

Issued to: _____
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3.3 Appliance Service & Installation Web Workbook



Railroad Commission of Texas Alternative Fuel Safety

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Administrative Rules

Slide #

- 18) . **Definitions**
SR §9.2 (22) 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.
- 19) . **LP-Gas Safety Rules**
Covers administrative codes, exceptions and enhancements to NFPA standards
Mandated by chapter 113 of the Texas Natural Resource Code
- 20) . **LP-Gas Safety Rules**
- Subchapter A
- Licensing, Examination, Training
 - Subchapter B
- Installation, Containers, Equipment
 - Subchapter C
- Vehicle registration, Identification, Testing
 - Subchapter D – Adoption of NFPA 54
 - Subchapter E – Adoption of NFPA 58
- 21) . **LP-Gas Safety Rules**
SR §9.7 (c) Applications for Licenses
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**.

- 22) . **LP-Gas Safety Rules**
SR §9.7. Applications for Licenses - (cont.)
In addition, licensees and registered manufacturers shall maintain a current version of the **rules** in this chapter and shall provide access to these rules for each company representative and operations supervisor.
The rules shall also be **available** to employees during business hours.
- 23) . **LP-Gas Safety Rules**
Revisions will occur after the date of publication.
It is your responsibility to comply with the rules in effect at the time the activities are conducted.
The current rules can be viewed online at: www.rrc.texas.gov.
- 24) . **NFPA 54 - 2018 Edition**
This is the edition currently adopted by the RRC
The safety rules, exams and study guides refer to this edition
- 25) . **New Certificate**
SR §9.8. Requirements & Application for New Certificate
(a) In addition to complying w/ NFPA 58 §4.4 & §11.2,
 - No person shall perform work,
 - Directly supervise LP-gas activities, or
 - Be employed in any capacity requiring contact with LP-gas unless:
- 26) . **New Certificate**
SR §9.8. (a) – (cont.)
(1) That individual is a **certificate holder** who is:
(A) In compliance with all applicable training and **continuing education** requirements in §9.51 and §9.52 of this title
(B) In compliance with **renewal requirements** in §9.9 of this title
(C) Employed by a licensee; or
(2) That individual is a trainee who complies with §9.12 of this title.

- 27) . **New Certificate**
SR §9.8. – (cont.)
(c) An applicant for a new certification 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;
(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.
- 28) . **Training Requirements**
58-§4.4 Qualification of Personnel.
§4.4.1 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.
- 29) . **Training Requirements**
58-§4.4 Qualification of Personnel. – (cont.)
§4.4.2 Persons whose primary duties include transporting LP-Gas, transferring liquid LP-Gas into or out of stationary containers, or making stationary installations shall complete training that includes the following components:
(1) Safe work practices
(2) The health and safety hazards of LP-Gas
(3) Emergency response procedures
(4) Supervised, on-the-job training
(5) An assessment of the person’s ability to perform the job duties assigned
- 30) . **Training Requirements**
58-§4.4 Qualification of Personnel. – (cont.)
§4.4.3 Refresher training shall be provided at least every **3 years**.
§4.4.4 Initial and subsequent refresher training shall be **documented**.

- 31) . **Definitions**
SR §9.2 (12) Company Representative--
The individual designated to the Commission by a license applicant or a licensee as the **principal individual** in authority and, in the case of a licensee other than a Category P licensee, actively supervising the conduct of the licensee's LP-gas activities.
- 32) . **Definitions**
SR §9.17 (b) Company Representative requirements
(1) Be an owner or employee of the licensee
(2) Be responsible for **supervising** all LP-Gas activities
(3) Have a working knowledge of the licensee's LP-Gas activities
(4) Pass the appropriate **management** level exam
(5) Complete any required training
- 33) . **Definitions**
SR §9.17 (b) Company Rep. requirements - (cont.)
(6) Comply with the work experience or training requirements
(7) Be directly responsible for all employees performing their assigned LP-gas activities
(8) Submit any additional information as deemed necessary by **AFS**
- 34) . **Definitions**
SR §9.2 (49) Trainee--
An Individual who has not yet taken and passed an employee-level rules examination.

