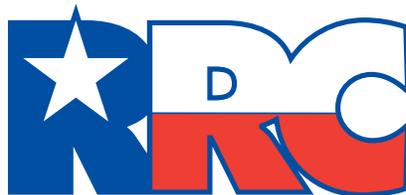


# **TEXAS CNG EXAMINATION STUDY GUIDE**

Transport Driver/Service  
and Installation/  
DOT Cylinder Filling  
Employee Level



**RAILROAD COMMISSION OF TEXAS**

September 2012



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This publication is intended for use in its entirety as a guide for persons preparing to take Railroad Commission CNG qualifying examinations. Any other use or distribution of this publication or use or distribution of any portion of this publication for any purpose whatsoever is considered by the Railroad Commission of Texas to be misuse of this publication.

This publication is not intended to be an exhaustive treatment of the subjects covered and should not be interpreted as precluding the use of other safety programs or procedures that comply with (1) applicable federal, state, and/or local code provisions, statutes, ordinances, and/or other regulations, including, but not limited to, the Railroad Commission of Texas' CNG Safety Rules (16 Texas Administrative Code, Chapter 13) and codes adopted by the Railroad Commission of Texas, and/or (2) other industry standards and/or practices.

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## Exam administration

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### Taking an examination in Austin

You may take any Railroad Commission qualifying examination in Austin without pre-registering (“walk-in”) on any business day, excluding holidays, from 8:00 a.m. to 12:00 noon at the Commission’s Alternative Fuels Training Center. The training center is located at 6506 Bolm Road, on the northwest corner of the intersection of Bolm Road and U.S. Highway 183.

Tuesdays and Thursdays are the preferred days for walk-in examinations.

(See map to Training Center on page 23.)

### Taking an examination outside of Austin

You may also take any Railroad Commission qualifying examination at more than two dozen other locations statewide. Exam dates, times and locations are listed three months in advance on the Commission’s web site. To view a complete schedule, go to [www.rrc.state.tx.us](http://www.rrc.state.tx.us). From the drop-down menu under “Education and Training,” choose “Training Classes & Qualifying Exams” and click on “Class/Exam Schedule.” The online schedule has links to maps showing each class and exam location.

You must register at least two business days in advance to take an examination outside of Austin. To register online, go to [www.rrc.state.tx.us](http://www.rrc.state.tx.us). From the drop-down menu under “Education and Training,” choose “Training Classes & Qualifying Exams” and click on “Register Now.” The web site allows you to register up to four people for an examination.

When you register online, you will receive a return e-mail confirming the registration and the dates and locations of the exams. Registering online also ensures that you will receive advance notification of any changes in the examination date, time or location.

### Payment for exams; CNG Form 1016; ID required

The fee is \$40.00 for each employee-level exam and \$70.00 for each management-level exam. Fees are non-refundable by state law, and cash cannot be accepted.

You may pay the required examination fee at any exam location by check or money order payable to the Railroad Commission of Texas. CNG Form 1016, “Application for Examination,” may also be completed at the examination site. Examinees must also present an official state-issued driver’s license or photo ID at the exam site.

You may also pay your examination fee by credit card in advance online. To pay by credit card, go to [www.rrc.state.tx.us](http://www.rrc.state.tx.us). From the drop-down menu under “Education and Training,” choose “Training Classes & Qualifying Exams” and click on “Pay Online.” Be sure to print out the confirmation page in Step 6. Make a copy of the confirmation page for your records and bring a copy with you to the examination site.

### Open-book examinations

All Railroad Commission employee-level qualifying examinations are open book. Examinees may use a copy of the Commission’s *Regulations for Compressed Natural Gas and Liquefied Natural Gas*. This study guide may not be used during any employee-level examination.

### **Examination time limit**

Railroad Commission employee-level qualifying examinations must be completed within two hours after the examination is given to you, including any breaks you elect to take. The examination proctor is the official timekeeper. You must submit both the examination itself and your answer sheet to the proctor within the two-hour limit.

### **Grades, reports and retakes**

The minimum passing grade is 75 percent on all Railroad Commission qualifying examinations.

Examinations administered at the Training Center in Austin are graded on-site, and examinees are immediately informed of the results. If you fail an examination that you took in Austin, you may retake that same examination only one additional time during a business day. Any subsequent examination must be taken on another business day, unless approved by the Commission.

Exams taken outside of Austin are graded as soon as possible, and the results of the examination are reported within 10 working days.

If you pass an examination, the Railroad Commission will issue you a blue certification card within 10 working days. You will be notified by letter if you fail an examination.

### **Contacts**

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# TEXAS CNG EXAMINATION STUDY GUIDE EMPLOYEE-LEVEL TRANSPORT DRIVER/SERVICE AND INSTALLATION/DOT CYLINDER FILLING

## Who should use this guide?

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You should use this guide if you plan to take the Railroad Commission's employee-level qualifying examination authorizing the sale, storage, transportation for delivery and dispensing of CNG and the sale, installation, servicing and repair of CNG systems.

