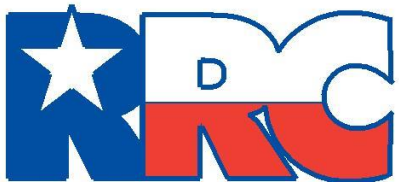
TEXAS LP-GAS EXAMINATION STUDY GUIDE

Appliance Service and Installation Employee Level



RAILROAD COMMISSION OF TEXAS

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LP-GAS EXAMINATION STUDY GUIDE
EMPLOYEE-LEVEL
Appliance Service and Installation

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 LP-gas appliance service and installation activities.

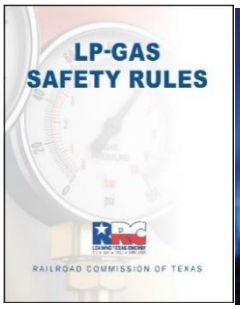
The Appliance Service & Installation examination qualifies an individual to perform all LP-gas activities related to appliances, including:

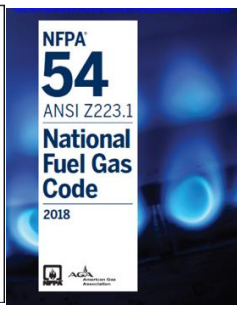
- Installing, repairing, and converting appliances,
- Installing and repairing connectors from the appliance gas stop through the venting system
- Perform leak checks on the new or repaired portion of the system.

The Appliance Service & Installation examination does **NOT** authorize an individual to:

- Install a container,
- Install or repair piping upstream of and including the appliance gas stop
- Install, repair, or adjust regulators.

What books do I need?





This examination tests your knowledge of the laws and standards that apply to Appliance Service and Installation operations in Texas. These laws and standards are found in three books:

LP-Gas Safety Rules (Texas Railroad Commission)
NFPA 54 *National Fuel Gas Code* (National Fire Protection Association 2018)

Where do I get these books?

You may download the current edition of the Railroad Commission's *LP-Gas Safety Rules* 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 of the listed sections and topics.

Terms and Definitions

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

NOTE: Informal terms that are sometimes used in the propane industry instead of formal technical terms are given in brackets.

Railroad Commission *LP-Gas Safety Rules*

NOTE: Section (§) 9.402(c) of the LP-Gas Safety Rules states, "The Commission does not adopt language in any NFPA rule, chart, figure, or table pertaining to any LP-gas container having a water capacity of one gallon (4.2 pounds LP-gas capacity) or less."

Alternative Fuel Safety (AFS). The RRC department responsible for LP-Gas training and inspection.
LP-Gas Safety Rules, §9.2(1)

LP Gas Safety Rules. The rules adopted by the Railroad Commission in the Texas Administrative Code, Title 16, Part 1, Chapter 9, including any NFPA or other documents adopted by reference. The official text of the Commission's rules is that which is on file with the Secretary of State's office and available at www.sos.state.tx.us or through the Commission's web site
LP-Gas Safety Rules, §9.2(22)

Rules examination. The Commission's written examination that measures an examinee's working knowledge of Chapter 113 of the Texas Natural Resources Code and/or the current LP-Gas Safety Rules.
LP-Gas Safety Rules, §9.2(41)

NFPA 54 (2018)

Appliance. Any device that utilizes gas as a fuel or raw material to produce light, heat, power, refrigeration, or air conditioning.
NFPA 54, §3.3.5

Appliance Shutoff Valve. A valve located in the piping system, used to shut off individual equipment.
NFPA 54, §3.3.99.1

Btu. Abbreviation for British thermal unit, which is the quantity of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit (equivalent to 1055 joules).
NFPA 54, §3.3.16

Controls. Devices designed to regulate the gas, air, water, or electrical supply to an appliance. These may be manual or automatic.
NFPA 54, §3.3.24

Clothes Drier. An appliance used to dry wet laundry by the means of heat
NFPA 54, §3.3.19

Clothes Drier Type 1. Primarily used in family living environment. May or may not be coin operated for public use.
NFPA 54, §3.3.19.1

Clothes Drier Type 2 Used in business with direct intercourse of the function with the public. May or may not be operated by public or hired attendant. May or may not be coin-operated.
NFPA 54, §3.3.19.2

Direct Vent Appliances. Appliances that are constructed and installed so that all air for combustion is derived directly from the outdoors and all flue gases are discharged to the outdoors.
NFPA 54, §3.3.5.3

Flue Gases. Products of combustion plus excess air in appliance flues or heat exchangers.
NFPA 54, §3.3.49.1

Gas Appliance Pressure Regulator. A pressure regulator for controlling pressure to the appliance manifold.
NFPA 54, §3.3.84.2

Gas Vent. A passageway composed of listed factory-built components assembled in accordance with the manufacturer's installation instructions for conveying vent gases from appliances or their vent connectors to the outdoors.
NFPA 54, §3.3.53

Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
NFPA 54, §3.2.4

Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.
NFPA 54, §3.2.5

Non-displaceable Valve Member. A valve member that cannot be moved from its seat by a force applied to the handle or to any exterior portion of the valve.
NFPA 54, §3.3.100.1

Orifice. The opening in a cap, spud, or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.
NFPA 54, §3.3.71

Pipe. Rigid conduit used to convey fuel gas or other fluids
NFPA 54, §3.3.75

Piping System. All piping, valves, and fittings from the outlet of the point of delivery from the supplier to the outlets of the equipment shutoff valves.
NFPA 54, §3.3.95.6

Pressure Test. An operation performed to verify the gastight integrity of gas piping following its installation or modification.
NFPA 58, §3.3.66

Quick-Disconnect Device. A hand-operated device that provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply and that is equipped with an automatic means to shut off the gas supply when the device is disconnected.
NFPA 54, §3.3.28.3

Regulator Vent. The opening in the atmospheric side of the regulator housing permitting the in and out movement of air to compensate for the movement of the regulator diaphragm.
NFPA 54, §3.3.105.3

Safety Shutoff Device. A device that will shut off the gas supply to the controlled burner(s) in the event the source of ignition fails. This device can interrupt the flow of gas to main burner(s) only or to pilot(s) and main burner(s) under its supervision.
NFPA 54, §3.3.28.4

