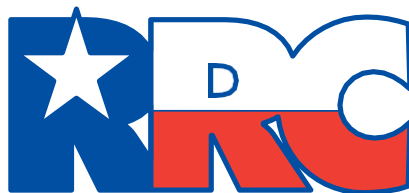


TEXAS CNG EXAMINATION STUDY GUIDE

DOT Cylinder Filling
and Exchange Technician
Employee Level



Railroad Commission of Texas

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CNG EXAMINATION STUDY GUIDE

Employee-LEVEL

DOT Cylinder Filling & Exchange Technician 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 CNG DOT cylinder filling and exchange operations.

The Cylinder Filler examination qualifies an individual to inspect, fill, disconnect, and connect CNG cylinders. It also authorizes the operation of a cylinder exchange cage or cylinder rack, and the replacement of cylinder valves.

NOTE: The DOT Cylinder Filling & Exchange Tech examination does **NOT** authorize an individual to operate a CNG transport or cylinder delivery unit.

What books do I need?



This examination tests your knowledge of the laws and standards that apply to DOT Cylinder Filling or Cylinder Exchange Operations 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 55, Compressed Gases and Cryogenic Fluids Code (2013 Edition)

Where do I get these books?

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.texas.gov. If you need printed copies, they may be purchased for \$10.00, tax included, by calling the Railroad Commission's publications office at (512) 463-7309.

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

Sections and Topics

Before you take this examination, you should know the definitions found in this study guide and the contents of the sections of the codes and standards listed below. The actual examination questions may not cover all 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 CNG activities you will perform, as well as the rules and standards highlighted in this guide.

Regulations for Compressed Natural Gas and Liquefied Natural Gas (2023)

ASME--American Society of Mechanical Engineers.
Regulations for CNG, §13.3(2)

Cascade storage system--Storage in multiple cylinders.
Regulations for CNG, §13.3(6)

CNG cylinder--A cylinder or other container designed for use or used as part of a CNG system.
Regulations for CNG, §13.3(11)

CNG system--A system of safety devices, cylinders, piping, fittings, valves, compressors, regulators, dryers, gauges, relief devices, vents, installation fixtures, and other CNG equipment intended for use or used in any building or public place by the general public, or used in conjunction with a motor vehicle or mobile fuel system fueled by CNG, and any system or facilities designed to be used or used in the compression, sale, storage, transportation for delivery, or distribution of CNG in portable CNG cylinders, but does not include natural gas facilities, equipment, or pipelines located upstream of the outlet of the natural gas meter.
Regulations for CNG, §13.3(12)

Commercial installation--Any CNG installation located on premises other than a single-family dwelling used as a residence, or a private agricultural installation, including but not limited to a retail business establishment, school, convalescent home, hospital, retail CNG cylinder filling/exchange operation, service station, forklift refueling facility, or private motor/mobile fuel cylinder filling operation.
Regulations for CNG, §13.3(13)

Company representative--The individual designated to the Commission by a license applicant or a licensee as the principal individual in authority and actively supervising the conduct of the licensee's CNG activities.
Regulations for CNG, §13.3(15)

Compressed natural gas is a mixture of hydrocarbons in gases and vapors consisting principally of methane.
Regulations for CNG, §13.3(16)

Cylinder service valve--A hand-wheel operated valve connected directly to a CNG cylinder.
Regulations for CNG, §13.3(18)

Dispensing installation--A CNG installation that dispenses CNG from any source by any means into fuel supply cylinders installed on vehicles or into portable cylinders.
Regulations for CNG, §13.3(20)

Fuel supply cylinder--A cylinder mounted upon a vehicle for storage of CNG as fuel supply to an internal combustion engine.
Regulations for CNG, §13.3(23)

Licensed--Authorized by the Commission to perform CNG activities through the issuance of a valid license.
Regulations for CNG, §13.3(25)

Licensee--A person which has applied for and been granted a CNG license by the Commission.
Regulations for CNG, §13.3(26)

Mobile fuel container--A CNG container mounted on a vehicle to store CNG as the fuel supply for uses other than the engine to propel the vehicle, including use in an auxiliary engine.
Regulations for CNG, §13.3(29)

Mobile fuel system--A CNG system which supplies natural gas fuel to an auxiliary engine other than the engine used to propel the vehicle or for other uses on the vehicle.
Regulations for CNG, §13.3(30)

Motor fuel container--A CNG container mounted on a vehicle to store CNG as the fuel supply to an engine used to propel the vehicle.
Regulations for CNG, §13.3(31)

Motor fuel system--A CNG system to supply natural gas as a fuel for an engine used to propel the vehicle.
Regulations for CNG, §13.3(32)

Operations supervisor--The individual who is certified by the Commission to actively supervise a licensee's CNG activities and is authorized by the licensee to implement operational changes.
Regulations for CNG, §13.3(34)

Outlet--A site operated by a CNG licensee from which any regulated CNG activity is performed.
Regulations for CNG, §13.3(35)

Pressure relief device--A device designed to provide a means of venting excess pressure to prevent rupture of a normally charged cylinder.
Regulations for CNG, §13.3(38)

Pullaway--The accidental separation of a hose from a cylinder, container, transfer equipment, or dispensing equipment, which could occur on a cylinder, container, transfer equipment, or dispensing equipment whether or not they are protected by a pullaway or breakaway device.

Regulations for CNG, §13.3(40)

Residential fueling facility--An assembly and its associated equipment and piping at a residence used for the compression and delivery of natural gas into vehicles.

Regulations for CNG, §13.3(42)

Trainee--An individual who has not yet taken and passed an employee-level rules examination.