## What books do I need?

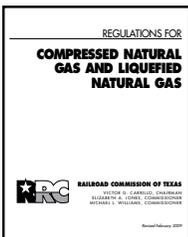
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This examination tests your knowledge of the laws and standards that apply to the sale, storage, transportation for delivery, and dispensing of CNG, and to the sale, installation, service and repair of CNG systems in Texas.

These laws and standards are found in the Railroad Commission's *Regulations for Compressed Natural Gas and Liquefied Natural Gas* (16 Texas Administrative Code, Chapter 13), known informally as the Commission's CNG Safety Rules.

## Where do I get the book?

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You may download the current edition of the Railroad Commission's *Regulations for Compressed Natural Gas and Liquefied Natural Gas* free online. Go to the Commission's home page at [www.rrc.state.tx.us](http://www.rrc.state.tx.us). From the drop-down menu under "Education and Training," choose "Training Classes & Qualifying Exams" and click on "CNG/LNG Safety Rules (PDF)." You may also buy a printed copy of the book for \$10.00, tax included, by calling the Railroad Commission's publications office at (512) 463-7309.

## Sections and topics

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Before you take this examination you should know the definitions on p. 9 of this study guide and the contents of the sections of the codes and standards listed below. The actual examination may not include questions on each of the listed sections and topics, and the exam questions are not organized by topic as they are in this study guide.

### *Regulations for Compressed Natural Gas and Liquefied Natural Gas*

§13.25	Filings Required for Stationary CNG installations
§13.26	Design and Construction of Cylinders, Pressure Vessels, and Vapor Recovery Receivers.
§13.27	Pressure Relief Devices
§13.28	Pressure Gauges

§13.29	Pressure Regulators
§13.30	Piping
§13.31	Valves
§13.32	Hose and Hose Connections
§13.33	Compression Equipment
§13.34	Vehicle Fuel Connection
§13.36	Report of CNG Incident/Accident
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§13.99	Installation of Piping and Hoses
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§13.101	Installation of Emergency Shutdown Equipment
§13.102	Installation of Electrical Equipment
§13.103	Stray or Impressed Currents and Bonding
§13.104	Operation
§13.105	Fire Protection
§13.106	Maintenance
§13.107	Dispenser Accuracy
§13.131	Applicability
§13.132	System Component Qualification
§13.133	Installation of Fuel Supply Cylinders
§13.134	Installation of Venting Systems
§13.135	Installation of Piping
§13.136	Installation of Valves
§13.137	Installation of Pressure Gauges
§13.138	Installation of Pressure Regulators
§13.139	Installation of Fueling Connection
§13.140	Labeling
§13.141	System Testing
§13.142	Maintenance and Repair
§13.143	Venting of CNG to the Atmosphere
§13.181	Applicability
§13.182	Scope
§13.183	System Component Qualifications
§13.184	General
§13.185	Installation

§13.186	Outdoor Installations
§13.187	Installation of Pressure Relief Valves
§13.188	Installation of Pressure Gauges
§13.189	Pressure Regulation
§13.190	Piping and Hose
§13.191	Testing
§13.192	Installation of Emergency Shutdown Equipment
§13.193	Operation
§13.194	Maintenance and Inspection

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## Terms and definitions

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NOTE: The list below is not exhaustive. You are responsible for knowing all the terms and definitions that apply to the CNG activities you will perform.

### *Regulations for Compressed Natural Gas and Liquefied Natural Gas*

A **cascade storage system** is defined as storage in multiple cylinders.

**CNG Safety Rules, §13.3(9)**

A **CNG system** includes safety devices, cylinders, piping, fittings, valves, compressors, regulators, gauges, relief devices, vents, installation fixtures, and other CNG equipment.

**CNG Safety Rules, §13.3(13)**

**Compressed natural gas** is a mixture of hydrocarbons in gases and vapors consisting principally of methane.

**CNG Safety Rules, §13.3(17)**

A **fuel supply cylinder** is a cylinder mounted upon a vehicle for storage of CNG as a fuel supply for the vehicle's internal combustion engine.

**CNG Safety Rules, §13.3(23)**

**Pressure-filled** refers to a method of transferring CNG into cylinders by using pressure differential.

**CNG Safety Rules, §13.3(37)**

A **transport** is 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.

**CNG Safety Rules, §13.3(48)**

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## Key topics

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

As you study the applicable codes and standards, pay special attention to the facts, rules and procedures related to the following key topics. Then, when you take the examination, read each question very carefully.

### **Filings Required for Stationary CNG Installations**

(a) Prior to the installation of any CNG container which would result in an aggregate storage capacity in excess of 240 cubic feet water volume, the licensee must submit CNG Form 1500 to the Railroad Commission at least 30 days prior to construction.

(b)(5) A nonrefundable fee of \$50 must be submitted for the initial submission of a CNG Form 1500 and \$30 for each resubmission.