Type 1 Clothes Dryer. Primarily used in family living environment. May or may not be coin-operated for public use.
NFPA 54, §3.3.19.1

Type 2 Clothes Dryer. Used in business with direct intercourse of the function with the public. May or may not be operated by public or hired attendant. May or may not be coin-operated.
NFPA 54, §3.3.19.2

Type B Gas Vent. A vent for venting listed gas appliances with draft hoods and other Category I appliances listed for use with Type B gas vents.
NFPA 54, §3.3.53.3

Type B-W Gas Vent. A gas vent for venting listed wall furnaces.
NFPA 54, §3.3.53.4

Type L Gas Vent. A vent for venting appliances listed for use with Type L vents and appliances listed for use with Type B gas vents.
NFPA 54, §3.3.53.5

Unvented Room Heater. An unvented, self-contained, freestanding, nonrecessed, fuel-gas-burning appliance for furnishing warm air by gravity or fan circulation to the space in which installed, directly from the heater without duct connection.
NFPA 54, §3.3.56.6

Vent Connector. The pipe or duct that connects a fuel-gas-burning appliance to a vent or chimney.
NFPA 54, §3.3.101

Venting. Removal of combustion products as well as process fumes to the outer air.
NFPA 54, §3.3.103

Sample Question 1

British thermal unit is the quantity of heat required to raise the temperature of _____ of water 1 degree Fahrenheit.

A. 1/2 Pound
B. 1 Pound
C. 5 Pounds
D. 1 Kilogram

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 LP-gas 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. When you take the examination, read each question very carefully.

ADMINISTRATIVE RULES - GENERAL REQUIREMENTS

Company License

No person may engage in any LP-gas activity until that person has obtained a license from the Commission authorizing the LP-gas activities.
LP-Gas Safety Rules, §9.7(a)

Licensees, registered manufacturers, company representatives, and operations supervisors at each outlet shall have copies of all current licenses and/or manufacturer registrations and certificates for employees at that location available for inspection during regular business hours.
LP-Gas Safety Rules, §9.7(c)

Application for a New Certificate

An applicant for a new certificate shall:
(1) file with AFS a properly completed LPG Form 16 and the applicable nonrefundable rules examination fee specified in §9.10 of this title (relating to Rules Examination); pass the applicable rules examination with a score of at least 75%
(2) pass the applicable rules examination with a score of at least 75%; and
(3) complete any required training and/or AFT in §9.51 and §9.52 of this title.
LP-Gas Safety Rules, §9.8(c)

Certificate Renewal

Certificate holders shall remit the nonrefundable $35 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.
(1) Failure to pay the nonrefundable annual renewal fee by the deadline shall result in a lapsed certificate
(A) To renew a lapsed certification, the individual must pay the nonrefundable $35 annual renewal fee plus a nonrefundable $20 late-filing fee.
(B) If an individual's certificate lapses or expires, that individual shall immediately cease performance of any LP-gas activities authorized by the certificate.
(C) 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 in §9.8 of this title (relating to Requirements and Application for a New Certificate) or §9.13 of this title.
LP-Gas Safety Rules, §9.9(c)

Continuing education. A certificate holder shall complete at least eight hours of continuing education every four years as specified in this subsection.
(1) Upon fulfillment of this requirement, the certificate holder's next continuing education deadline shall be four years after the May 31 following the date of the most recent class the certificate holder has completed, unless the course was completed on May 31, in which case the deadline shall be four years from that date.
LP-Gas Safety Rules, §9.52(b)

Rules Examination

Failure of any exam shall immediately disqualify the individual from performing any LP-gas related activities covered by the exam which is failed, except for activities covered by a separate exam which the individual has passed.
LP-Gas Safety Rules, §9.10(f)

Trainees

A licensee or ultimate consumer may employ an individual as a trainee for a period not to exceed 45 calendar days without that individual having successfully completed the rules examination
(1) 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.
LP-Gas Safety Rules, §9.12

Qualified Personnel

Persons whose duties fall within the scope of this code shall be provided with training that is consistent with the scope of their job activities and that includes proper handling and emergency response procedures.
NFPA 58, §4.4.1

Refresher training shall be provided at least every 3 years.
NFPA 58, §4.4.3

Initial and subsequent refresher training shall be documented.
NFPA 58, §4.4.4

Transfer of LP-Gas to and from a container shall be accomplished only by qualified individuals trained in proper handling and operating procedures.
NFPA 58, §7.2.2.1

At least one qualified person shall remain in attendance at the transfer operation from the time connections are made until the transfer is completed, shutoff valves are closed, and lines are disconnected.
NFPA 58, §7.2.1.2

Public access to areas where LP-Gas is stored and transferred shall be prohibited except where necessary for the conduct of normal business activities.
NFPA 58, §7.2.3.1

Sample Question 2

A licensee or ultimate consumer may employ an individual as a trainee for a period not to exceed ____ calendar days without that individual having successfully completed the rules examination

A. 7
B. 14
C. 30
D. 45

Answer on last Page

System Design and Materials

All appurtenances and equipment placed into LP-gas service shall be listed by a nationally recognized testing laboratory such as Underwriters Laboratory (UL), Factory Mutual (FM), or American Gas Association (AGA) unless:
(1) it is specifically prohibited for use by another section of the rules in this chapter;
(2) there is no test specification or procedure developed by the testing laboratory for the appurtenance or equipment; or
(3) it is used and in compliance with any NFPA standard adopted by the Commission.
LP-Gas Safety Rules, §9.126(a)(1,2,&3)

Gas piping systems shall be of such size and so installed as to provide a supply of gas sufficient to meet the maximum demand and supply gas to each appliance inlet at not less than the minimum supply pressure required by the appliance.
NFPA 54, §5.4.1

The volumetric flow rate of gas to be provided shall be the sum of the maximum input of the appliances served.
NFPA 54, §5.4.2.1

The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are operating at full capacity simultaneously.
NFPA 54, §5.4.2.3

