tank shell or head by a continuous weld or in such a manner as to preclude formation of pockets that may become sites for corrosion.

CFR 49, §178.338-3(g)(2)

Except as prescribed in paragraphs (g)(1) and (g)(2) of this section, the welding of any appurtenance the cargo tank wall must be made by attachment of a mounting pad so that there will be no adverse effect upon the lading retention integrity of the cargo tank if any force less than that prescribed in paragraph (b)(1) of this section is applied from any direction.

The thickness of the mounting pad may not be less than that of the shell or head to which it is attached, and not more than 1.5 times the shell or head thickness.

CFR 49, §178.338-3(g)(3)

Each mounting pad must be fabricated from material determined to be suitable for welding to both the cargo tank material and the material of the appurtenance or structural support member.

CFR 49, §178.338-3(g)(3)(i)

Each mounting pad must be preformed to an inside radius no greater than the outside radius of the cargo tank at the attachment location.

CFR 49, §178.338-3(g)(3)(ii)

Each mounting pad must extend at least 2 inches in each direction from any point of attachment of an appurtenance or structural support member. This dimension may be measured from the center of the attached structural member.

CFR 49, §178.338-3(g)(3)(iii)

Each mounting pad must have rounded corners, or otherwise be shaped in a manner to minimize stress concentrations on the shell or head.

CFR 49, §178.338-3(g)(3)(iv)

Each mounting pad must be attached by continuous fillet welding. Any fillet weld discontinuity may only be for the purpose of preventing an intersection between the fillet weld and a tank or jacket seam weld.

CFR 49, §178.338-3(g)(3)(v)

Joints

All joints in the tank, and in the jacket if evacuated, must be as prescribed in Section VIII of the ASME Code, except that a butt weld with one plate edge offset is not authorized.

CFR 49, §178.338-4(a)

Welding procedure and welder performance tests must be made in accordance with Section IX of the ASME Code. Records of the qualification must be retained by the tank manufacturer for at least five years and must be made available, upon request, to any duly identified representative of the Department, or the owner of the cargo tank.

CFR 49, §178.338-4(b)

All longitudinal welds in tanks and load bearing jackets must be located so as not to intersect nozzles or supports other than load rings and stiffening rings.

CFR 49, §178.338-4(c)

Substructures must be properly fitted before attachment and the welding sequence must minimize stresses due to shrinkage of welds.

CFR 49, §178.338-4(d)

Filler material containing more than 0.05 percent vanadium may not be used with quenched and tempered steel.

CFR 49, §178.338-4(e)

All tank nozzle-to-shell and nozzle-to-head welds must be full penetration welds.

CFR 49, §178.338-4(f)

Manholes

Each tank having a manhole must be provided with a means of entrance and exit through the jacket, or the jacket must be marked to indicate the manway location on the tank.

CFR 49, §178.338-6(b)

A manhole with a bolted closure may not be located on the front head of the tank.

CFR 49, §178.338-6(c)

Sample Question 4

For a cargo tank constructed of stainless steel, the maximum design stress may not exceed ____ percent of the ultimate tensile strength of the type steel used.

- A. 25
- B. 50
- C. 75
- D. 80
- E. 85

Answer on last page

Openings

The inlet to the liquid product discharge opening of each tank intended for flammable ladings must be at the bottom centerline of the tank.

CFR 49, §178.338-7(a)

If the leakage of a single valve, except a pressure relief valve, pressure control valve, full try cock or gas phase manual vent valve, would permit loss of flammable material, an additional closure that is leak tight at the tank design pressure must be provided outboard of such valve.

CFR 49, §178.338-7(b)

Pressure relief devices, piping, valves and fittings.

The burst pressure of all piping, pipe fittings, hoses, and other pressure parts, except for pump seals and pressure relief devices, must be at least 4 times the design pressure of the tank. Additionally, the burst pressure may not be less than 4 times any higher pressure to which each pipe, pipe fitting, hose or other pressure part may be subjected to in service.

CFR 49, §178.338-8(b)(1)

Pipe joints must be threaded, welded, or flanged. If threaded pipe is used, the pipe and fittings must be Schedule 80 weight or heavier. Malleable metals must be used in the construction of valves and fittings. Where copper tubing is permitted, joints shall be brazed or be of equally strong metal union type.

CFR 49, §178.338-8(b)(2)

Piping must be protected from damage due to thermal expansion and contraction, jarring, and vibration.

CFR 49, §178.338-8(b)(4)

All piping, valves and fittings on a cargo tank must be proved free from leaks.

CFR 49, §178.338-8(b)(5)

Each valve must be suitable for the tank design pressure at the tank design service temperature.

CFR 49, §178.338-8(b)(6)

Holding time.

“Holding time” is the time, as determined by testing, that will elapse from loading until the pressure of the contents, under equilibrium conditions, reaches the level of the lowest pressure control valve or pressure relief valve setting.