35) . **Training Requirements**

SR §9.12. Trainees

A licensee 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 a certificate holder for the area of work being performed by the trainee.

(4) A trainee who has been in training for a total period of 45 calendar days, in any combination and **with any number of employers**, shall cease to perform any LP-gas activities for which he or she is not currently **certified**.

36) . **Rules Examination**

SR §9.10. Rules Examination

(a) An individual who passes the applicable rules examination with a score of at least **75%** will become a certificate holder.

(1) Successful completion of any examination shall be credited to and accrue to the **individual**,

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

37) . **Rules Examination**

SR §9.10 (c)(4) Time Limits

(A)(i) Employee-level examinations shall be limited to **two hours**.

You can use:

- LP Gas Safety Rules - 2022
- NFPA 54 - 2018

38) . **Employee-Level Certification**

SR §9.10. Rules Examination – (cont.)

(d)(1) Employee-Level examination:

(I) 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.

39) . **Employee-Level Certification**

SR §9.10. Rules Examination – (cont.)

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.

40) . **Certification Card**

Annual Renewals are due by **May 31st**, each year.

41) . **Rules Examination**

SR §9.10 (f) Failure

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.

- 42) . **Certificate Renewal**
SR §9.9. Requirements for Certificate Renewal
(a) In order to maintain active status, certificate holders shall **renew** their certification/registration **annually** in accordance with (c) and (e) of this section.
(c) 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.
- 43) . **Certificate Renewal**
SR §9.9. Requirements for Certificate Renewal – (cont.)
(1) Failure to pay the nonrefundable annual renewal fee by the deadline shall result in a **lapsed certificate**.
(A) To renew a lapsed certificate, the individual shall pay the nonrefundable \$35 annual renewal fee plus a nonrefundable **\$20 late-filing fee**. Failure to do so shall result in the expiration of the certificate.
- 44) . **Certificate Renewal**
SR §9.9. Requirements for Certificate Renewal – (cont.)
(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 for a **new** certificate. – **(Start Over)**
- 45) . **Certificate Renewal**
SR §9.52. Training and Continuing Education Courses
(b) A certificate holder shall complete at least **eight hours** of continuing education every **four years** as specified by this subsection.

- 46) . **Certificate Renewal**
SR §9.9. Requirements for Certificate Renewal – (cont.)
(d) Certificate holders shall successfully complete the **continuing education** requirements as specified in §9.51 and §9.52 of this title to maintain active status.
(1) Failure to comply with the continuing education requirements by the assigned deadline shall result in a **lapsed certification**.

- 47) . **Poll Questions**

- 48) . **Characteristics of Propane**

- 49) . **Characteristics of Propane**
Propane is a **Liquefied Petroleum Gas** which must be stored under pressure to remain in liquid state at normal temperatures.

It is a colorless, odorless, non-toxic gas.

It is odorized for safety using a substance called **ethyl mercaptan** which produces a “rotten egg” smell.

Propane can be an inhalation hazard.
(It displaces oxygen and can cause suffocation)

- 50) . **Characteristics of Propane**
Propane is highly flammable

Flammability Limits

Lower: **2.15%** propane in air

Upper: **9.6%** propane in air

Ignition Temperature

960 to 1,120°F

Common sources of ignition include a pilot light, match, cigarette, electric motors, switches and static electricity

- 51) . **Characteristics of Propane**
Propane at atmospheric pressure boils at -44°F
Propane vapor is heavier than air.
Specific Gravity
Propane liquid = **0.504** (water is 1.0)
Propane vapor = **1.5** (air is 1.0)
This means that propane vapor will sink to the lowest ground level.
- 52) . **Characteristics of Propane**
The expansion rate of propane liquid into vapor is **270x**

As it expands it absorbs heat from the surrounding atmosphere, it poses a freezing hazard to exposed skin. Always wear personal protective equipment.
- 53) . **Characteristics of Propane**
What is the white fog seen when it is released into the air?