(f)(1) A CNG Form 1501 must be submitted to the Commission within 10 calendar days after completion of a CNG installation having an aggregate storage capacity of less than 240 standard cubic feet of CNG.

(k)(1) Appurtenances and equipment must be listed by a nationally recognized testing laboratory such as the Canadian Gas Association (CGA), Factory Mutual (FM) or Underwriters Laboratories (UL).

***CNG Safety Rules, §13.25***

### **Design and Construction of Cylinders, Pressure Vessels, and Vapor Recovery Receivers**

(a) Cylinders and pressure vessels must be fabricated of steel, aluminum, or composite materials.

(b) Cylinders must be manufactured, inspected, marked, tested, and retested in accordance with United States Department of Transportation (DOT) regulations and exemptions for compressed natural gas (CNG) service.

Fuel supply cylinders must have a rated service pressure of not less than 2,400 psig at 70 degrees Fahrenheit.

Cascade storage cylinders must have a rated service pressure of not less than 3,600 psig at 70 degrees Fahrenheit.

Steel cylinders must be manufactured and tested in compliance with DOT 3AA specifications.

Fiber reinforced plastic and full composite cylinders must comply with DOT FRP1 standard.

Fiber reinforced plastic and hoop wrapped composite cylinders must comply with DOT FRP2 standard.

Vapor recovery receivers must have a minimum rated service pressure of 250 psig and be manufactured, inspected, marked, tested, and, if applicable, retested in accordance with DOT regulations or the American Society of Mechanical Engineers (ASME) Code.

(d) Pressure vessels and containers other than cylinders shall be manufactured, inspected, marked, and tested in accordance with the "Rules for the Construction of Unfired Pressure Vessels," ASME Boiler and Pressure Vessel Code, Section VIII (Division I or II).

***CNG Safety Rules, §13.26***

## Pressure Relief Devices

(a) Each fuel supply cylinder must be fitted with a pressure relief device in accordance with the following:

- (1) Pressure relief devices for cylinders must be in accordance with Compressed Gas Association (CGA) Pamphlet S-1.1, "Pressure Relief Device Standards--Part 1, Cylinders for Compressed Gases."
- (2) Cylinders manufactured under a U.S. Department of Transportation exemption or special permit that require fire tests for design qualification must be equipped with pressure relief devices in accordance with CGA S-1.1 and be of the type, temperature rating, pressure rating, number, and location used in the fire tests.
- (3) The pressure relief device must communicate with the fuel and be vented to the atmosphere by a method that will withstand the maximum pressure which will result.
- (4) The discharge flow rate of the pressure relief device must not be reduced below that required for the capacity of the container upon which the device is installed.
- (5) Pressure relief devices must be located so that the temperature to which they are subjected is representative of the temperature to which the cylinder is subjected.

(d) Pressure relief valves for CNG service must not be fitted with lifting devices. The adjustment, if external, must be provided with means for sealing the adjustment to prevent tampering by unauthorized persons. If the seal is broken at any time, the valve must be removed from service until it has been reset and sealed. Any adjustments necessary must be made by the manufacturer or the manufacturer's authorized representatives.

***CNG Safety Rules, §13.27***

## Piping

(a) Piping, tubing, fittings, gaskets, and packing material must be compatible with the fuel under the service conditions.

(b) All tubing must be a minimum of Type 304 Stainless Steel. All tubing connectors must be a minimum of Type 304 Stainless Steel industrial type connectors having a minimum design pressure of 5,000 psig.

(c) Piping, tubing, fittings, and other piping components between a cylinder or pressure vessel and the first shutoff valve must be capable of withstanding a hydrostatic test of at least four times the rated working pressure without structural failure.

(d) Piping must be American Standard Testing Material (ASTM) steel, Schedule 80, or better. All pipe fittings must be forged steel stamped 6,000 psi or greater.

All tubing connectors must be a minimum of Type 304 Stainless Steel industrial type connectors having a minimum design pressure of 5,000 psig.

***CNG Safety Rules, §13.30***

## Valves

- (a) Valves, valve packing, and gaskets must be suitable for the fuel over the full range of pressures and temperatures to which they may be subjected under normal operating conditions.
- (b) Shutoff valves must have a design working pressure not less than the rated working pressure of the entire system and must be capable of withstanding a hydrostatic test of at least four times the rated service pressure without failure. Leakage must not occur at less than one and one half times the rated service pressure using dry air as the test medium.
- (c) Valves of cast iron or semi-steel other than those complying with ASTM Specifications A-536 (Grade 60-40-18), A-395, and A-47 (Grade 35018) must not be used as primary shutoff valves.
- (d) Valves of a design that will allow the valve stem to be removed without removal of the complete bonnet or disassembly of the valve body must not be used.
- (e) The manufacturer must stamp or otherwise permanently mark the valve body to indicate the service ratings. Exception: Fuel supply container valves need not be marked as such.
- CNG Safety Rules, §13.31***