The design pressure loss in any piping system under maximum probable flow conditions, from the point of delivery to the inlet connection of the appliance, shall be such that the supply pressure at the appliance is greater than or equal to the minimum pressure required by the appliance
NFPA 54, §5.4.4

The maxi- mum operating pressure for any piping systems located inside buildings shall not exceed 5 psi unless one or more of the following conditions are met:
(1)* The piping joints are welded or brazed.
(2) The piping joints are flanged and all pipe-to-flange connections are made by welding or brazing.
(3) The piping is located in a ventilated chase or otherwise enclosed for protection against accidental gas accumulation.
(4) The piping is located inside buildings or separate areas of buildings used exclusively for one of the following: (a) Industrial processing or heating (b) Research (c) Warehousing (d) Boiler or mechanical rooms
(5) The piping is a temporary installation for buildings under construction.
(6) The piping serves appliances or equipment used for agri- cultural purposes.
(7) The piping system is an LP-Gas piping system with an operating pressure greater than 20 psi (138 kPa) and complies with NFPA 58
NFPA 54, §5.5.4

Gas Piping Installation

Pipe, fittings, valves, or other materials shall not be used again unless they are free of foreign materials and have been ascertained to be adequate for the service intended.
NFPA 54, §5.6.1.2

Cast-iron pipe shall not be used.
NFPA 54, §5.6.2.1

Steel, stainless steel, and wrought-iron pipe shall be at least Schedule 10 and shall comply with the dimensional standards of ANSI/ ASME B36.10M, *Welded and Seamless Wrought Steel Pipe,* and one of the following:
(1) ASTM A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless*
(2) ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*
(3) ASTM A312, *Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes*
NFPA 54, §5.6.2.2

Corrugated stainless steel tubing shall be listed in accordance with ANSI LC 1/CSA 6.26, Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing.
NFPA 54, §5.6.3.6

Gas pipe, tubing, and fittings shall be clear and free from cutting burrs and defects in structure or threading and shall be thoroughly brushed and chip and scale blown. Defects in pipe, tubing, and fittings shall not be repaired. Defective pipe, tubing, and fittings shall be replaced.
NFPA 54, §5.6.5

Pipe with threads that are stripped, chipped, corroded, or otherwise damaged shall not be used. Where a weld opens during the operation of cutting or threading, that portion of the pipe shall not be used.
NFPA 54, §5.6.6.2

Thread joint compounds (pipe dope) shall be resistant to the action of LP-gas or to any other chemical constituents of the gases to be used in the piping.
NFPA 54, §5.6.6.4

Gas piping inside any building shall not be installed in or through a clothes chute, chimney or gas vent, dumbwaiter, elevator shaft, or air duct, other than combustion air ducts.
NFPA 54, §7.2.5

Outlets shall not be located behind doors.
NFPA 54, §7.7.1.2

Outlets shall be located far enough from floors, walls, patios, slabs, and ceilings to permit the use of wrenches without straining, bending, or damaging the piping.
NFPA 54, §7.7.1.3

The unthreaded portion of gas piping outlets shall extend not less than 1 in. through finished ceilings or indoor or outdoor walls.
NFPA 54, §7.7.1.4

The unthreaded portion of gas piping outlets shall extend not less than 2 in. above the surface of floors or outdoor patios or slabs.
NFPA 54, §7.7.1.5

Each outlet, including a valve, shall be closed gastight with a threaded plug or cap immediately after installation and shall be left closed until the appliance or equipment is connected thereto. When an appliance or equipment is disconnected from an outlet and the outlet is not to be used again immediately, it shall be capped or plugged gastight.
NFPA 54, §7.7.2.1

Main gas shutoff valves controlling several gas piping systems shall be readily accessible and protected from physical damage. They must be marked with a metal tag or other permanent means so the gas piping systems supplied through them can be readily identified.
NFPA 54, §7.8.2.1

Sample Question 3

Outlets shall not be located behind _____.

A. appliances
B. furniture
C. doors
D. beds

Answer on last page

Gas Pressure Regulators

A line gas pressure regulator or gas equipment pressure regulator, shall be installed where the gas supply pressure exceeds the maximum allowable inlet pressure of the appliance served.
NFPA 54, §5.8.1

Line pressure regulators shall be Listed where the outlet pressure is set to 2 psi or less.
NFPA 54, §5.8.2

The gas pressure regulator shall be accessible for servicing.
NFPA 54, §5.8.3

Pressure regulators shall be protected against physical damage.
NFPA 54, §5.8.4

Appliance Installation Requirements

When additional or replacement appliances or equipment is installed or an appliance is converted to gas from another fuel, the location in which the appliances or equipment is to be operated shall be checked to verify the following:
(1) Air for combustion and ventilation is provided where required, in accordance with the provisions of Section 9.3.
(2) The installation components and appliances meet the clearances to combustible material provisions of 9.2.2. It shall be determined that the installation and operation of the additional or replacement appliances do not render the remaining appliances unsafe for continued operation.
(3) The venting system is constructed and sized in accordance with the provisions of Chapter 12.
NFPA 54, §9.1.2

The appliance shall be connected to the fuel gas for which it was designed. No attempt shall be made to convert the appliance from the gas specified on the rating plate for use with a different gas without consulting the installation instructions, the serving gas supplier, or the appliance manufacturer for complete instruction.
NFPA 54, §9.1.3

Appliances in residential garages and in adjacent spaces that open to the garage and are not part of the living space of a dwelling unit shall be installed so that all burners and burner ignition devices are located not less than 18 in. above the floor unless listed as flammable vapor ignition resistant.
NFPA 54, §9.1.10.1

Where appliances are installed in a separate, enclosed space having access only from outside of the garage, such appliances shall be permitted to be installed at floor level, providing the required combustion air is taken from the exterior of the garage.
NFPA 54, §9.1.10.3

Appliances shall be so supported and so connected to the piping as not to exert undue strain on the connections.
NFPA 54, §9.1.17

Where the gas supply pressure is higher than the design pressure limits of the appliance, a gas appliance pressure regulator shall be installed.
NFPA 54, §9.1.18

All appliances shall be located with respect to building construction and other equipment so as to permit access to the appliance. Sufficient clearance shall be maintained to permit cleaning of heating surfaces; the replacement of filters, blowers, motors, burners, controls, and vent connections; the lubrication of moving parts where necessary; the adjustment and cleaning of burners and pilots; and the proper functioning of explosion vents, if provided. For attic installation, the passageway and servicing area adjacent to the appliance shall be floored.
NFPA 54, §9.2.1

Sample Question 4

Appliances shall be so supported and so connected to the piping as not to exert undue strain on the _____.