The propane vapor is so cold it condenses the moisture in the air which is visible as fog.
- 54) . **System Design & Materials**
- 55) **Definitions**
SR §9.2 (23) LP-gas System--
All piping, fittings, valves and equipment, excluding containers and appliances, that connect one or more containers to one or more appliances that use or consume LP-gas.
- 56) . **System Design & Materials**
SR §9.126 (a) Appurtenances and Equipment
All appurtenances and equipment placed into LP-gas service **shall be listed** by a nationally recognized testing laboratory:
- Underwriters Laboratory (UL)
 - Factory Mutual (FM)
 - American Gas Association (AGA)

- 57) . **System Design & Materials**
SR §9.126 (a) Appurtenances and Equipment
Exceptions to listing:
(1) it is **specifically prohibited** for by another section of the LP-Gas Safety Rules;
(2) there is **no test specification** developed by the testing laboratory for the equipment; or
(3) it is **used in compliance** with an NFPA standard adopted by the Commission.

- 58) . **System Design & Materials**
SR §9.126 (b) Appurtenances and Equipment
Appurtenances and equipment that **cannot be listed** but:
- Are not prohibited by the LP-Gas Safety Rules
or
- The manufacturer's instructions

Shall be acceptable, provided the appurtenances and equipment are installed in compliance with the LP-Gas Safety Rules.

- 59) . **System Design & Materials**
54-§3.3.5 Appliance.
Any device that utilizes gas as a fuel or raw material to produce:
- Light
 - Heat
 - Power
 - Refrigeration or
 - Air conditioning

- 60) . **System Design & Materials**
54-§5.4.1 Sizing Piping Systems
Gas piping systems shall be sized and installed to provide a supply of gas sufficient to meet the **maximum demand** without undue loss of pressure between the point of delivery and the appliance.

- 61) . **System Design & Materials**
54-§5.4.2.1 Sizing Piping Systems
The volumetric flow rate of gas to be provided shall be the **sum** of the **maximum input** of the appliances served.
- 62) . **System Design & Materials**
54-A.5.4.2.1 Sizing Piping Systems
Some older appliances do not have a nameplate.
In this case, Table **A.5.4.2.1** should be used.
An estimate of appliance input can be based on the following:
- A rating provided by the manufacturer
 - The rating of similar appliances
 - Recommendations of the gas supplier
 - Recommendations of a qualified agency
 - A gas flow test
 - Measurement of the orifice size of the appliance
- 63) . **System Design & Materials**
Table A.5.4.2.1
- 64) . **System Design & Materials**
54-§5.4.2.3 Sizing Piping Systems
The total connected hourly load shall be used as the basis for piping sizing, assuming all appliances are **operating at full capacity simultaneously**.
- Exception: Sizing shall be permitted to be based upon established load diversity factors (for instance multi-family units).*
- 65) . **System Design & Materials**
54-§5.4.3 Sizing Methods
Gas piping shall be sized in accordance with one of the following:
- (1) Pipe sizing tables or sizing equations in Chapter 6
 - (2) Other approved engineering methods acceptable to the authority having jurisdiction
 - (3) Sizing tables included in a listed piping system manufacturer's installation instructions

- 66) . **System Design & Materials**
54-§5.4.4 Allowable Pressure Drop
The design pressure loss in a piping system under **maximum probable flow** conditions, from the point of delivery to the inlet connection of the appliance.