Regulations for CNG, §13.3(47)

Transfer system--All piping, fittings, valves, pumps, compressors, meters, hoses, and equipment used in transferring CNG between containers.

Regulations for CNG, §13.3(48)

Transport--Any vehicle or combination of vehicles and CNG cylinders designed or adapted for use or used principally as a means of moving or delivering CNG from one place to another, including but not limited to any truck, trailer, semitrailer, cargo tank, or other vehicle used in the distribution of CNG.

Regulations for CNG, §13.3(49)

Ultimate consumer--The person controlling CNG immediately prior to its ignition.

Regulations for CNG, §13.3(50)

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

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

Pressure Vessel. A container or other component designed in accordance with the ASME Boiler and Pressure Vessel Code or CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
NFPA 52, §3.3.47

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

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

NFPA 55 (2013)

CFR. The Code of Federal Regulations of the United States Government. [1, 2012]
NFPA 55, §3.3.18

Compressor. A mechanical device used to increase the pressure and the resultant density of a gas through the act of compression.
NFPA 55, §3.3.22

Cylinder. A pressure vessel designed for absolute pressures higher than 40 psi and having a circular cross section. It does not include a portable tank, multiunit tank car tank, cargo tank, or tank car.
NFPA 55, §3.3.29

Emergency Shutoff Valve. A designated valve designed to shut off the flow of gases or liquids.
NFPA 55, §3.3.37

Automatic Emergency Shutoff Valve. A designated fail-safe automatic closing valve designed to shut off the flow of gases or liquids that is initiated by a control system where the control system is activated by either manual or automatic means.
NFPA 55, §3.3.37.1

Manual Emergency Shutoff Valve. A designated valve designed to shut off the flow of gases or liquids that is manually operated.
NFPA 55, §3.3.37.2

Qualified Individual. An individual knowledgeable in the hazards of compressed gases and cryogenic fluids through training and work experience.
NFPA 55, §3.3.82

Tank.

Portable Tank. Any packaging over 60 U.S. gal capacity designed primarily to be loaded into or on, or temporarily attached to, a transport vehicle or ship and equipped with skids, mountings, or accessories to facilitate handling of the tank by mechanical means.
NFPA 55, §3.3.94.1

Stationary Tank. A packaging designed primarily for stationary installations not intended for loading, unloading, or attachment to a transport vehicle as part of its normal operation in the process of use.
NFPA 55, §3.3.94.2

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

Licensees, registered manufacturers, company representatives, and operations supervisors at each outlet shall have copies of all current licenses and/or manufacturer registrations and certification cards for employees at that location available for inspection during regular business hours. In addition, licensees and registered manufacturers shall maintain a current version of the rules in this chapter and any adopted codes covering CNG activities performed by the licensee or manufacturer, and shall provide at least one copy of all publications to each company representative and operations supervisor. The copies shall be available to employees during business hours.

Regulations for CNG, §13.61(h)

Application for a New Certificate

In addition to NFPA 52 §§1.4.3 and 4.2, and NFPA 55 §4.7, no person shall perform work, directly supervise CNG activities, or be employed in any capacity requiring contact with CNG unless that individual is employed by a licensee and:

- (A) is a certificate holder who is in compliance with renewal requirements in subsection (h) of this section;
- (B) is a trainee who complies with subsection (f) of this section; or
- (C) holds a current examination exemption pursuant to subsection (g) of this section.

Regulations for CNG, §13.70(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 the CNG Form 1016.

If a licensee is not listed on the form, AFS will send the certificate to the individual's personal address.

(A) Successful completion of any required examination shall be credited to and accrue to the individual.

(B) An individual who has been issued a certificate shall make it readily available and shall present the certificate to any Commission employee or agent who requests proof of certification.

Regulations for CNG, §13.70(b)(1)

An individual who files CNG Form 1016 and pays the applicable nonrefundable examination fee may take the rules examination.

(A) Dates and locations of available Commission CNG examinations may be obtained on the Commission's web site. Examinations may be administered:

(i) at the Commission's AFS Training Center in Austin:

(ii) at other designated times and locations around the state; and

(iii) through an online testing or proctoring service.

(B) Individuals or companies may request in writing that examinations be given in their area. AFS shall schedule examinations at its discretion.

(C) Exam fees.

(i) The nonrefundable management-level rules examination fee is \$70.

(ii) The nonrefundable employee-level rules examination fee is \$40.

(iii) The nonrefundable examination fees shall be paid each time an individual takes an examination.

(iv) A military service member, military veteran, or military spouse shall be exempt from the examination fee pursuant to the requirements in §13.76 of this title (relating to Military Fee Exemption). An individual who receives a military fee exemption is not exempt from renewal fees specified in subsection (h) of this section.

(v) Beginning February 7, 2023, individuals who register for an examination to be administered by a testing or proctoring service shall pay any fee required by the testing or proctoring service in addition to paying the examination fee to the Commission.

(D) Time limits.

(i) An applicant shall complete the examination within two hours.

(ii) The examination proctor shall be the official timekeeper.

(iii) An examinee shall submit the examination and the answer sheet to the examination proctor before or at the end of the established time limit for an examination.

(iv) The examination proctor shall mark any answer sheet that was not completed within the time limit.

(E) Each individual who performs CNG activities as an employee of an ultimate consumer or a state agency, county, municipality, school district, or other governmental subdivision shall be properly supervised by his or her employer. Any such individual who is not certified by AFS to perform such CNG activities shall be properly trained by a competent person in the safe performance of such CNG activities.