A. connections
B. regulator
C. orifice
D. controls

Answer on last page

Combustion and Ventilation Air

The required volume of indoor air shall be determined by the:
(1) Standard Method
(2) Known Air Infiltration Rate (KAIR) Method
Except that where the air infiltration rate is known to be less than 0.40 ACH, the KAIR shall be used.
NFPA 54, §9.3.2

The minimum required volume shall be 50 ft^3 per 1000 Btu/hour.
NFPA 54, §9.3.2.1

Openings used to connect indoor spaces shall be sized and located in accordance with the following: Each opening shall have a minimum free area of 1 in^2/1000 Btu/hr. of the total input rating of all appliances in the space but not less than 100 in^2 One permanent opening shall commence within 12 in. of the top of the enclosure and one permanent opening shall commence within 12 in. of the bottom of the enclosure. The minimum dimension of air openings shall not be less than 3 in.
NFPA 54, §9.3.2.3

Two permanent openings, within 12 in. of the top of the enclosure and one commencing within 12 in. of the bottom. Of the enclosure shall be provided. The openings shall communicate directly or by ducts with the outdoors.
(1) Vertical ducts, each opening shall have a minimum free area of 1 in^2/4000 Btu/hr
(2) Horizontal ducts, shall have free area of 1 in^2/2000 Btu/hr. of total input rating of all appliances.
NFPA 54, §9.3.3.1

One permanent opening, commencing within 12 in. of the top of the enclosure, shall be provided. The appliance shall have clearances of at least 1 in. from the sides and back and 6 in. from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of 1 in^2/3000 Btu/hr. of the total input rating of all appliances
NFPA 54, §9.3.3.2

The required size of openings for combustion, ventilation, and dilution air shall be based on the net free area of each opening. Where the free area through a design of louver, grille, or screen is known, it shall be used in calculating the size opening required to provide the free area specified. Where the louver and grille design and free area are not known, it shall be assumed that wood louvers have 25 percent free area, and metal louvers and grilles have 75 percent free area. Nonmotorized louvers and grilles shall be fixed in the open position
NFPA 54, §9.3.7.1

Screens shall not be smaller than 1⁄4 in. mesh.
NFPA 54, §9.3.7.2

Ducts shall be constructed of galvanized steel or a material having equivalent corrosion resistance, strength, and rigidity.
NFPA 54, §9.3.8.1

Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.
NFPA 54, §9.3.8.2

Ducts shall serve a single space.
NFPA 54, §9.3.8.3

Ducts shall not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
NFPA 54, §9.3.8.4

Ducts shall not be screened where terminating in an attic space.
NFPA 54, §9.3.8.5

Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.
NFPA 54, §9.3.8.6

Combustion air intake openings located on the exterior of the building shall have the lowest side of the combustion air intake openings located at least 12 in. above the adjoining grade level.
NFPA 54, §9.3.8.8

An attic in which an appliance is installed shall be accessible through an opening and passageway at least as large as the largest component of the appliance, and not less than 22 in. × 30 in.
NFPA 54, §9.5.1

Sample Question 5

Screens on combustion air ducts shall not be smaller than _____ in. mesh.

A. 1/8 in
B. 1/4 in
C. 1/2 in
D. 3/4 in
E. 1 in

Answer on last page

Appliance Installation

Appliances and equipment shall be connected to the building piping in compliance by one of the following:
(1) Rigid metallic pipe and fittings.
(2) Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.
(3) A listed connector in compliance with ANSI Z21.24/CSA 6.10, Connectors for Gas Appliances. The connector shall be used in accordance with the manufacturer's installation instructions and shall be in the same room as the appliance. Only one connector shall be used per appliance.
(4) A listed connector in compliance with ANSI Z21.75/CSA 6.27, Connectors for Outdoor Gas Appliances and Manufactured Homes. Only one connector shall be used per appliance.
(5) CSST where installed in accordance with the manufacturer’s installation instructions. CSST shall connect only to appliances that are fixed in place.
(6) Listed nonmetallic gas hose connectors in accordance with 9.6.2.
(7) Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with 9.6.3
NFPA 54, §9.6.1

Use of Nonmetallic Gas Hose Connectors.
Listed gas hose connectors shall be used in accordance with the manufacturer's installation instructions and as follows:
(1) *Indoor*. Indoor gas hose connectors shall be used only to connect laboratory, shop, and ironing appliances requiring mobility during operation and installed in accordance with the following:
(a) An appliance shutoff valve shall be installed where the connector is attached to the building piping.
(b) The connector shall be of minimum length and shall not exceed 6 ft
(c) The connector shall not be concealed and shall not extend from one room to another or passthrough wall partitions, ceilings, or floors.
(2) *Outdoor*. Where outdoor gas hose connectors are used to connect portable outdoor appliances, the connector shall be listed in accordance with ANSI Z21.54, Gas Hose Connectors for Portable Outdoor Gas-Fired Appliances and installed in accordance with the following:
(a) An appliance shutoff valve, a listed quick-disconnect device, or a listed gas convenience outlet shall be installed where the connector is attached to the supply piping and in such a manner so as to prevent the accumulation of water or foreign matter.
(b) This connection shall be made only in the outdoor area where the appliance is to be used.
NFPA 54, §9.6.2

Where flexible connections are used, they shall be of the minimum practical length and shall not extend from one room to another or pass through any walls, partitions, ceilings, or floors. Flexible connections shall not be used in any concealed location. They shall be protected against physical or thermal damage and shall be provided with gas shutoff valves in readily accessible locations in rigid piping upstream from the flexible connections.
NFPA 54, §9.6.4.4