## Hose and Hose Connections

- (a) Hose and metallic hose must be of or lined with materials that are resistant to corrosion and the actions of CNG.
- (b) Hose, metallic hose, flexible metal hose, tubing, and their connections must be suitable for the most severe pressure and temperature conditions expected under normal operating conditions with a burst pressure of at least four times the maximum working pressure.
- (c) Hose assemblies must be tested by the manufacturer or its designated representative prior to use at pressure at least twice the service pressure.
- (d) Hose must be continuously and distinctly marked with the manufacturer's name or trademark, the words "CNG service," and the working pressure. Metallic hose must have a manufacturer's permanently attached tag marked with the manufacturer's name or trademark, the words "CNG service," and the working pressure. This subsection does not apply to the hose installed from the regulator to the mixer on a motor vehicle.
- (e) Hose, metallic hose, or flexible metal hose used in CNG vehicle fuel system areas where a high degree of flexibility is required for vehicle safety must comply with the requirements of subsections (a)–(d) of this section.
- (f) Hose, metallic hose, or flexible metal hose may be used in fuel lines provided it meets the following requirements:
- (1) The hose must be capable of conducting an electrical current from one end of the hose to the other end without the necessity of connecting a jumper wire from end to end.
  - (2) The length of the hose including the swaged fittings on each end must not exceed 48 inches.

- (3) The hose must be protected from fretting and sources of extremely high heat.
- (4) The hose must have fittings or connectors on each end made of Type 304 or better stainless steel with a minimum design pressure of at least 5,000 psig.

***CNG Safety Rules, §13.32***

### **Compression Equipment**

(a) Compression equipment must be designed for use with CNG and for the pressures and temperatures to which it may be subjected under normal operating conditions. It must have pressure relief devices which must limit each stage pressure to the maximum allowable working pressure for the cylinder and piping associated with that stage of compression.

***CNG Safety Rules, §13.33***

### **Removal from CNG Service**

If the Railroad Commission determines that a CNG cylinder constitutes an immediate danger to the public health, safety and welfare, a properly licensed company must remove the CNG immediately to the extent necessary to eliminate the danger.

***CNG Safety Rules, §13.38***

### **Manufacturer's Nameplates and Markings on ASME Containers**

CNG must not be introduced into any ASME container not equipped with a manufacturer's original or manufacturer's replacement nameplate permanently attached to the container.

***CNG Safety Rules, §13.40***

#### **SAMPLE QUESTION**

Shutoff valves must have a design working pressure \_\_\_\_\_ than the rated working pressure of the entire system and must be capable of withstanding a hydrostatic test of at least \_\_\_\_\_ times the rated service pressure without failure.

- A. Three times greater / three
- B. Two times greater / three
- C. Not less / four
- D. One and one-half times greater / four

***Answer: C***

# **CNG COMPRESSION, STORAGE, AND DISPENSING SYSTEMS**

## **General**

(a) Equipment related to a compression, storage, or dispensing installation, excluding automatic dispensers and residential fueling facilities, must be protected from tampering and damage and the protection must be maintained in good condition at all times and in accordance with one of the three standards set forth in this subsection. Automatic dispensers for general public use must be protected against collision damage in accordance with subsection (d) of this section.

### **(1) Fencing**

(A) Fencing material must be chain link type with wire no smaller than 12 ½ American wire gauge (AWG).

(B) Fencing must be no less than 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 no more than four inches apart.

(C) All uprights, braces, and/or corner posts must be composed of noncombustible material if located within distances for sources of ignition or combustible materials required in Table 1 of §13.94 of this title (relating to Location of Installations) of the enclosed CNG transfer systems or CNG cylinders.

(D) All fenced enclosures must have at least one gate suitable for ingress and egress. All gates must be locked whenever the area enclosed is unattended.

(E) A minimum clearance of two feet must be maintained between the fencing and the compression equipment, cylinder cascades, or containers, and the entire dispensing systems.

(F) Fencing which is located more than 25 feet from any point of a CNG dispensing system, container, or compression equipment is designated as perimeter fencing. If a CNG dispensing system, cylinder cascade, or compression equipment is located inside perimeter fencing and is subject to vehicular traffic, it must be protected against damage according to the specifications set forth in paragraph (2) of this subsection.

(G) The cylinder cascade containers, compression equipment, and the entire dispensing system must be completely enclosed by fencing.

### **(2) Guardrails.**

(A) Where fencing is not used to protect the installation as provided in paragraph (1) of this subsection, then valve locks, a means of locking the electric control for the compressor(s), or other suitable means must be provided to prevent unauthorized withdrawal of CNG.

(B) Vertical supports for guardrails must be a minimum of three-inch Schedule 40 steel pipe, or material with equal or greater strength. The vertical supports must be capped on the top and anchored below the ground a minimum of 18 inches in concrete, with a minimum height of 30 inches above the ground. Supports must be spaced no more than four feet apart.