Regulations for CNG, §13.70(b)(3)

Failure of any examination shall immediately disqualify the individual from performing any CNG related activities covered by the examination which is failed, except for activities covered by a separate examination which the individual has passed.

(1) Any individual who fails an examination administered by the Commission at the Austin location may retake the same examination one additional time during a business day.

(2) Any subsequent examinations shall be taken on another business day, unless approved by the AFS director.

(3) An individual who fails an examination may request an analysis of the individual's performance on the examination.

Regulations for CNG, §13.70(e)

Trainees.

(1) 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, as specified in subsection (b) of this section or registered as specified in subsection (g) of this section, subject to the following conditions:

(A) In addition to NFPA 52 §4.2, 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 calendar days, in any combination and with any number of employers, shall cease to perform any CNG activities for which the trainee is not certified until the trainee successfully completes the rules examination.

(2) A trainee who fails the rules examination shall immediately cease to perform any CNG related activities covered by the examination failed.

Regulations for CNG, §13.70(f)**Requirements for certificate holder renewal.**

(1) In order to maintain active status, certificate holders shall renew their certificate or exemption annually as specified in this subsection.

(2) AFS shall notify licensees of any of their employees' pending renewal deadlines and shall notify the individual if not employed by a licensee, in writing, at the address on file with AFS no later than March 15 of a year for the May 31 renewal date of that year.

(3) 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 CNG 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 (a) of this section.

(B) Upon receipt of the annual renewal fee and late filing fee, AFS shall verify that all applicable requirements have been met. After verification, AFS shall renew the certificate and send a copy of the certificate, and the individual may continue or resume CNG activities authorized by that certificate.

Regulations for CNG, §13.70(h)

Report of CNG Incident/Accident

(a) 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 CNG which:

- (1) caused a death or personal injury requiring hospitalization;
- (2) required taking an operating facility out of service;
- (3) resulted in unintentional gas ignition requiring emergency response;
- (4) meets the requirements of subsection (c) of this section;
- (5) caused an estimated damage to the property of the operator, others or both totaling \$50,000 or more, including gas loss;
- (6) involves a single release of CNG during or following CNG transfer or during container transportation. Any loss of CNG which is less than 1.0% of the gross amount delivered, stored, or withdrawn need not be reported. However, any loss occurring as a result of a pullaway shall be reported;
- (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 the United States Department of Transportation).

(b) The telephonic notice required by this section shall be made to the Railroad Commission's 24-hour emergency line at (512) 463-6788 or (844) 773-0305 and shall include the following:

- (1) date and time of the incident;
- (2) name of reporting operator;
- (3) phone number of operator;
- (4) location of leak or incident;
- (5) personal injuries and/or fatalities;
- (6) whether fire, explosion, or gas leak has occurred;
- (7) status of gas leak or other immediate hazards;
- (8) other significant facts relevant to the incident; and
- (9) whether immediate assistance from AFS is requested.

(c) Any transport unit required to be registered with AFS in accordance with §13.69 of this title (relating to Registration and Transfer of CNG Cargo Tanks and Delivery Units) which is involved in an accident where there is damage to the tank, piping or appurtenances, or any release of CNG resulting from an accident shall be reported to AFS in accordance with this section regardless of the accident location. Any CNG powered motor vehicle used for school transportation or mass transit including any state owned vehicle which is involved in an accident resulting in a substantial release of CNG or damage to the CNG conversion equipment shall be reported to AFS in accordance with this section regardless of accident location.

(d) Following the initial telephone report, the licensee who made the telephonic report shall submit CNG Form 1020 to AFS. The form shall be postmarked within 14 calendar days of the date of initial notification to AFS, or within five business days of receipt of the fire department report, whichever occurs first, unless AFS grants authorization for a longer period of time when additional investigation or information is necessary.

(e) Within five business days of receipt, AFS shall review CNG Form 1020 and notify in writing the person submitting CNG Form 1020 if the report is incomplete and specify in detail what information is lacking or needed. Incomplete reports may delay the resumption of CNG activities at the involved location.

Regulations for CNG, §13.36

Odorization

Natural gas introduced into any system covered by this code shall have a distinctive odor potent enough for its presence to be detected down to a concentration in air of not over one-fifth of the lower limit of flammability.
NFPA 52, §5.2.1.1

General Rules for Stationary CNG Installations

Cylinders, Containers, and Tanks

Containers shall be fabricated of steel, aluminum, or composite materials.
NFPA 52, §5.4.1

The container shall be designed for CNG service.
NFPA 52, §5.4.2

The container shall be permanently marked “CNG” by the manufacturer.
NFPA 52, §5.4.2.1

Cylinders shall be manufactured, inspected, marked, tested, retested, equipped, and used in accordance with the following:

- (1) U.S. Department of Transportation (DOT) or Transport Canada (TC) regulations, exemptions, or special permits
 - (2) ANSI NGV2, *Compressed Natural Gas Vehicle (NGV) Fuel Containers, specifically for CNG service*
 - (3) CSA B51, *Boiler, Pressure Vessel and Pressure Piping Code*
 - (4) U.S. Federal Motor Vehicle Safety Standard, 49 CFR 571.304, *Compressed Natural Gas Fuel Container Integrity*
- NFPA 52, §5.4.4*

Cylinders that have reached the labeled expiration date shall be removed from service.
NFPA 52, §5.4.4.1

Composite reinforced cylinders or other cylinders marked with exemption or special permit numbers shall be removed from service at the end of the service life designated in the exemption or special permit.
NFPA 52, §5.4.4.2