The supply pressure at the appliance shall be greater than the **minimum pressure** required for proper appliance operation.
- 67) . **System Design & Materials**
54-§5.5.4 Maximum Design Operating Pressure
The maximum pressure for piping inside buildings shall **not exceed 5-psi** unless one of these conditions is met:
(1) The piping system is 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.
- 68) . **System Design & Materials**
54-§5.5.4 Maximum Design Operating Pressure - (cont.)
(4) The piping is located inside buildings used exclusively for:
(a) Industrial processing or heating
(b) Research
(c) Warehousing
(d) Boiler or mechanical rooms
(5) Piping is a temporary installation in buildings under construction.
- 69) . **System Design & Materials**
54-§5.5.4 Maximum Design Operating Pressure - (cont.)
(6) Piping serves appliances/equipment used for agricultural purposes.
(7) The piping system is an LP-Gas piping system with an operating pressure greater than 20-psi and complies with **NFPA 58**.
- 70) . **Poll Questions**
Break

71) . **Gas Piping Installation**

72) . **Consumer Safety Notification**

SR §9.32 (a) Consumer Safety Notification

A person holding a license to install or repair an LP-gas system who sells, installs, or repairs an LP-gas system, piping, shall provide the following notice to the owner of the system:

73) . **Consumer Safety Notification**

SR §9.32 (a) Consumer Safety Notification

“WARNING: Flammable Gas.

The installation, modification, or repair of an LPG system by a person who is not licensed or registered to install, modify, or repair an LPG system may cause injury, harm, or loss. Contact a person licensed or registered to install, modify, or repair an LPG system.

A person licensed to install or repair an LPG system may not be liable for damages caused by the modification of an LPG system by an unlicensed person except as otherwise provided by applicable law.”

74) . **Consumer Safety Notification**

SR §9.32 (b) Consumer Safety Notification

A person holding a license to install or repair an LP-gas system who sells, installs, or repairs an LP-gas system, piping, shall **document the notice**.

75) . **Gas Piping Installation**

54-§5.6.1.1 Acceptable Materials for Piping Systems

Shall comply with the requirements of this chapter

- or -

Shall be acceptable to the authority having jurisdiction (AHJ).

These criteria shall be used for Inspection ONLY.

Appliance Technicians are NOT authorized to install piping.

- 76) . **Gas Piping Installation**
54-§5.6.1.2 Used Materials
Pipe, fittings, valves, or other materials shall not be used again unless they are free of foreign materials
- and-
Are adequate for the service intended.
- 77) . **Gas Piping Installation**
54-§5.6.2 Metallic Pipe
5.6.2.1 Cast iron pipe shall **not** be used.
- 78) . **Gas Piping Installation**
54-§5.6.2.2 Steel and Wrought Iron
Steel and wrought-iron pipe shall be at least **Schedule 10** and comply with:
(1) ASTM A53
Steel, Black, and Hot Dipped, Welded and Seamless Pipe
(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
- 79) . **Gas Piping Installation**
54-§5.6.3.3 Corrugated Stainless Steel
Stainless steel tubing shall comply with one of the following:
(1) ASTM A268, *Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service*
(2) ASTM A269, *Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*

80) . **Gas Piping Installation**
54-§5.6.4.1 Plastic Pipe & Tubing
§5.6.4.1.1 Polyethylene plastic pipe, tubing, and fittings used to supply fuel gas shall conform to ASTM D 2513, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*.

- Marked “gas” and “ASTM D2513.”
- **Outdoors Underground Only**

81) . **Gas Piping Installation**
54-§5.6.5 Workmanship and Defects
Gas piping, 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**.

82) . **Gas Piping Installation**
54-§5.6.6.1 Specifications for Pipe Threads
Metallic pipe and fitting threads shall be **taper** pipe threads and shall comply with ANSI/ASME B1.20.1, *Pipe Threads, General Purpose, Inch*.

83) . **Gas Piping Installation**
54-§5.6.6.2 Damaged Threads
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.

84) . **Gas Piping Installation**
54-§5.6.6.3 Number of Threads
Field threading of metallic pipe shall be in accordance with Table 5.6.6.3.

85) . **Gas Piping Installation**

54-§5.6.6.4 Thread Compounds

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.

86) . **Gas Piping Installation**

54-§7.2.1 Installation of Piping

Piping installed aboveground shall be securely supported and located where it will be **protected from physical damage**.