Each appliance connected to a piping system shall have an accessible, approved manual shutoff valve with a non-displaceable valve member, or a listed gas convenience outlet. Appliance shutoff valves and convenience outlets shall serve a single appliance only and shall be installed in accordance with 9.6.5.1.
NFPA 54, §9.6.5

The shutoff valve shall be located within 6 ft of the appliance it serves
(A) Where a connector is used, the valve shall be installed upstream of the connector. A union or flanged connection shall be provided downstream from the valve to permit removal of appliance controls.
(B) Shutoff valves serving decorative appliances in a fireplace shall not be located within the fireplace firebox except where the valve is listed for such use.
NFPA 54, §9.6.5.1

Shutoff valves serving appliances installed in vented fireplaces and ventless firebox enclosures shall not be required to be located within 6 ft of the appliance where such valves are readily accessible and permanently identified.
NFPA 54, §9.6.5.2

Where installed at a manifold, the appliance shutoff valve shall be located within 50 ft of the appliance served and shall be readily accessible and permanently identified.
NFPA 54, §9.6.5.3

Appliances can be connected to the building piping by means of a listed gas convenience outlet, in conjunction with a listed appliance connector, used in accordance with the manufacturer's installation instructions.
NFPA 54, §9.6.7

Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be installed downstream of the appliance shutoff valve as close to the inlet of the appliance as practical at the time of appliance installation. The sediment trap shall be either a tee fitting with a capped nipple in the bottom outlet, as illustrated in Figure 9.6.8, or another device recognized as an effective sediment trap. Illuminating appliances, gas ranges, clothes dryers, decorative appliances for installation in vented fireplaces, gas fire- places, and outdoor cooking appliances shall not be required to be so equipped.
NFPA 54, §9.6.8

Sample Question 6

Where installed at a manifold, the appliance shutoff valve shall be located within ____ ft of the appliance served and shall be readily accessible and permanently identified.

A. 6
B. 50
C. 75
D. 100

Answer on last page

Appliance Venting

Venting systems shall be designed and constructed to convey all flue and vent gases to the outdoors.
NFPA 54, §12.1

The following appliances shall not be required to be vented:
(1) Listed ranges
(2) Built-in domestic cooking units listed and marked for optional venting
(3) Listed hot plates
(4) Listed Type 1 clothes dryers exhausted in accordance with Section 10.4
(5) Listed dishwasher instantaneous hot water heaters
(6) Listed refrigerators
(7) Counter appliances
(8) Room heaters listed for unvented use
(9) Direct gas–fired make-up air heaters
(10) Other appliances listed for unvented use and not provided with flue collars
(11) Specialized appliances of limited input such as laboratory burners or gas lights
NFPA 54, §12.3.2

The use of ventilating hoods and exhaust systems to vent appliances shall be limited to industrial appliances and appliances installed in commercial applications.
NFPA 54, §12.3.3

A venting system shall satisfy the draft requirements of the appliance in accordance with the manufacturer's instructions.
NFPA 54, §12.4.1

A chimney for residential-type or low-heat appliances shall extend at least 3 ft. above the highest point where it passes through a roof of a building and at least 2 ft. higher than any portion of a building within a horizontal distance of 10 ft.
NFPA 54, §12.6.2.1

The installation of gas vents shall meet the following requirements:
(1) Gas vents shall be installed in accordance with the manufacturer's installation instructions.
(2) A Type B-W gas vent shall have a listed capacity not less than that of the listed vented wall furnace to which it is connected.
NFPA 54, §12.7.2

(1) A gas vent shall terminate in accordance with one of the following:
(a) Gas vents that are 12 in. or less in size and located not less than 8 ft from a vertical wall or similar obstruction shall terminate above the roof in accordance with Figure 12.7.3 and Table 12.7.3.
(b) Gas vents that are over 12 in. in size or are located less than 8 ft from a vertical wall or similar obstruction shall terminate not less than 2 ft above the highest point where they pass through the roof and not less than 2 ft above any portion of a building within 10 ft horizontally.
(2) A Type B or a Type L gas vent shall terminate at least 5 ft in vertical height above the highest connected appliance draft hood or flue collar.
(3) A Type B-W gas vent shall terminate at least 12 ft in vertical height above the bottom of the wall furnace.
(4) A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets, except as provided in 12.3.5 and 12.4.3.
(5) Decorative shrouds shall not be installed at the termination of gas vents except where such shrouds are listed for use with the specific gas venting system and are installed in accordance with the manufacturer's installation instructions.
(6) All gas vents shall extend through the roof flashing, roof jack, or roof thimble and terminate with a listed cap or listed roof assembly.
NFPA 54, §12.7.3

For a single appliance having more than one draft hood outlet or flue collar, the manifold shall be constructed according to the instructions of the appliance manufacturer. Where there are no instructions, the manifold shall be designed and constructed in accordance with approved engineering practices. The effective area of the manifold shall equal the combined area of the flue collars or draft hood outlets, and the vent connectors shall have a minimum 1 ft. rise.
NFPA 54, §12.11.3.2

A vent connector shall be installed without any dips or sags and shall slope upward toward the vent or chimney at least 1⁄4 in/ft.
NFPA 54, §12.11.7

A vent connector shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints.
NFPA 54, §12.11.9

Installation of Specific Appliances

Bedrooms or Bathrooms

Appliances shall not be installed so their combustion, ventilation, and dilution air are obtained only from a bedroom or bathroom unless they have the required volume in accordance with 9.3.2. (50 ft^3/1000 Btu/hr.)
NFPA 54, §10.1.2

Central heating furnace and low-pressure boiler installations in bedrooms or bathrooms shall comply with one of the following:
(1) Be installed in a closet located in the bedroom or bathroom, with a weather-stripped solid door with a self-closing device, and all combustion air shall be obtained from the outdoors.
(2) Be of the direct vent type.
NFPA 54, §10.3.1

Water heater installations in bedrooms and bathrooms shall comply with one of the following:
(1) Water heater shall be installed in a closet equipped with a weather-stripped door with a self-closing device, and all combustion air shall be obtained from the outdoors.
(2) Water heater shall be of the direct vent type.
NFPA 54, §10.27.1