(C) The top of the horizontal guard railing must be secured to the vertical supports a minimum of 30 inches above the ground. The horizontal guard railing must be no less than three-inch Schedule 40 steel pipe, or material with equal or greater strength. The horizontal guard railing must be welded or bolted to the vertical supports with bolts of sufficient size and strength to prevent displacement of the horizontal guard railing.

(D) No opening in the horizontal guard railing may exceed 36 inches. A means of temporarily removing the guard railing and/or vertical supports to facilitate the handling of heavy compression equipment may be incorporated into the horizontal guard railing and vertical supports. In no case must the protection provided by the guard railing and vertical supports be decreased.

(E) A minimum clearance of 24 inches must be maintained between the railing and any part of the CNG compression equipment, cylinder cascades, containers, or dispensing equipment.

(F) The operating end of the container and any part of the CNG compression equipment, piping, or cylinder cascade which is exposed to vehicular traffic must be protected from damage by the vehicular traffic. The protection must extend at least 24 inches beyond any part of the CNG compression equipment, cylinder cascade, container, or dispensing equipment which is exposed to vehicular traffic.

(3) **Protection.** Each automatic dispenser must 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. Each automatic dispenser must be protected against collision damage. Support columns or other such protection installed at the approach ends of the concrete island must prevent collision with the automatic dispenser. If such protection cannot be provided, then the requirements of paragraph (2) of this subsection must apply.

(d) The authorized automatic dispenser must have the following features:

(1) A key, card, or code system must be used.

(2) All appurtenances, metering equipment, and other related equipment installed on an automatic dispenser must meet all applicable requirements of the Railroad Commission's *Regulations for Compressed Natural Gas*.

(3) All dispensing equipment must be fabricated of material suitable for CNG, and resistant to the action of CNG under service conditions. Pressure-containing parts must be of steel, ductile iron, forged steel, brass, or an equivalent material. Aluminum may be used for approved meters. All piping must be Schedule 80, and all pipe fittings must be forged steel stamped 6,000 psi or greater.

(4) The automatic dispensing system must incorporate a cutoff valve with an opening and closing device which ensures the valve is in a closed position when the dispenser is deactivated.

(5) A device must be installed in the CNG piping in such a manner that displacement of the dispenser will result in the displacement of such piping on the downstream side of the device.

- (6) The transfer hose on an automatic dispenser must incorporate a pull-away device. The pull-away device must be installed so as to separate by a force not greater than 45 pounds when applied in any horizontal direction. The device must stop the flow of CNG in the event of a separation.
- (7) All electric installations within the automatic dispenser enclosure and the entire pit or open space beneath the dispenser must comply with the National Electrical Code, Class 1, Group D, Division 2, except for dispenser components located at least 48 inches above the dispenser base which are intrinsically safe according to the National Electrical Code.
- (8) The fueling connector on an automatic dispenser must have a remote vapor discharge and a manual shut-off valve.

***CNG Safety Rules, §13.93***

**Location of Installations**

- (a) CNG compression, storage, and dispensing must be located and conducted outdoors.
- (b) A facility in which CNG compression, storage, and dispensing equipment is sheltered by a canopy-type structure constructed of noncombustible materials which has at least one side open and a roof designed for ventilation and dispersal of escaped gas is in compliance, provided that a ventilation space 12 inches wide is provided along the full length at the top of 3 sides.
- (c) CNG storage cylinders charged with CNG and not connected for use must be located outdoors in a fenced, protected area. Each cylinder must be equipped with a valve cap or guard securely tightened.
- (d) With the exception of a customer service line, compression, storage, and dispensing equipment must not be placed in any area that is directly beneath an electric transmission line or distribution line or that area which is six feet to either side of the line.
- (e) A clear space of three feet must be provided for access to all valves and fittings of multiple groups of cylinders.
- (f) A vehicle is not considered a source of ignition if the fuel-fired equipment is shut off completely before entering an ignition source area.

***CNG Safety Rules, §13.94***

**Installation of Cylinders and Cylinder Appurtenances**

- (a) Storage cylinders must be installed aboveground on stable noncombustible foundations.
- (b) Cylinders must be protected by painting or other equivalent means where necessary to inhibit corrosion.
- (c) All external steel surfaces on cylinders subjected to direct or indirect sunlight or heat must be painted white.
- (d) A means must be provided to prevent the flow or accumulation of flammable or combustible liquids under cylinders, such as by diversion curbs, grading or pads.

***CNG Safety Rules, §13.95(d)***

### **Installation of Pressure Relief Devices**

(a) Pressure relief valves must be so arranged so that escaping gas will not impinge upon buildings, other equipment, or areas that could be occupied by the public.

(b) A pressure relief device must be provided in the transfer system to prevent overpressure of a vehicle.

***CNG Safety Rules, §13.96***

### **Installation of Pressure Regulator**

Regulators must be designed, installed and protected so their operation will not be affected by freezing rain, sleet, snow, ice, mud or debris.