Where passing through an exterior wall, the piping shall also be **protected against corrosion**.

Where piping is encased in a protective pipe sleeve, it shall be sealed to prevent the entry of water, insects, or rodents.

87) . **Gas Piping Installation**

54-§7.2.5 Prohibited Locations

Gas piping inside any building **shall not be installed** in or through a:

- Clothes chute
- **Chimney** or gas vent
- Dumbwaiter
- Elevator shaft
- **Air duct**, other than combustion air ducts.

88) . **Gas Piping Installation**

54-§7.7.1 Location and Installation

§7.7.1.1 The outlet fittings or piping shall be securely fastened in place.

§7.7.1.2 Outlets shall not be located behind doors.

§7.7.1.3 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.

89) . **Gas Piping Installation**

54-§7.7.1.4 Outlet Installation

The **unthreaded** portion of gas piping outlets shall:

Extend **not less than 1 in.** through finished **ceilings or indoor or outdoor walls.**

§7.7.1.5

Extend **not less than 2 in.** above the surface of **floors or outdoor patios or slabs.**

90) . **Gas Piping Installation**

54-§7.7.2 Cap All Outlets

§7.7.2.1 Each outlet shall be closed **gastight** with a **threaded plug or cap** immediately after installation

Shall be left closed until the appliance is **connected.**

When an appliance or equipment is disconnected and the outlet is not immediately used again, it shall be capped or plugged gastight.

91) . **Gas Piping Installation**

54-§7.8.2.1 Accessibility of Gas Valves

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.**

92) . **Gas Pressure Regulators**

93) . **Gas Pressure Regulators**

54-§5.8.1 Line Pressure Regulator

A **line gas pressure regulator** or gas equipment pressure regulator, **shall be installed**

Where the **gas supply pressure is higher** than what the branch supply line or appliances are designed to operate

- or -

Vary beyond design pressure limits.

94) . **Gas Pressure Regulators**

54-§5.8.2 Listing

Line pressure regulators shall be listed in accordance with ANSI Z21.80/CSA 6.22, *Line Pressure Regulators*, where the **outlet pressure** is set to **2-psi or less**.

§5.8.3 Location

The gas pressure regulator shall be accessible for servicing.

§5.8.4 Regulator Protection

Pressure regulators shall be protected against physical damage.

95) . **Poll Questions**

96) . **Appliance Installation Requirements**

97) . **Appliance Installation**

54-§9.1.1 Appliance Approval

Appliances, equipment, and accessories shall be approved.

§9.1.1.2

Listed appliances, equipment, and accessories shall be installed in accordance with Chapter 8 and the **manufacturer's installation instructions**.

98) . **Appliance Installation**

54-§9.1.1.3 Unlisted Appliance Approval

Acceptance of unlisted appliances, equipment, and accessories shall be on the basis of a sound engineering evaluation.

§9.1.1.4

The unlisted appliance, equipment, or accessory shall be safe and suitable for the proposed service and shall be recommended for the service by the manufacturer.

99) . **Appliance Installation**

54-§9.1.2 Added or Converted Appliances

When additional or replacement appliances are installed or an appliance is **converted to gas from another fuel**, the location must be checked to verify the following:

100) . **Appliance Installation**

54-§9.1.2 Added or Converted Appliances – (cont.)

- (1) Air for combustion and ventilation is provided where required
- (2) The installation components and appliances meet the **clearances to combustible material**
- (3) The **venting system** is constructed and sized in accordance with the provisions of Chapter 12.