Clothes Dryers

The installation of clothes dryers shall comply with the following requirements:
(1) Listed Type 1 clothes dryers shall be installed with a minimum clearance of 6 in. from adjacent combustible material. Clothes dryers listed for installation at reduced clearances shall be installed in accordance with the manufacturer's installation instructions. Type 1 clothes dryers installed in closets shall be specifically listed for such installation.
(2) Listed Type 2 clothes dryers shall be installed with clearances of not less than shown on the marking plate and in the manufacturer's instructions. Type 2 clothes dryers designed and marked “For use only in noncombustible locations” shall not be installed elsewhere.
(3) Unlisted clothes dryers shall be installed with clearances to combustible material of not less than 18 in. Combustible floors under unlisted clothes dryers shall be protected in an approved manner
NFPA 54, §10.4.1

Type 1 and Type 2 clothes dryers shall be exhausted to the outdoors.
NFPA 54, §10.4.2

A clothes dryer exhaust duct shall not be connected into any vent connector, gas vent, chimney, crawl space, attic, or other similar concealed space.
NFPA 54, §10.4.4.1

Ducts for exhausting clothes dryers shall not be assembled with screws or other fastening means that extend into the duct and that would catch lint and reduce the efficiency of the exhaust system.
NFPA 54, §10.4.4.2

Exhaust ducts shall be constructed of rigid metallic material. Transition ducts used to connect the dryer to the exhaust duct shall be listed and labeled in accordance with ANSI/UL 2158A, and installed in accordance with the clothes dryer manufacturer's installation instructions.
NFPA 54, §10.4.4.3

Exhaust ducts for Type 2 clothes dryers shall be constructed of sheet metal or other noncombustible material. Such ducts shall be equivalent in strength and corrosion resistance to ducts made of galvanized sheet steel not less than 0.0195 in. thick
NFPA 54, §10.4.5.2

Type 2 dryers shall be equipped with lint-controlling means.
NFPA 54, §10.4.5.3

Exhaust ducts for unlisted Type 2 clothes dryers shall be installed with a minimum clearance of 6 in. from adjacent combustible material.
NFPA 54, §10.4.5.4

Where ducts pass through walls, floors, or partitions, the space around the duct shall be sealed with noncombustible material.
NFPA 54, §10.4.5.5

All clothes dryers installed for multiple-family or public use shall be equipped with approved safety shutoff devices and shall be installed as specified for a Type 2 clothes dryer.
NFPA 54, §10.4.5.6

Sample Question 7

_____ clothes dryers shall be exhausted to the outdoors.

A. Type 1
B. Type 2
C. Unlisted
D. Both A and B

Answer on last page

Decorative Appliances for Fireplaces

A decorative appliance for installation in a vented fireplace shall be installed only in a vented fireplace having a working chimney flue and constructed of noncombustible materials. These appliances shall not be thermostatically controlled.
NFPA 54, §10.6.2

Vented gas fireplaces shall not be installed in bathrooms or bedrooms unless the appliance is listed and the bedroom or bathroom has the required volume in accordance with 9.3.2.
NFPA 54, §10.7.1

The installation of vented gas fireplaces shall comply with the following requirements:
(1) Listed vented gas fireplaces shall be installed in accordance with the manufacturer's installation instructions and where installed in or attached to combustible material shall be specifically listed for such installation.
(2) Unlisted vented gas fireplaces shall not be installed in or attached to combustible material and shall also comply with the following: (a) They shall have a clearance at the sides and rear of not less than 18 in.
NFPA 54, §10.7.2

Duct Furnaces

Listed duct furnaces shall be installed with clearances of at least 6 in. between adjacent walls, ceilings, and floors of combustible material and the furnace draft hood and shall comply with the following:
(a) Furnaces listed for installation at lesser clearances shall be installed in accordance with the manufacturer's installation instructions.
(b) In no case shall the clearance be such as to interfere with combustion air and accessibility
NFPA 54, §10.10.1

The controls, combustion air inlet, and draft hoods for duct furnaces shall be located outside the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.
NFPA 54, §10.10.4

Food Service Appliances

Listed floor mounted food service appliances, such as ranges for hotels and restaurants, deep fat fryers, unit broilers, kettles, steam cookers, steam generators, and baking and roasting ovens, shall be installed at least 6 in. from combustible material except that at least a 2 in. clearance shall be maintained between a draft hood and combustible material. Floor mounted food service appliances listed for installation at lesser clearances shall be installed in accordance with the manufacturer’s installation instructions
NFPA 54, §10.12.1

Floor-mounted appliances with casters shall be listed for such construction and shall be installed in accordance with the manufacturer’s installation instructions for limiting the movement of the appliance to prevent strain on the connection.
NFPA 54, §10.12.6

A vertical distance of not less than 48 in. shall be provided between the top of all food service hot plates and griddles and combustible material.
NFPA 54, §10.13.1

Listed floor-mounted and built-in household cooking appliances shall be installed in accordance with the manufacturer's installation instructions.
NFPA 54, §10.14.1

(1) Listed floor-mounted household cooking appliances, where installed on combustible floors, shall be set on their own bases or legs.
NFPA 54, §10.14.2

Household cooking appliances shall have a vertical clearance above the cooking top of not less than 30 in. to combustible material or metal cabinets. A minimum clearance of 24 in. is permitted when one of the following is installed:
(2) A metal ventilating hood of sheet metal not less than 0.0122 in. thick is installed above the cooking top with a clearance of not less than 1⁄4 in. between the hood and the underside of the combustible material or metal cabinet, and the hood is at least as wide as the appliance and is centered over the appliance.
(3) A listed cooking appliance or microwave oven is installed over a listed cooking appliance and conforms to the terms of the upper appliance's manufacturer's installation instructions.
NFPA 54, §10.14.2.1

Where an appliance pressure regulator is not supplied with an illuminating appliance and the service line is not equipped with a service pressure regulator, an appliance pressure regulator shall be installed in the line serving one or more illuminating appliances.
NFPA 54, §10.15.5

Infrared Heaters

Suspended-type infrared heaters shall be fixed in position independent of gas and electric supply lines. Hangers and brackets shall be of noncombustible material. Heaters subject to vibration shall be provided with vibration isolating hangers.
NFPA 54, §10.17.1