***CNG Safety Rules, §13.97***

### **Installation of Pressure Gauges**

Gauges must be installed to indicate compression discharge, storage pressure and fuel supply cylinder fill pressure.

***CNG Safety Rules, §13.98***

### **Installation of Piping and Hoses**

(a) Piping and tubing must be installed with adequate provisions for expansion, contraction, jarring, vibration, and settling.

(b) All exterior piping installed underground must be installed with a minimum of 18 inches of cover unless it is located beneath driveways, roads, or streets. If the piping is installed beneath driveways, roads, or streets, it must be buried at a depth to prevent damage from vehicular traffic or encased in steel pipe or bridged (shielded). The 18-inch cover may be reduced to 12 inches if external damage to the piping is not likely to result (e.g., piping is under a lawn area not subjected to traffic). If a minimum of 12 inches of cover cannot be maintained, the pipe must be encased in steel pipe or bridged (shielded) or protected against mechanical injury by means of curbs, slabs, substantial posts, or other suitable means.

(1) All underground piping must be installed with sufficient clearance from any other underground structure, and to protect against damage from proximity to other structures.

(2) Underground piping must be protected from corrosion in compliance with industry recognized practices.

(3) Uncoated threaded or socket-welded joints must not be used in piping in contact with soil or where internal or external crevice corrosion may occur.

(c) The use of hose in an installation is limited to:

(1) a vehicle fueling hose; and

(2) a section of metallic reinforced hose not exceeding 36 inches in length to provide flexibility where necessary. Each section must be installed so as to be protected against mechanical damage and be readily visible for inspection. The manufacturer's identification must be retained in each section.

***CNG Safety Rules, §13.99***

## Testing

(a) Piping, tubing, hoses, and hose assemblies must be leak-tested to prove free from leaks at a pressure equal to at least the normal operating pressure of that portion of the system.

***CNG Safety Rules, §13.100***

## Installation of Emergency Shutdown Equipment

(d) The fill line on storage cylinders must be equipped with a backflow check valve to prevent discharge of natural gas from the cylinder in case of a line, hose, or fittings rupture.

(e) Device(s) for emergency shutdown of compression and dispensing equipment must be provided at a location remote from the dispensing area.

***CNG Safety Rules, §13.101***

## Installation of Electrical Equipment

(a) Electrical installations located within the vicinity of any compressor, cascade, or dispensing equipment must be in accordance with the *National Electrical Code* (NEC) for Class 1, Group D; Hazardous Locations, Division 2. A Division 2 electrical area at a compressor, cascade, or dispensing equipment does not extend beyond an unpierced wall, roof or vapor-tight partition.

***CNG Safety Rules, §13.102***

## Stray or Impressed Currents and Bonding

(a) When stray or impressed currents are used or may be present on dispensing systems (such as for cathodic protection), protective measures must be taken to prevent ignition.

(b) Static protection is not required when CNG is loaded or unloaded by conductive or nonconductive hose, flexible metallic tubing, or pipe connections where both halves of the metallic couplings are in contact.

***CNG Safety Rules, §13.103***

## Operation

(a) DOT cylinders must 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.

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

***CNG Safety Rules, §13.104***

## Fire Protection

Automatic CNG dispensing or refueling areas must be provided with a portable fire extinguisher having a rating not less than 20-B:C.

***CNG Safety Rules, §13.105***

## Maintenance

(a) Cylinders and their appurtenances, piping systems, compression equipment, controls, vehicle fueling hoses and devices must be maintained in proper operating condition any time the system is in the on position.

***CNG Safety Rules, §13.106***

## Dispenser Accuracy

Each retail CNG dispenser must comply with the applicable weights and measures requirements of the Texas Department of Agriculture relating to dispensing accuracy.

***CNG Safety Rules, §13.107***

### SAMPLE QUESTION

A device must be installed in the CNG piping of an automatic dispenser in such a manner that displacement of the dispenser will result in the displacement of the piping on the \_\_\_\_\_ side of the device.

- A. Downstream
- B. Upstream

***Answer: A***

## ENGINE FUEL SYSTEMS

### Applicability

(b) Each component of a CNG system must be installed in accordance to the written instructions provided by the manufacturer.

***CNG Safety Rules, §13.131***

### Installation of Fuel Supply Cylinders

(a) Fuel supply cylinders on vehicles other than school buses, mass transit, or other vehicles used in public transportation may be located within, below, or above the driver or passenger compartment, provided all connections to the cylinders are external to, or sealed and vented from those compartments.

(b) Fuel supply cylinders on school buses, mass transit, and other public transportation vehicles must not be located above or within the driver or passenger compartment. The motor fuel containers installed on a special transit vehicle may be installed in the passenger compartment, provided it complies with subsection (a) of this section.

(c) Each fuel supply cylinder must be mounted in a location to minimize damage from collision. No part of a cylinder or its appurtenances must protrude beyond the sides or top of the vehicle at the point where it is installed.