Cylinders, containers, and tanks shall be designed, fabricated, tested, and marked (stamped) in accordance with regulations of DOT, Transport Canada (TC) *Transportation of Dangerous Goods Regulations*, or the ASME *Boiler and Pressure Vessel Code*, “Rules for the Construction of Unfired Pressure Vessels,” Section VIII.
NFPA 55, §7.1.6.1

Pressure Relief Devices

Each cylinder complying with 5.4.4 shall be fitted with one or more pressure relief devices (PRDs) with the number, location, and part number as specified by the cylinder manufacturer and OEM for CNG service for a new vehicle, in accordance with the following:

- (1) For a retrofitted vehicle, each cylinder complying with 5.4.4 shall be of the number, location, and part number as specified by the cylinder manufacturer.
- (2) A PRD shall be in accordance with one of the following standards:
 - (a) CGA S-1.1, *Pressure Relief Device Standards — Part 1 — Cylinders for Compressed Gases*
 - (b) ANSI/IAS PRD 1, *Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers*
 - (c) ANSI/IAS PRD 1a, *Addenda to ANSI/IAS PRD 1, Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers*
 - (d) ANSI/CSA PRD 1b, *Addenda to ANSI/IAS PRD 1, Pressure Relief Devices for Natural Gas Vehicle (NGV) Fuel Containers*
- (3) The PRD shall be in direct communication with the fuel and vented to the atmosphere by a method that withstands the maximum pressure that results.

NFPA 52, §5.5.1

The discharge flow rate of the PRD shall not be reduced below that required for the capacity of the container upon which the device is installed.

NFPA 52, §5.5.1.1

PRDs shall be located so that the temperature to which they are subjected is representative of the temperature to which the fuel supply container is subjected.

NFPA 52, §5.5.1.2

The minimum rate of discharge of PRDs on containers shall be in accordance with CGA S-1.1, Pressure Relief Device Standards — Part 1 — *Cylinders for Compressed Gases*, or the ASME *Boiler and Pressure Vessel Code*, whichever is applicable.

NFPA 52, §5.5.2.1

Pressure relief valves for CNG service shall not be fitted with lifting devices.

NFPA 52, §5.5.2.2

The adjustment, if external, shall be provided with a means for sealing the adjustment to prevent tampering.

NFPA 52, §5.5.2.2.1

Valves

Valves, valve packing, and gaskets shall be designed or selected for the fuel over the full range of pressures and temperatures to which they are subjected under operating conditions.

NFPA 52, §5.9.1

Shutoff valves shall have a rated service pressure not less than the rated service pressure of the entire system and shall be capable of withstanding a hydrostatic test of at least four times the rated service pressure without rupture.

NFPA 52, §5.9.1.1

Valves of cast irons other than those complying with ASTM A 47, Standard Specification for Ferritic Malleable Iron Castings (Grade 35018); ASTM A 395, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; and ASTM A 536, Standard Specification for Ductile Iron Castings (Grade 60-40-18), shall not be used as primary stop valves.

NFPA 52, §5.9.2

Valves of a design that allows the valve stem to be removed without removal of the complete valve bonnet or without disassembly of the valve body shall not be used.

NFPA 52, §5.9.3

The manufacturer shall stamp or otherwise permanently mark the valve body to indicate the service ratings.

NFPA 52, §5.9.4

Hose and Hose Connections

Hose and metallic hose shall be constructed of or lined with materials that are resistant to corrosion and exposure to natural gas.

NFPA 52, §5.10.1

Hose, metallic hose, flexible metal hose, tubing, and their connections shall be designed or selected for the most severe pressures and temperatures under normal operating conditions with a burst pressure of at least four times the service pressure.

NFPA 52, §5.10.2

Prior to use, hose assemblies shall be tested by the OEM or its designated representative at a pressure at least twice the service pressure.

NFPA 52, §5.10.3

Hose and metallic hose shall be distinctly marked by the OEM or component manufacturer, either by the manufacturer's permanently attached tag or by distinct markings indicating the manufacturer's name or trademark, applicable service identifier, and design pressure.

NFPA 52, §5.10.4

Removal from CNG Service

In addition to NFPA 55 §§7.1.14 and 7.1.15 and for any installations subject to NFPA 52 requirements, if AFS determines that any CNG cylinder or installation constitutes an immediate danger to the public health, safety, and welfare, AFS shall require the immediate removal of all CNG and/or the immediate disconnection by a properly licensed company to the extent necessary to eliminate the danger. This may include equipment or any part of the system including the service container. A warning tag shall be attached by AFS until the unsafe condition is remedied. Once the unsafe condition is remedied, the tag may be removed by an AFS inspector or by the licensee if authorized by AFS.

Regulations for CNG, §13.38(a)

Sample Question 2

Shutoff valves shall have a rated service pressure _____ than the rated service pressure of the entire system and shall be capable of withstanding a hydrostatic test of at least _____ times the rated service pressure without rupture.

- A. Three times greater / four
- B. Two times greater / five
- C. Not less / four
- D. Three times greater / five

Answer on last page.

CNG Compression, Storage, and Dispensing

General

Equipment related to a compression, storage, or dispensing installation shall be protected to prevent damage from vehicles and minimize the possibilities of physical damage and vandalism.

NFPA 52, §7.3.2

Compression equipment shall be designed for use with CNG and for the pressures and temperatures to which it is subjected under operating conditions.

NFPA 52, §7.3.7

Compression equipment shall have pressure relief devices that limit each stage pressure to the maximum allowable service pressure for the compression cylinder and piping associated with that stage of compression.

NFPA 52, §7.3.8

Where CNG compression equipment is operated unattended, it shall be equipped with a high discharge and a low suction pressure automatic shutdown control.