Suspended-type unit heaters shall be safely and adequately supported, with due consideration given to their weight and vibration characteristics. Hangers and brackets shall be of noncombustible material.
NFPA 54, §10.25.1

Where unvented infrared heaters are used, natural or mechanical means shall be provided to supply and exhaust at least 4 ft^3/min/1000 Btu/hr. input of installed heaters.
NFPA 54, §10.17.3.1

Exhaust openings for removing flue products shall be above the level of the heaters.
NFPA 54, §10.17.3.2

Outdoor Cooking Appliances

Listed outdoor cooking appliances shall be installed in accordance with the manufacturer's installation instructions.
NFPA 54, §10.19.1

Unlisted outdoor cooking appliances shall be installed outdoors with clearances to combustible material of not less than 36 in. at the sides and back and not less than 48 in. at the front. In no case shall the appliance be located under overhead combustible construction.
NFPA 54, §10.19.2

Pool Heaters

A pool heater shall be located or protected so as to minimize accidental contact of hot surfaces by persons.
NFPA 54, §10.20.1

The installation of pool heaters shall meet the following requirements:
(1) In no case shall the clearances be such as to interfere with combustion air, draft hood or vent terminal clearance and relief, and accessibility for servicing.
(2) A listed pool heater shall be installed in accordance with the manufacturer's installation instructions.
(3) An unlisted pool heater shall be installed with a minimum clearance of 12 in. on all sides and the rear. A combustible floor under an unlisted pool heater shall be protected in an approved manner.
NFPA 54, §10.20.2

Room Heaters

Unvented room heaters shall not be installed in bathrooms or bedrooms.
Exception No. 1: Where approved by the authority having jurisdiction, one listed wall-mounted, unvented room heater equipped with an oxygen depletion safety shutoff system shall be permitted to be installed in a bathroom, provided that the input rating does not exceed 6000 Btu/hr and combustion and ventilation air is provided as specified in 10.1.2.
Exception No. 2: Where approved by the authority having jurisdiction, one listed wall-mounted unvented room heater equipped with an oxygen depletion safety shutoff system shall be permitted to be installed in a bedroom, provided that the input rating does not exceed 10,000 Btu/hr and combustion and ventilation air is provided as specified in 10.1.2.
NFPA 54, §10.22.1

Room heaters shall not be installed in the following occupancies:
(1) Residential board and care
(2) Health care
NFPA 54, §10.22.3

In addition to *NFPA 54, Chapter 10* room heaters in, schools, day care centers, foster homes, hotels, similar buildings, or rooms for temporary lodging. shall be vented and equipped with a safety shut-off device, shall not exceed 40,000 Btu, and shall be equipped with an oxygen depletion system.
LP-Gas Safety Rules, §9.306

Wall Furnaces

Vented wall furnaces connected to a Type B-W gas vent system listed only for a single story shall be installed only in single-story buildings or the top story of multistory buildings.
Vented wall furnaces connected to a Type B-W gas vent system listed for installation in multistory buildings shall be permitted to be installed in single-story or multistory buildings.
NFPA 54, §10.26.1.3

Wall furnaces shall be located so as not to cause a hazard to walls, floors, curtains, furniture, or doors. other parts of the building.
NFPA 54, §10.26.2

Water Heaters

Unlisted water heaters shall be installed with a clearance of 12 in. on all sides and rear. Combustible floors under unlisted water heaters shall be protected in an approved manner.
NFPA 54, §10.27.2.2

A water heater installation shall be provided with overpressure protection by means of an approved, listed device installed in accordance with the manufacturer's installation instructions. The pressure setting of the device shall exceed the water service pressure and shall not exceed the maximum pressure rating of the water heater.
NFPA 54, §10.27.3

Appliances installed in manufactured housing after the initial sale shall be listed for installation in manufactured housing, or approved, and shall be installed in accordance with the requirements of this code and the manufacturers' installation instructions.
NFPA 54, §10.29

Sample Question 8

One listed wall-mounted, unvented room heater equipped with an oxygen depletion safety shutoff system shall be permitted to be installed in a bedroom, provided that the input rating does not exceed _____ Btu/hr and combustion and ventilation air is provided.

A. 6,000
B. 10,000
C. 20,000
D. 40,000

Answer on last page

Placing Appliances in Operation

Leak Check

Leak checks using fuel gas shall be permitted in piping systems that have been pressure tested
NFPA 54, §8.2.1

The leakage shall be located by means of an approved gas detector, a noncorrosive leak detection fluid, or other approved leak detection methods.
NFPA 54, §8.1.5.2

During the process of turning gas on into a system of new gas piping, the entire system shall be inspected to determine that there are no open fittings or ends and that all valves at unused outlets are closed and plugged or capped.
NFPA 54, §8.2.2

Immediately after the gas is turned on into a new system or into a system that has been initially restored after an interruption of service, the piping system shall be checked for leakage. Where leakage is indicated, the gas supply shall be shut off until the necessary repairs have been made.
NFPA 54, §8.2.3

Appliances and equipment shall not be placed in operation until after the piping system has been checked for leakage in accordance with 8.2.3, the piping system is purged in accordance with Section 8.3, and connections to the appliance are checked for leakage.
NFPA 54, §8.2.4

Reported Leaks

(a) Each licensee shall maintain a written procedure to be followed when any employee receives notification of a possible leak. The licensee shall ensure that all employees are familiar with the procedure and shall authorize employees to implement the procedure without management oversight. The written procedure shall be available to emergency response agencies as specified in NFPA 58, §6.29.2.
(b) The written procedures shall include the classification of the leak grade as defined in §9.2
LP-Gas Safety Rules, §9.35