CFR 49, §178.338-9(a)

If more than one cargo tank is made to the same design, only one cargo tank must be subjected to the full holding time test at the time of manufacture. However, each subsequent cargo tank made to the same design must be performance tested during its first trip.

CFR 49, §178.338-9(c)(1)

Accident Damage Protection.

All valves, fittings, pressure relief devices and other accessories to the tank proper, which are not isolated from the tank by closed intervening shut-off valves or check valves, must be installed within the motor vehicle framework or within a suitable collision resistant guard or housing, and appropriate ventilation must be provided.

Each pressure relief device must be protected so that in the event of the upset of the vehicle onto a hard surface, the device's opening will not be prevented, and its discharge will not be restricted.

CFR 49, §178.338-10(a)

Each protective device or housing, and its attachment to the vehicle structure, must be designed to withstand static loading in any direction that it may be loaded as a result of front, rear, side, or sideswipe collision, or the overturn of the vehicle. The static loading shall equal twice the loaded weight of the tank and attachments. A safety factor of four, based on the tensile strength of the material, shall be used. The protective device or the housing must be made of steel at least 3/16-inch thick, or other material of equivalent strength.

CFR 49, §178.338-10(b)

Rear-end tank protection. Rear-end tank protections devices must:

Consist of at least one rear bumper designed to protect the cargo tank and piping in the event of a rear-end collision. The rear-end tank protection device design must transmit the force of the collision directly to the chassis of the vehicle. The rear-end tank protection device and its attachments to the chassis must be designed to withstand a load equal to twice the weight of the loaded cargo tank and attachments, using a safety factor of four based on the tensile strength of the materials used, with such load being applied horizontally and parallel to the major axis of the cargo tank. The rear-end tank protection device dimensions must meet the requirements of § 393.86 of this title and extend vertically to a height adequate to protect all valves and fittings located at the rear of the cargo tank from damage that could result in loss of lading.

CFR 49, §178.338-10(c)

Every part of the loaded cargo tank, and any associated valve, pipe, enclosure, or protective device or structure (exclusive of wheel assemblies), must be at least 14 inches above level ground.

CFR 49, §178.338-10(d)

Discharge control devices.

If pressure from a reservoir or from an engine-driven pump or compressor is used to open this valve, the control must be of fail-safe design and spring-biased to stop the admission of such pressure into the cargo tank. If the jacket is not evacuated, the seat of the valve must be inside the tank, in the opening nozzle or flange, or in a companion flange bolted to the nozzle. If the jacket is evacuated, the remotely controlled valve must be located as close to the tank as practicable.

CFR 49, §178.338-11(c)(1)

Each remotely controlled shut off valve must be provided with on-vehicle remote means of automatic closure, both mechanical and thermal. One means may be used to close more than one remotely controlled valve. Cable linkage between closures and remote operators must be corrosion resistant and effective in all types of environment and weather. The thermal means must consist of fusible elements actuated at a temperature not exceeding 121 °C (250 °F), or equivalent devices. The loading/unloading connection area is where hoses are connected to the permanent metal piping.

CFR 49, §178.338-11(c)(2)

Supporting and anchoring.

On a cargo tank motor vehicle designed and constructed so that the cargo tank constitutes in whole or in part the structural member used in place of a motor vehicle frame, the cargo tank or the jacket must be supported by external cradles or by load rings.

For a cargo tank mounted on a motor vehicle frame, the tank or jacket must be supported by external cradles, load rings, or longitudinal members.

If cradles are used, they must subtend at least 120 degrees of the cargo tank circumference.

CFR 49, §178.338-13(a)

When a loaded tank is supported within the vacuum jacket by structural members, the design calculations for the tank and its structural members must be based on a safety factor of four and the tensile strength of the material at ambient temperature.

The enhanced tensile strength of the material at actual operating temperature may be substituted for the tensile strength at ambient temperature to the extent recognized in the ASME Code for static loadings.

CFR 49, §178.338-13(b)

Gauging Devices.***Liquid level gauging devices.***

Unless a cargo tank is intended to be filled by weight, it must be equipped with one or more gauging devices, which accurately indicate the maximum permitted liquid level at the loading pressure, in order to provide a minimum of two percent outage below the inlet of the pressure control valve or pressure relief valve at the condition of incipient opening of that valve.

A fixed-length dip tube, a fixed trycock line, or a differential pressure liquid level gauge must be used as the primary control for filling. Other gauging devices, except gauge glasses, may be used, but not as the primary control for filling.

CFR 49, §178.338-14(a)(1)

If a fixed length dip tube or trycock line gauging device is used, it must consist of a pipe or tube of small diameter equipped with a valve at or near the jacket and extending into the cargo tank to a specified filling height. The fixed height at which the tube ends in the cargo tank must be such that the device will function when the liquid reaches the maximum level permitted in loading.