(d) The fuel system must be installed with as much road clearance as practical, but not less than the minimum road clearance of the vehicle when loaded to its gross vehicle weight rating. This minimum clearance shall be measured from the lowest part of the fuel system.

(e) No portion of a fuel supply cylinder or cylinder appurtenance must be located ahead of the front axle or behind the rear bumper mounting face of a vehicle. Cylinder valves must be protected from physical damage using the vehicle structure, valve protectors, or a suitable metal shield.

(f) Each cylinder bracket must be secured to the vehicle body, bed, or frame with bolts, lock washers and nuts, or self-locking nuts of a size and strength capable of withstanding a static force in any direction of eight times the weight of a fully pressurized cylinder. The cylinder bracket must be designed and manufactured by a cylinder manufacturer. Each specific mounting bracket manufactured on or after January 1, 1994, must have the manufacturer's name or logo on it in order to properly identify the bracket manufacturer. If self-locking nuts are installed, such nuts must not be reused once they are removed. The container mounting brackets must prevent the container from jarring loose, slipping, or rotating.

(g) Each fuel supply cylinder must be secured in the mounting brackets by bolts, lock washers and nuts, or self-locking nuts of a size and strength capable of withstanding a static force applied in any direction eight times the weight of the fully pressurized cylinder. If self-locking nuts are installed, such nuts must not be reused once they are removed.

(h) The cylinder weight must not be supported by the outlet, service valves, manifolds, or other fuel connections.

(i) Fuel supply cylinders located less than eight inches from the exhaust system must be shielded against direct heat.

(j) The mounting system must minimize fretting corrosion between the cylinder and the mounting system by means of rubber insulators or other suitable means.

(k) Fuel supply cylinders must not be installed so as to adversely affect the driving characteristics of the vehicle.

(l) Containers must be secured to a school bus, mass transit, or special transit vehicle frame (not the floor) by container fastenings or mounting brackets described in subsection (f) of this section. The fastenings or brackets must be secured to the frame or securely mounted to a supporting structure so as not to compromise the strength of that structure (i.e., backing plates or other acceptable means may be used to accomplish this purpose). Containers which are currently installed on school buses or mass transit vehicles by means of strap mounting brackets may continue to be used.

(m) The motor fuel containers installed on a school bus or mass transit vehicle must be installed on the underside of the vehicle.

(n) If necessary, a plumbing chamber door must be provided in the sidewall of the school bus, mass transit, or special transit vehicle to allow easy access for filling or securing the service valve in the event of an emergency. The plumbing chamber door must be hinged and latched, but not locked.

***CNG Safety Rules, §13.133***

### **Installation of Valves**

(a) A manual or electronic cylinder service valve must be installed on each fuel cylinder.

***CNG Safety Rules, §13.136***

## Labeling

(b) Any vehicle equipped with a CNG fuel system must have a durable label, readily visible, located at the fueling connection receptacle. The label must include the system working pressure, name of company or entity and license number, the cylinder retest dates where applicable, and the total cylinder water volume in cubic inches.

***CNG Safety Rules, §13.140***

## System Testing

(b) After installation, every connection must be checked with a non-ammonia soap solution or a leak-detection instrument after the equipment is connected and pressurized to its working pressure.

(c) If a completed CNG fuel system assembly is leak-tested with natural gas, the testing must be done under adequately ventilated conditions.

***CNG Safety Rules, §13.141***

## Venting of CNG to the Atmosphere

All venting of CNG must be done outdoors only, under conditions that will result in rapid dispersion of the product being released. When venting CNG to the atmosphere, consideration must be given for the use of a vent pipe or stack so that a flammable mixture will not reach a point of ignition.

***CNG Safety Rules, §13.143***

### SAMPLE QUESTION

Compression, storage or dispensing installations, excluding automatic dispensers and residential fueling facilities, must be protected from tampering by a chain link type fence a minimum of \_\_\_\_\_ feet in height.

- A. 8
- B. 7
- C. 6
- D. 5

***Answer: C***

## RESIDENTIAL FUELING FACILITIES

### General

(a) All equipment related to a residential fueling facility must be suitably packaged and located to be protected from physical damage and vandalism.

***CNG Safety Rules, §13.184***

### Installation

(c) All residential fueling facility equipment must be installed in accordance with the equipment manufacturer's instructions.

(d) The residential fueling facility must have a nameplate marked with minimum and maximum gas inlet pressure and flow rate, gas outlet maximum pressure, and electrical requirements.

***CNG Safety Rules, §13.185***

### **Installation of Pressure Relief Valves**

The discharge vent line on a residential fueling facility must be able to withstand the pressure from the relief vapor discharge when the relief valve is in full open position and must permit sufficient pressure relief relieving capacity.

***CNG Safety Rules, §13.187***

### **Installation of Pressure Gauges**

For measurement and test purposes, pressure gauges may be installed, but are not required.