NFPA 52, §7.3.9

In addition to NFPA 52 §7.3.2, and NFPA 55 §§4.11 and 7.1.9, equipment related to a compression, storage, or dispensing installation, shall be protected from tampering and damage in accordance with subsections (b) and (c) of this section. These protections shall be maintained in good condition at all times.

Regulations for CNG, §13.93(a)

Fencing at CNG stationary installations shall comply with the following.

- (1) Fencing material shall be chain link type with wire at least 12-1/2 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 the compression equipment, cylinder cascade(s), or container(s), and the entire dispensing system(s).
- (7) Fencing which is located more than 25 feet from any point of a CNG dispensing system(s), container(s), or compression equipment is designated as perimeter fencing. If a CNG dispensing system(s), cylinder cascade(s), or compression equipment is located inside perimeter fencing and is subject to vehicular traffic, it shall be protected against damage according to the specifications set forth in 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 CNG.

Regulations for CNG, §13.93(b)

Guardrails at CNG stationary installations shall comply with the following:

- (1) Vertical supports for guardrails shall be at least three-inch Schedule 40 steel pipe, or other material with equal or greater strength. The vertical supports shall be capped on the top or otherwise protected to prevent the entrance of water or debris into the guardpost, anchored in concrete at least 18 inches below the ground, and rise at least 30 inches above the ground. Supports shall be spaced four feet apart or less.
- (2) The top of the horizontal guardrailing shall be secured to the vertical supports at least 30 inches above the ground. The horizontal guardrailing shall be at least three-inch Schedule 40 steel pipe, or other material with equal or greater strength. The horizontal guardrailing shall be capped on the ends or otherwise protected to prevent the entrance of water or debris into the guardpost, and welded or bolted to the vertical supports with bolts of sufficient size and strength to prevent damage to the protected equipment under normal conditions, including the nature of the traffic to which the protected equipment is subjected.
- (3) Openings in horizontal guardrailing shall not exceed 36 inches. Only one opening is allowed on each side of the guardrailing. A means of temporarily removing the horizontal guardrailing and/or vertical supports to facilitate the handling of heavy equipment may be incorporated into the horizontal guardrailing and vertical supports. In no case shall the protection provided by the horizontal guardrailing and vertical supports be decreased.
- (4) A minimum clearance of 24 inches shall be maintained between the railing and any part of the CNG compression equipment, cylinder cascade(s), container(s), or dispensing equipment.
- (5) The operating end of the container(s) and any part of the CNG compression equipment, piping, or cylinder cascade(s) which is exposed to collision damage or vehicular traffic shall be protected from this type of damage.

Regulations for CNG, §13.93(c)

Dispenser protection. Each dispenser shall be secured to a concrete island a minimum of six inches above the normal grade and two inches above the grade of any other fuel dispenser(s). Each dispenser shall be protected against collision damage. Support columns or other such protection installed at the approach end(s) of the concrete island shall prevent collision with the dispenser. If such protection cannot be provided, then the requirements of subsection (c) of this section shall apply.

Regulations for CNG, §13.93(d)

Location of Installations

CNG storage containers charged with CNG not connected for use shall be located outdoors.

NFPA 52, §7.4.2.1

A facility in which CNG compression, storage, and dispensing equipment are sheltered by weather protection constructed in accordance with the requirements of the building code and by a roof designed for ventilation and dispersal of escaped gas shall be considered to be located outdoors.

NFPA 52, §7.4.2.2

Compression, storage, and dispensing equipment located outdoors shall be above ground.

NFPA 52, §7.4.2.3

Compression, storage, and dispensing equipment located outdoors shall be a minimum of 10 ft from the nearest important building or line of adjoining property that is able to be built upon or from any source of ignition.

NFPA 52, §7.4.2.3.2

A clear space of at least 3 ft shall be provided for access to all valves and fittings of multiple groups of containers.

NFPA 52, §7.4.2.5

Combustible material shall not be permitted within 10 ft of any stationary container.

NFPA 52, §7.4.2.6

The minimum separation between containers and aboveground tanks containing flammable or combustible liquids shall be 20 ft.

NFPA 52, §7.4.2.7

During outdoor fueling operations, the point of transfer shall be located at least 10 ft from any important building, mobile home, public sidewalk, highway, street, or road and at least 3 ft from storage containers.

NFPA 52, §7.4.2.8

Installation of Cylinders and Cylinder Appurtenances

Storage containers shall be installed above ground on stable, noncombustible foundations or in vaults with ventilation and drainage.

NFPA 52, §7.5.1

In areas subject to flooding, each container shall be anchored to prevent floating.

NFPA 52, §7.5.1.2

Containers shall be protected by painting or other equivalent means where necessary to inhibit corrosion.

NFPA 52, §7.5.2

Composite containers shall not be painted without prior permission from the container manufacturer.

NFPA 52, §7.5.2.1

Horizontally installed containers shall not be in direct contact with each other.

NFPA 52, §7.5.2.2

Composite containers shall be protected from UV radiation as required by the manufacturer.

NFPA 52, §7.5.2.3

Means shall be provided to prevent the flow or accumulation of flammable or combustible liquids under containers, such as by grading, pads, or diversion curbs.

NFPA 52, §7.5.3

Installation of Pressure Relief Devices

Pressure relief valves shall be arranged so that they discharge to a location where escaping gas does not impinge on buildings, other equipment, or areas that are occupiable by the public.

NFPA 52, §7.6.1

Pressure relief valves on pressure vessels shall be installed so that any discharge is in a vertical position.

NFPA 52, §7.6.2

Pressure relief valves shall be fitted with rain caps.