CFR 49, §178.338-14(a)(3)

The liquid level gauging device used as a primary control for filling must be designed and installed to accurately indicate the maximum filling level at the point midway of the tank both longitudinally and laterally.

CFR 49, §178.338-14(a)(4)

Pressure gauges.

Each cargo tank must be provided with a suitable pressure gauge indicating the lading pressure and located on the front of the jacket so it can be read by the driver in the rear-view mirror. Each gauge must have a reference mark at the cargo tank design pressure or the set pressure of the pressure relief valve or pressure control valve, whichever is lowest.

CFR 49, §178.338-14(b)

Orifices.

All openings for dip tube gauging devices and pressure gauges in flammable cryogenic liquid service must be restricted at or inside the jacket by orifices no larger than 0.060-inch diameter. Trycock lines, if provided, may not be greater than 1/2-inch nominal pipe size.

CFR 49, §178.338-14(c)

Marking.

Fuel-carrying components (excluding service valves, tubing, and fittings) shall be labeled or stamped with the following:

- (1) the manufacturer's name or symbol;
- (2) the model designation;
- (3) the maximum allowable maximum allowable working pressure;
- (4) the design temperature range;
- (5) direction of flow of fuel when necessary for correct installation; and
- (6) capacity or electrical rating as applicable.

Regulations for LNG, §14.2604

Each cargo tank certified after October 1, 2004, must have a corrosion-resistant metal name plate (ASME Plate) and specification plate permanently attached to the cargo tank by brazing, welding, or other suitable means on the left side near the front, in a place accessible for inspection.

If the specification plate is attached directly to the cargo tank wall by welding, it must be welded to the tank before the cargo tank is postweld heat treated.

CFR 49, §178.338-18(a)

The plates must be legibly marked by stamping, embossing, or other means of forming letters into the metal of the plate, with the information required in paragraphs (b) and (c) of this section,

CFR 49, §178.338-18(a)(1)

Each insulated cargo tank must have additional plates, as described, attached to the jacket in the location specified unless the specification plate is attached to the chassis and has the information required in paragraphs (b) and (c) of this section.

CFR 49, §178.338-18(a)(2)

The information required for both the name and specification plate may be displayed on a single plate. If the information required by this section is displayed on a plate required by Section VIII of the ASME Code, the information need not be repeated on the name and specification plates.

CFR 49, §178.338-18(a)(3)

Sample Question 5

Every part of the loaded cargo tank, and any associated valve, pipe, enclosure, or protective device or structure (exclusive of wheel assemblies), must be at least _____ above level ground.

- A. 12 inches
- B. 14 inches
- C. 24 inches
- D. 30 inches
- E. 36 inches

Answer on last page

LNG Transports

DOT Requirements

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(b)

Testing Requirements

(a) 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.

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

(c) 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

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

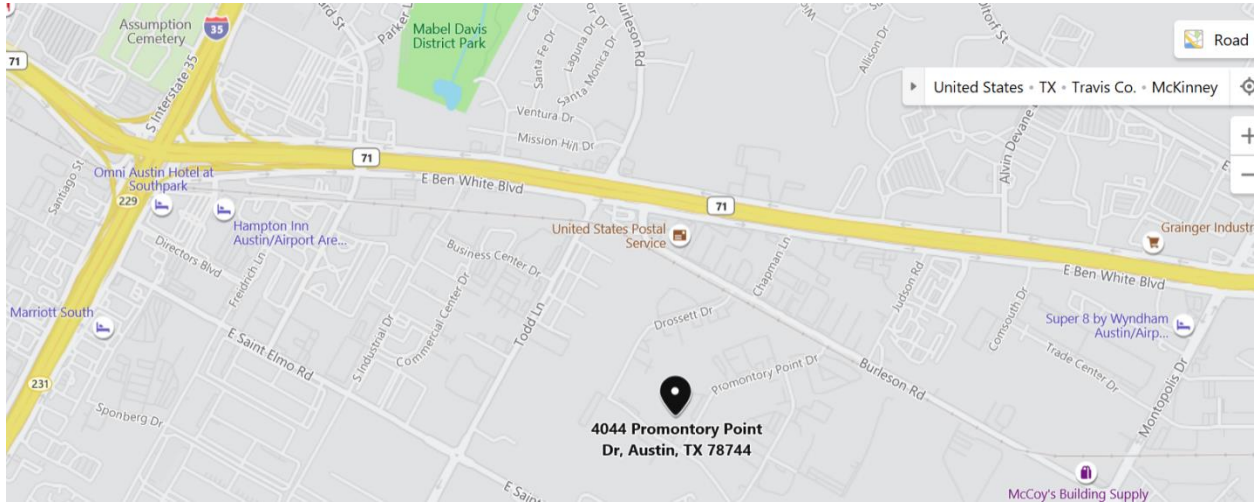
Extinguishers Required

- (a) 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.
- (b) 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

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Sample Question Answers

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