- 101) . **Appliance Installation**
54-§9.1.3 Type of Gas(es).
It shall be determined whether the appliance has been designed for use with the gas to which it will be connected.
- 102) . **Appliance Installation**
54-§9.1.3 Type of Gas(es) – (cont.)
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**
 - **Service gas supplier, or**
 - **Appliance manufacturer** for complete instructions.
- 103) . **Appliance Installation**
Example: Empire Natural Gas to Propane Conversion Kit
- 104) . **Appliance Installation**
54-§9.1.10.1 Installation in Residential Garages
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.
- 105) . **Appliance Installation**
- 106) . **Appliance Installation**
54-§9.1.10.3 Installation in Residential Garages
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.
- 107) . **Appliance Installation**
54-§9.1.17 Avoiding Strain on Gas Piping
Appliances shall be so **supported** and so **connected** to the piping as **not to exert undue strain** on the connections.

108) . **Appliance Installation**
54-§3.3.84.2 Gas Appliance Pressure Regulators.
A pressure regulator for controlling pressure to the **appliance manifold**.

§9.1.18 Gas Appliance Pressure Regulators.
Where the gas supply pressure is higher than the pressure the appliance is designed to operate at, a gas appliance pressure regulator shall be installed.

109) . **Appliance Installation**
54-§9.2.1 Accessibility for Service
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
- **Replacement** of filters, blowers, motors, burners, controls, and vent connections

110) . **Appliance Installation**
54-§9.2.1 Accessibility for Service – (cont.)

- Lubrication of moving parts
- Adjustment and cleaning of burners and pilots
- Proper functioning of explosion vents

For attic installation, the passageway and servicing area adjacent to the appliance shall be floored.

111) . **Combustion and Ventilation Air**
54-§9.3.2 Indoor Combustion 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 second method shall be used.

- 112) . **Combustion and Ventilation Air**
54-§9.3.2.1 Standard Method.
The minimum required volume shall be 50 ft³ per 1000 Btu/hour.
- 113) . **Combustion and Ventilation Air**
54-§9.3.2.3(1) Indoor Opening Size and Location.
Minimum free area of **1 in.²/1000 Btu/hr** of total input rating of appliances.
- Not less than **100 in.²**
 - One opening within **12 in.** of the **top**.
 - One opening within **12 in.** of the **bottom**.
- 114) . **Combustion and Ventilation Air**
54-§9.3.3 Outdoor Combustion Air.
Outdoor combustion air shall be provided through **opening(s)** to the outdoors in accordance with the Standard Method or Known Air Infiltration Rate Method.
- The **minimum** dimension of air openings shall not be less than **3 in.**
- 115) . **Combustion and Ventilation Air**
54-§9.3.3.1 Two Permanent Openings Method.
Two permanent openings:
- Within **12 in.** of the **top**
 - Within **12 in.** of the **bottom**
 - The openings shall communicate directly or by ducts with the **outdoors**.
- 116) . **Combustion and Ventilation Air**
54-§9.3.3.1 (1) Two Permanent Openings Method. – (cont.)
Each **vertical** duct:
Free area of **1 in.²/4000 Btu/hr.** of total input rating of all appliances.
- 117) . **Combustion and Ventilation Air**
54-§9.3.3.1 (2) Two Permanent Openings Method. – (cont.)
Each **horizontal** duct:
Free area of **1 in.²/2000 Btu/hr.** of total input rating of all appliances.

118) . **Combustion and Ventilation Air**

54-§9.3.3.2 One Permanent Opening Method.

- One opening within **12 in.** of the top.
- Appliance clearances:
1 in. from the sides & back and
6 in. from the front.
- Free area of **1 in²/3000 Btu/hr** of the total input rating of all appliances.

119) . **Combustion and Ventilation Air**

54-§9.3.7.1 Louvers and Grilles.

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 is not known it is assumed that:

- **Wood louvers** have **25%** free area
- **Metal louvers** and grilles have **75%** free area.

120) . **Combustion and Ventilation Air**

121) . **Combustion and Ventilation Air**

54-§9.3.7.2 Minimum Screen Mesh Size.

Screens shall not be smaller than **1/4 in.** mesh.

122) . **Combustion and Ventilation Air**

54-§9.3.8 Combustion Air Ducts.