***CNG Safety Rules, §13.188***

### **Piping and Hoses**

(b) The maximum length of a fueling hose on a residential fueling facility is limited to 12 feet.

***CNG Safety Rules, §13.190***

### **Installation of Emergency Shutdown Equipment**

(a) A residential fueling facility must be equipped with emergency manual shutdown of the gas supply power and electrical power.

(b) Break-away protection must be provided in a manner such that, in the event of a pull-away, natural gas will cease to flow at any separation.

***CNG Safety Rules, §13.192***

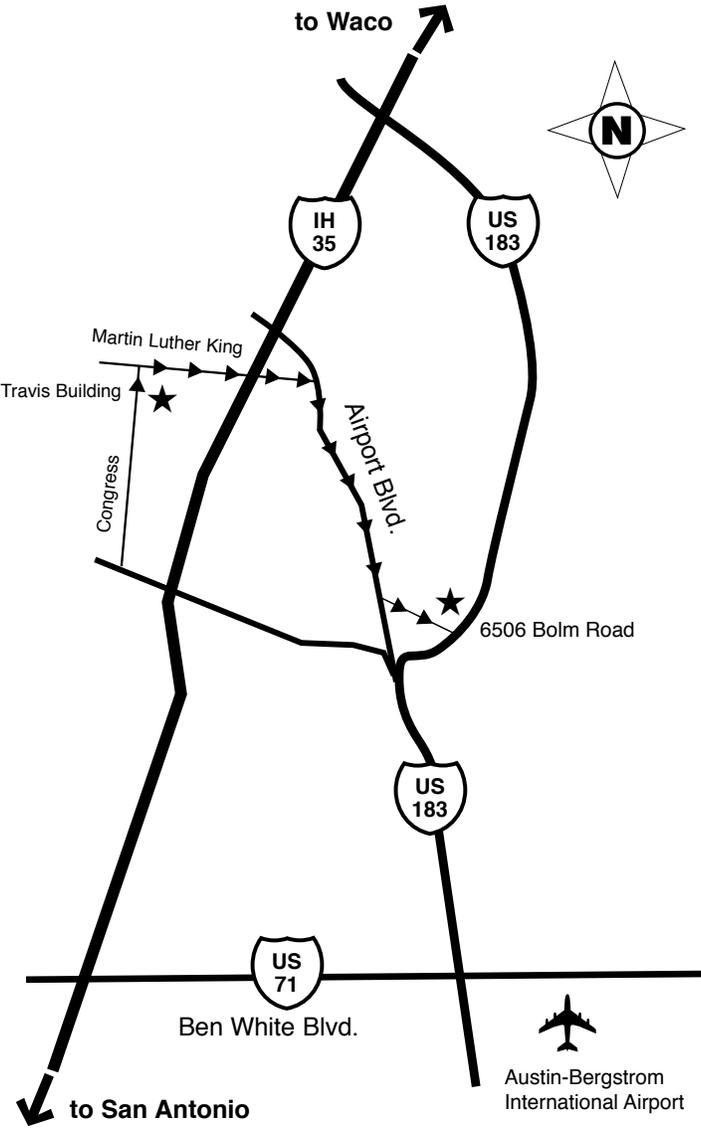
#### **SAMPLE QUESTION**

A vehicle is not considered a source of ignition if the fuel-fired equipment is shut off completely before entering an ignition source area.

- A. True
- B. False

***Answer: A***

# RRC/AFRED TRAINING CENTER 6506 BOLM RD., AUSTIN



### DIRECTIONS TO RRC ALTERNATIVE FUELS TRAINING CENTER, AUSTIN

#### From the Travis Building:

Go one block north to Martin Luther King, Jr. Blvd. Turn right on MLK and go about 2 miles to Airport Blvd. Turn right (south) on Airport and go about 1 1/2 miles. The fifth traffic light, just over the railroad bridge, is Bolm Road. Turn left (east) onto Bolm Road and go about 1 mile. 6506 is the last building on the left before U.S. 183.

#### Entering Austin on I-35 going south:

Take exit 239/240 for Hwy 183 South/ Austin-Bergstrom International Airport. Stay on 183 past Cameron Road, U.S. 290, Manor Road, Loyola Lane, and Techni-Center Drive. Proceed down the hill on 183 and take the Bolm Road exit. At the light, turn right onto Bolm Road. The Training Center is on the northwest corner of 183 and Bolm Road. Enter through the double glass doors on the south side of the building.

#### Entering Austin on I-35 going north:

Take exit 230 for Texas Hwy. 71/Ben White Blvd. Turn right toward Bastrop. Stay on 71 for approximately 4.3 miles. Exit onto U.S. 183 North. Stay on 183 past the Colorado River bridge. Stay in the right lane and take the Bolm Road exit. Turn left at the light onto Bolm Road and go under the overpass. The Training Center is on the northwest corner of 183 and Bolm Road. Enter through the double glass doors on the south side of the building.