NFPA 52, §7.6.2.1

A pressure relief valve other than a rupture disc shall be installed in the fueling transfer system to prevent pressures in excess of 125 percent of the vehicle service pressure from being supplied to the vehicle.

NFPA 52, §7.6.3

As a precaution to keep pressure relief devices in reliable operating condition, care shall be taken in the handling or storing of CNG cylinders to avoid damage. Care shall also be exercised to avoid plugging by paint or other dirt accumulation of pressure relief device channels or other parts which could interfere with the functioning of the device.

Regulations for CNG, §13.106(c)

Installation of Pressure Regulator

Regulators shall be designed, installed, or protected so that their operation is not affected by freezing rain, sleet, snow, ice, mud, insects, or debris.

NFPA 52, §7.7.1

Regulator protection of 7.7.1 shall be permitted to be integral with the regulator.

NFPA 52, §7.7.2

Installation of Pressure Gauges

Gauges or other readout devices shall be installed to indicate compression discharge pressure, storage pressure, and dispenser discharge pressure.

NFPA 52, §7.8

Installation of Emergency Shutdown Equipment

A manually operated container valve shall be provided for each DOT or TC storage cylinder.

NFPA 52, §7.11.1.1

Individual ASME pressure vessels of any size, not part of a manifold system, shall have a manual shutoff valve.

NFPA 52, §7.11.1.3

The fill line on a storage container shall be equipped with a backflow check valve to prevent discharge of natural gas from the container in case of the rupture of the line, hose, fittings, or other equipment upstream of the storage containers.

NFPA 52, §7.11.2

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

An emergency manual shutdown device shall be provided within 10 ft of the dispensing area and also greater than 25 ft from the dispensing area.

NFPA 52, §7.11.5

This device, when activated, shall shut off the power supply and gas supply to the compressor and the dispenser.

NFPA 52, §7.11.5.1

Emergency shutdown devices shall be distinctly marked for easy recognition with a permanently affixed legible sign.

NFPA 52, §7.11.5.2

Breakaway protection shall be provided in a manner that, in the event of a pullaway, natural gas ceases to flow at any separation.

NFPA 52, §7.11.6

A breakaway device shall be installed at every dispensing point.

NFPA 52, §7.11.6.1

A breakaway device shall be arranged to separate using a force not greater than 150 lb. when applied in any direction that the vehicle would move.

NFPA 52, §7.11.6.2

Installation of Electrical Equipment

Fixed electrical equipment and wiring within areas specified in Table 7.4.2.9 shall comply with Table 7.4.2.9 and be installed in accordance with NFPA 70, *National Electrical Code*.

NFPA 52, §7.12.1

Operation

A cylinder shall not be charged in excess of the design pressure at the normal temperature for that cylinder.

NFPA 52, §7.14.1

DOT, TC, and ANSI/IAS NGV2 cylinders shall be charged in accordance with DOT, TC, and ANSI/IAS NGV2 regulations.

NFPA 52, §7.14.1.1

DOT, TC, and ANSI/IAS NGV2 cylinders shall not be subjected to pressure in excess of 125 percent of the marked service pressure even if, on cooling, the pressure settles to the marked service pressure.

NFPA 52, §7.14.1.2

CNG dispensing systems shall be equipped to stop fuel flow automatically when a fuel supply container reaches the temperature-corrected fill pressure (see 7.6.3).

NFPA 52, §7.14.3

The transfer of CNG into a fuel supply container shall be performed in accordance with instructions posted at the dispensing station.

NFPA 52, §7.14.5

Where CNG is being transferred to or from a motor vehicle, the engine shall be turned off.

NFPA 52, §7.14.6

Transfer systems shall be capable of depressurizing to facilitate disconnection.

NFPA 52, §7.14.8

CNG shall not be used to operate any device or equipment that has not been designed or modified for CNG service.

NFPA 52, §7.14.10

Sources of ignition shall not be permitted within 10 ft. of any filling connection during a transfer operation.

NFPA 52, §7.14.11

Fire Protection

A portable fire extinguisher having a rating of not less than 20-B:C shall be provided at the dispensing area.

NFPA 52, §7.15

Maintenance

Containers and their appurtenances, piping systems, compression equipment, controls, and detection devices shall be maintained in safe operating condition and according to manufacturers' instructions.

NFPA 52, §7.16.1

Dispenser Accuracy

The dispenser shall be designed to detect any malfunction that fills the vehicle fuel container in excess of the limits specified, or causes the relief valve required in 7.6.3 to open.

NFPA 52, §7.14.4

After any such malfunction, the dispenser shall be repaired and calibrated in accordance with Section 7.16 before continued operation.

NFPA 52, §7.14.4.1

Sample Question 3

An emergency manual shutdown device shall be provided within _____ of the dispensing area and also greater than 25 ft from the dispensing area.

- A. 10 ft
- B. 6 ft
- C. 3 ft
- D. 1 ft

Answer on last page.

Engine Fuel Systems

Vehicle Fueling Connections

CNG vehicle fueling connection devices shall be listed in accordance with ANSI/IAS NGV1, *Standard for Compressed Natural Gas Vehicle Fueling Connection Devices*.

NFPA 52, §5.11.1

The use of adapters shall be prohibited.

NFPA 52, §5.11.1.2

Installation of Fuel Supply Cylinders

Fuel supply containers on vehicles shall be permitted to be located within, below, or above the driver or passenger compartment, provided all connections to the container(s) are external to, or sealed and vented from, these compartments.

NFPA 52, §6.3.2

Fuel supply containers shall be protected with a means to prevent damage that occurs due to road hazards, loading, unloading, direct sunlight, exhaust heat, and vehicle use, including accidental cargo leakage.