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

***Exception:** Within dwellings units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one fireblock is removed.*

- 123) . **Combustion and Ventilation Air**
54-§9.3.8 Combustion Air Ducts. – (cont.)
§9.3.8.2
Ducts shall terminate in an unobstructed space, allowing free movement of combustion air to the appliances.
§9.3.8.3
Ducts shall serve a single space.
- 124) . **Combustion and Ventilation Air**
54-§9.3.8 Combustion Air Ducts. – (cont.)
§9.3.8.4
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.
- 125) . **Combustion and Ventilation Air**
54-§9.3.8 Combustion Air Ducts. – (cont.)
§9.3.8.5
Ducts shall not be screened where terminating in an attic space.
§9.3.8.6 Horizontal upper combustion air ducts shall not slope downward toward the source of combustion air.
- 126) . **Combustion and Ventilation Air**
54-§9.3.8 Combustion Air Ducts. – (cont.)
§9.3.8.8
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.

- 127) . **Appliances in Attics**
54-§9.5.1 Attic Access.
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.**
§9.5.1.1
Where the height of the passageway is **less than 6 ft.**, the distance from the passageway access to the appliance **shall not exceed 20 ft.**
- 128) . **Appliances in Attics**
54-§9.5.1 Attic Access. – (cont.)
§9.5.1.2
The passageway shall be unobstructed and shall have **solid flooring not less than 24 in.** wide from the entrance opening to the appliance.
§9.5.2 Work Platform.
A level working platform not less than **30 in. × 30 in.** shall be provided in front of the service side of the appliance.
- 129) . **Appliances in Attics**
54-§9.5.3 Lighting and Convenience Outlet.
A permanent **120 Volt** receptacle outlet and a lighting fixture shall be installed near the appliance.
The switch controlling the lighting fixture shall be located at the **entrance** to the passageway.
- 130) . **Appliance Installation**
54-§9.6.1 Connecting Appliances.
Appliances and equipment shall be connected to the building piping by one of the following:
- (1) Rigid metallic pipe** and fittings.
 - (2) Semi-rigid metallic tubing** and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.

131) . **Appliance Installation**

54-9.6.1 Connecting Appliances – (cont.)

(3) A listed connector in compliance with ANSI Z21.24, *Standard for Connectors for Gas Appliances*.

The connector shall be used in accordance with the **manufacturer's installation instructions**

Shall be in the **same room** as the appliance.

Only one connector shall be used per appliance.

132) . **Appliance Installation**

133) . **Appliance Installation**

54-§9.6.1 Connecting Appliances – (cont.)

(4) A listed connector in compliance with ANSI Z21.75, *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 fixed in place.

134) . **Appliance Installation**

54-§9.6.1 Connecting Appliances – (cont.)

(6) Listed nonmetallic gas hose connectors.

135) . **Appliance Installation**

54-9.6.1 Connecting Appliances – (cont.)

(7) Unlisted gas hose connectors for use in laboratories and educational facilities in accordance with 9.6.3.

§9.6.3 Injection (Bunsen) burners used in laboratories and educational facilities shall be permitted to be connected to the gas supply by an unlisted hose.

- 136) . **Appliance Installation**
54-§9.6.1.3 Commercial Cooking Appliance Connectors
Commercial cooking appliances that are moved for **cleaning** and **sanitation purposes**:
- Shall be connected in accordance with the connector **manufacturer's installation instructions**
 - Using a listed appliance connector complying with ANSI Z21.69, *Connectors for Movable Gas Appliances*.

- 137) . **Appliance Installation**
54-§9.6.2 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:

- 138) . **Appliance Installation**
54-§9.6.2 Nonmetallic Gas Hose Connectors. – (cont.)
- (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 pass through wall partitions, ceilings, or floors.

- 139) . **Appliance Installation**
54-§9.6.2 Nonmetallic Gas Hose Connectors. – (cont.)
- (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, and installed in accordance with the following:

- 140) . **Appliance Installation**
54-§9.6.2 Nonmetallic Gas Hose Connectors. – (cont.)
(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**.