LP-Gas Leak Classification

Classification	Action Criteria	Examples
Grade 1	Requires prompt action to protect life and property. The prompt action in some instances may require one or more of the following: 1. Implementation of company emergency plan 2. Evacuating premises 3. Blocking off an area 4. Rerouting traffic 5. Eliminating sources of ignition 6. Venting the area 7. Stopping the flow of gas by closing valves or other means 8. Notifying police and fire departments	1. Any leak which, in the judgment of operating personnel at the scene, is regarded as an immediate hazard 2. Escaping gas that has ignited 3. Any indication of gas which has migrated into or under a building or into a tunnel 4. Any leak that can be seen, heard or felt and which is in a location that may endanger the general public or property
Grade 2	Many Grade 2 leaks, because of their location and magnitude, can be scheduled for repair on a normal routine basis with periodic re-inspection as necessary. Product may not be introduced into a container with a Grade 2 leak on a container appurtenance until the leak is repaired.	Any leak which, in the judgment of operating personnel at the scene, is NOT regarded as an immediate hazard shall be scheduled for repair, where no migration of gas into or under a building or into a tunnel is evident

Purging

When piping full of air is placed in operation, the air in the piping shall be displaced with fuel gas.
NFPA 54, §8.3.1.2

After the piping system has been placed in operation, appliances and equipment shall be purged before being placed into operation.
NFPA 54, §8.3.3

Placing Appliances in Operation

The input rate of the burner shall be adjusted to the proper value in accordance with the appliance manufacturer's instructions. Firing at a rate in excess of the nameplate rating shall be prohibited.
NFPA 54, §11.1.1

The input rate can be adjusted by either changing the size of a fixed orifice, changing the adjustment of an adjust- able orifice, or readjusting the appliance's gas pressure regulator outlet pressure (where a regulator is provided in the appliance)
NFPA 54, §11.1.1.1

The input rate shall be determined by one of the following:
(1) Checking burner input by using a gas meter
(2) Checking burner input by using manifold pressure and orifice size
NFPA 54, §11.1.1.2

Gas input ratings of appliances shall be used for elevations up to 2000 ft.
The input ratings of appliances operating at elevations above 2000 ft. shall be reduced in accordance with one of the following methods:
(1) 4% for each 1000 ft. above sea level
(2) As permitted by the AHJ
(3) De-rated per the manufacturer's instructions
NFPA 54, §11.1.2

The primary air for injection (Bunsen)-type burners shall be adjusted for proper flame characteristics in accordance with the appliance manufacturer's instructions. After setting the primary air, the adjustment means shall be secured in position.
NFPA 54, §11.2

Where a safety shutoff device is provided, it shall be checked for proper operation and adjustment in accordance with the appliance manufacturer's instructions. Where the device does not function properly to turn off the gas supply in the event of pilot outage or other improper operation, it shall be properly serviced or replaced with a new device.
NFPA 54, §11.3

Appliances supplied with means for automatic ignition shall be checked for proper operation within the parameters provided by the manufacturer. Any adjustments made shall be in accordance with the manufacturer's installation instructions.
NFPA 54, §11.4

All protective devices furnished with the appliance:
Limit control, fan control to blower, temperature and pressure relief valve, low-water cutoff device, manual operating features, shall be checked for proper operation within the parameters provided by the manufacturer.
NFPA 54, §11.5

Draft hood–equipped appliances shall be checked to verify that there is no draft hood spillage after 5 minutes of main burner operation
NFPA 54, §11.6

Operating instructions shall be furnished and shall be left in a prominent position near the appliance for the use of the consumer.
NFPA 54, §11.7

(a) Upon completion of the conversion and testing of LP-gas appliances, the licensee, registrant, or appliance manufacturer making the conversion shall attach to each appliance a decal or tag of metal or other permanent material indicating that the appliance is converted for use with LP-gas.
(b) Conversion of an appliance for use with LP-gas by an authorized representative of the appliance manufacturer, using parts provided by the manufacturer, is not an activity requiring licensing pursuant to Texas Natural Resources Code, §113.081.
LP-Gas Safety Rules, §9.307

Sample Question 9

The input rate of the burner shall be adjusted to the proper value in accordance with the _____.

A. appliance manufacturer's instructions
B. LP Gas Safety Rules
C. Code Of Federal Regulations
D. Boiler Pressure Vessel Code
E. universal burner adjustment standards

Answer on last page

ALTERNATIVE FUELS TRAINING CENTER

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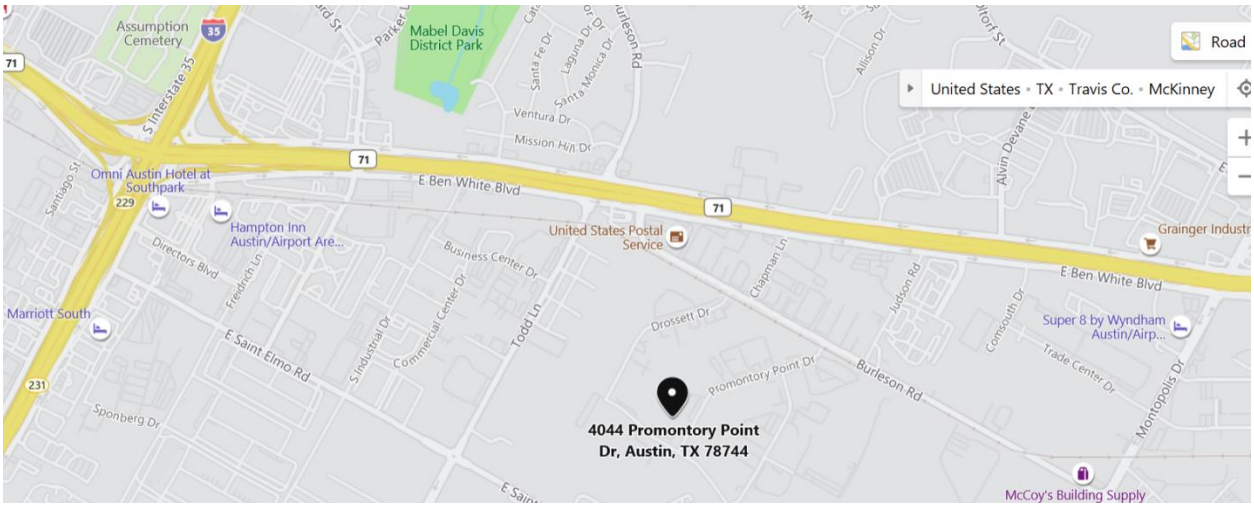

Sample Question Answers

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