NFPA 52, §6.3.2.1

Shields, if present, shall be installed in a manner that prevents damage to the shield or coating in the following occurrences:

- (1) Direct contact between the shield and the fuel supply container
- (2) Trapping of solid materials or liquids between the shield and fuel supply container

NFPA 52, §6.3.2.2

The fuel supply container shall be positioned to prevent contact with vehicle components such as, but not limited to, frame members, body panels, or brake lines that leads to container fretting or abrasion over time.

NFPA 52, §6.3.2.3

Vehicle fuel supply containers shall be mounted in a location to minimize damage from collision.

NFPA 52, §6.3.3

Containers shall be protected by covers from accidental contact with overhead electrical wiring.

NFPA 52, §6.3.3.1

The fuel system, including containers, shall be installed with as much road clearance as practical.

NFPA 52, §6.3.3.2

This minimum clearance shall be measured from the road to the container, its housing, or its fittings, whichever is lowest, and shall not, with the vehicle loaded to its gross weight rating, allow any component to touch the road surface in the event of a flat tire or the removal of any tire.

NFPA 52, §6.3.3.3

No portion of a fuel supply container or container appurtenance mounted on the undercarriage of the vehicle shall be located ahead of the front axle or behind the point of attachment of the rear bumper to the vehicle.

NFPA 52, §6.3.3.4

Container valves shall be protected from physical damage using the vehicle structure, valve protectors, or a metal shield.

NFPA 52, §6.3.3.4.1

No part of the fuel supply container or its appurtenances shall protrude beyond the sides or top of any vehicle to prevent the container from being struck or punctured.

NFPA 52, §6.3.3.5

Installation of Valves

Every cylinder shall be equipped with either of the following:

- (1) A manual valve
- (2) A normally closed, remotely actuated shutoff valve connected directly to the cylinder and equipped to bleed the cylinder manually.

NFPA 52, §6.6.1

Labeling

A vehicle equipped with a CNG fuel system shall bear the following durable labels:

- (1) A label readily visible and located in the engine compartment shall include the following:
 - (a) Identification as a CNG-fueled vehicle
 - (b) System service pressure
 - (c) Installer's name or company
 - (d) Fuel container life expires (insert date for limited-life fuel containers. This label item not required for containers with unlimited life.)
 - (e) Total container water volume in gallons (liters)
 - (f) Date by which fuel containers are to be inspected (insert date) and every (insert number) months thereafter
- (2) A label located at the fueling connection receptacle shall include the following:
 - (a) Identification as a CNG-fueled vehicle
 - (b) System service pressure
 - (c) Fuel container life expires (insert date for limited-life fuel containers. This label item not required for containers with unlimited life.)
 - (d) Fuel containers are to be inspected by (insert date) and each (insert number) months thereafter.

NFPA 52, §6.11.1

The fuel container inspection dates shall be changed after each required container inspection to denote the next required inspection date and shall be permitted on a separate additional label.

NFPA 52, §6.11.1.1

In addition to the label(s) required by 6.11.1, each vehicle shall be identified with a weather-resistant, diamond shaped label located on the exterior vertical surface or near vertical surface on the lower right rear of the vehicle other than on the bumper of the vehicle.

NFPA 52, §6.11.3

The labels for vehicles less than Class 6 shall be a minimum of 4.72 in. long × 3.27 in. high.

NFPA 52, §6.11.3.1

The marking in the label shall consist of a border and the letters "CNG" of silver or white reflective luminous material on a blue background.

NFPA 52, §6.11.3.3

Nameplates on ASME containers manufactured on or after November 1, 1994, shall be stainless steel.

Regulations for CNG, §13.40(a)(2)

System Testing

The completed fuel system assembly shall be leak tested using natural gas or inert gas.

NFPA 52, §6.12.1

Before use, every connection shall be verified leak free with a noncorrosive leak detector solution or a leak detector instrument after the equipment is connected and pressurized to its service pressure.

NFPA 52, §6.12.2

If the completed assembly is leak tested with natural gas, the testing shall be done under ventilated conditions.

NFPA 52, §6.12.3

Where a vehicle is involved in an accident or fire causing damage to the CNG container, or if the container is subjected to a pressure greater than 125 percent of service pressure, the CNG container shall be replaced or removed, inspected, and retested in accordance with the document under which it was originally manufactured before being returned to service.

NFPA 52, §6.12.4

Where a vehicle is involved in an accident or fire causing damage to any part of the CNG fuel system, the system shall be repaired and retested before being returned to service.

NFPA 52, §6.12.5

Venting of CNG to the Atmosphere

The venting or depressurization of a CNG container shall be performed only by trained personnel using written procedures.

NFPA 52, §6.14.1

The gas to be removed from the container shall be discharged into a closed transfer system or vented by an approved method of atmospheric venting.

NFPA 52, §6.14.1.1

A valve shall be used to control the discharge of gas from high-pressure systems to a venting system.

NFPA 52, §6.14.1.2

Direct gas venting shall be done through a vent tube that diverts the gas flow to atmosphere.

NFPA 52, §6.14.3

The vent tube shall have a gastight connection to the container prior to venting.

NFPA 52, §6.14.3.1

The vent tube shall be constructed of Schedule 80 pipe of at least 2 in. diameter.

NFPA 52, §6.14.3.2

Sample Question 4

Vehicle fuel supply containers shall be mounted in a location to maximize damage from collision.

- A. True
- B. False

Answer on last page.

Natural Resources Code -Chapter 116 - Compressed Natural Gas

Entry on Property; Inspection and Investigation

(a) An employee, agent, or inspector of the commission may enter the premises of a licensee under this chapter or any building or other premises open to the public or inspect any CNG or LNG system or motor vehicle equipped with CNG or LNG equipment at any reasonable time for the purpose of determining and verifying compliance with this chapter and rules of the commission adopted under this chapter.

(b) Any authorized representative of the LPG division may enter any building or premises where an accident has occurred in which CNG or LNG was a probable cause for purposes of investigating the cause, origin, and circumstances of such accident. The LPG division may request that any state or local authority having jurisdiction take appropriate action as may be necessary for preservation of property and premises.

Texas Natural Resources Code, §116.015

Disciplinary Action

If the commission or division determines that the probable violation or noncompliance constitutes an immediate danger to the public health, safety, and welfare, it shall require the immediate cessation of the probable violation or noncompliance and proceed with a hearing.

Texas Natural Resources Code, §116.037(e)

Registration

Each motor vehicle that is equipped with a CNG or LNG cargo tank and each motor vehicle used principally to transport CNG or LNG in portable cylinders or containers must be registered with the commission as provided by commission rules.

Texas Natural Resources Code, §116.072(a)

Warning Tags

(a) An employee, agent, or inspector of the commission may declare unsafe or dangerous for service any motor vehicle required to be registered under this chapter or any CNG or LNG equipment or system that is defective or that does not otherwise conform to the safety requirements of this chapter and the rules adopted under this chapter and shall attach a warning tag to the motor vehicle, equipment, or system in a conspicuous location.

(b) A person may not sell, furnish, deliver, or supply compressed natural gas and liquefied natural gas for use or consumption by or through a motor vehicle or system in a public place or operate a motor vehicle having CNG or LNG equipment to which a warning tag is attached.

(c) A warning tag may be removed on approval of the commission or by a person designated by the commission to remove the tag. A warning tag may not be removed by any person who is not authorized to remove the tag by the commission.

Texas Natural Resources Code, §116.103

Administrative Penalty

(a) If a person violates this chapter, a rule of the commission adopted under this chapter, or a term, condition, or provision of a license or registration issued by the commission under this chapter and the violation results in pollution of the air or water of this state or poses a threat to the public safety, the person may be assessed a civil penalty by the commission.

(b) The penalty may not exceed \$10,000 a day for each violation. Each day a violation continues may be considered a separate violation for purposes of penalty assessments.

(c) In determining the amount of the penalty, the commission shall consider the person's history of previous violations of this chapter, the seriousness of the violation, any hazard to the health or safety of the public, and the demonstrated good faith of the person charged.

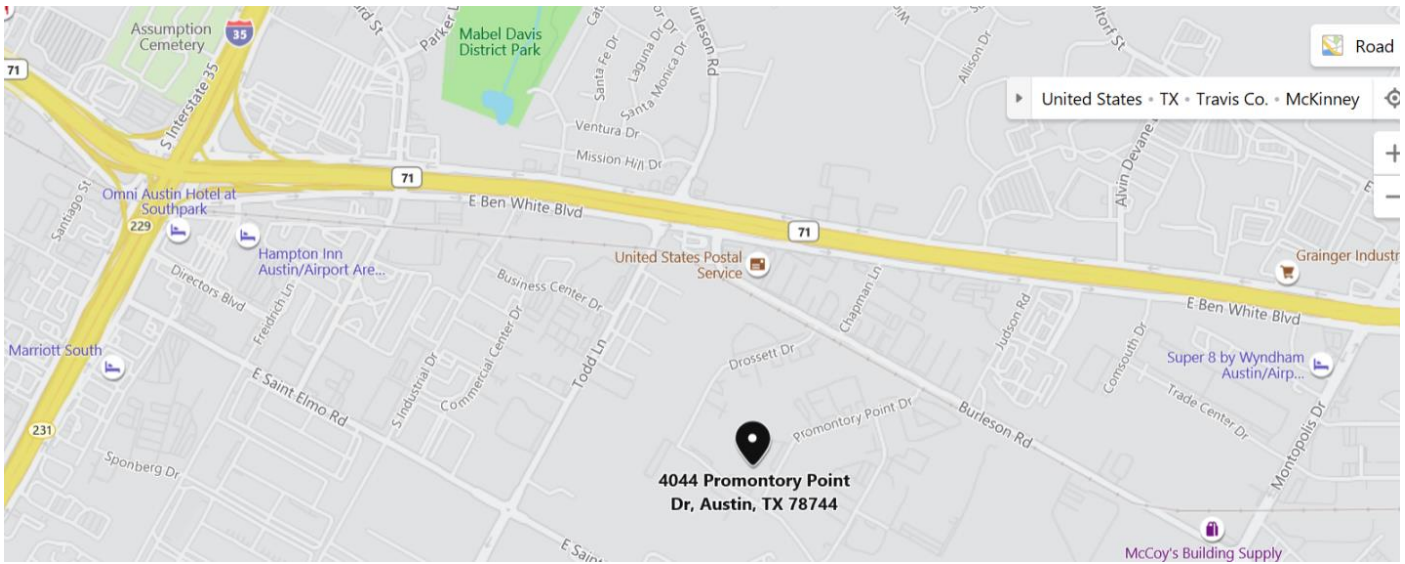
Texas Natural Resources Code, §116.143

Penalty Assessment Procedure

A civil penalty under Section 116.145 of this code may be assessed only after the person charged with the violation has been given an opportunity for a public hearing.

Texas Natural Resources Code, §116.144(a)

**Alternative Fuels Training Center
4044 Promontory Point
Austin, Texas 78744**



**Sample Question
Answers**

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