- 141) . **Appliance Installation**
54-§9.6.4 Connection of Portable Appliances
§9.6.4.4
Where flexible connections are used they shall:
- Be of minimum practical length
 - Not extend from **one room to another**
 - Not pass through **walls, partitions, ceilings, or floors**
 - Not be used in a **concealed location**
 - Protected against physical or thermal damage
 - Provided with a gas shutoff valve in the rigid piping

- 142) . **Appliance Installation**

- 143) . **Appliance Installation**

- 144) . **Appliance Installation**
54-§9.6.5 Appliance Shutoff Valves and Connections.
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**.

- 145) . **Definitions**
54-§3.3.100.1 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.
- 146) . **Appliance Installation**
54-§9.6.5.1 Appliance Shutoff Valves
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 can be installed in fireplaces if listed for such use.
- 147) . **Appliance Installation**
54-§9.6.5.2 Appliance Shutoff Valves – (cont.)
Shutoff valves serving appliances installed in vented fireplaces and ventless firebox enclosures are **not required to be located within 6 ft** of the appliance if such valves are **readily accessible** and **permanently identified**.
- 148) . **Appliance Installation**
54-§9.6.5.3 Appliance Shutoff Valves – (cont.)
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**.
- 149) . **Appliance Installation**
54-§9.6.7 Gas Convenience Outlets
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.
- 150) . **Appliance Installation**

151) . **Appliance Installation**

54-§9.6.8 Sediment Trap.

Where a sediment trap is not incorporated as a part of the appliance, a sediment trap shall be **installed as close to the inlet of the appliance** as practicable.

152) . **Appliance Installation**

54-§9.6.8 Sediment Trap. – (cont.)

- Illuminating appliances
- Ranges
- Clothes dryers,
- Decorative appliances for vented fireplaces
- Gas fireplaces,
- Outdoor grills

Are **not required** to be equipped with a sediment trap.

153) . **Appliance Installation**

154) . **Appliance Installation**

155) . **Appliance Installation**

156) . **Poll Questions**

157) . **Appliance Venting**

158) . **Appliance Venting**

54-§12.1 Minimum Safe Performance.

Venting systems shall be designed and constructed to convey all flue and vent gases to the **outdoors**.

§12.2.1 Installation.

Listed vents shall be installed in accordance with **Chapter 12** and the manufacturers' installation instructions.

159) . **Definitions**

54-§3.3.103 Venting.

The conveyance of combustion products to the outdoors.

54-§3.3.53 Gas Vent.

A passageway composed of listed factory-built components assembled in accordance with the manufacturer's installation instructions for conveying vent gases to the outdoors.

160) . **Definitions**

54-§3.3.53.3 Type B Gas Vent.

A gas vent for venting listed gas appliances with draft hoods and other Category 1 appliances listed for use with Type B gas vents.

54-§3.3.53.4 Type B-W Gas Vent.

A gas vent for venting listed **wall furnaces**.

54-§3.3.53.5 Type L Gas Vent.

A gas vent for venting appliances listed for use with Type L vents or with Type B gas vents.

161) . **Appliance Venting**

Type B

162) . **Appliance Venting**

Type B-W

163) . **Appliance Venting**

54-§12.3.2 Appliances Not Required to Be Vented.

The following are **not required** to be vented:

- (1) Listed ranges**
- (2) Built-in cooking units listed for optional venting**
- (3) Listed hot plates and listed laundry stoves**
- (4) Listed Type 1 clothes dryer**

- 164) . **Appliance Venting**
54-§12.3.2 Appliances Not Required to Be Vented. – (cont.)
(5) Listed dish washer instantaneous hot water heaters
(6) Listed refrigerator
(7) Counter appliances
(8) Room heaters listed for unvented use
(9) Direct gas fired make-up air heaters
(10) Other listed unvented appliances
(11) Specialized appliances of limited input such as laboratory burners or gas lights

- 165) . **Appliance Venting**
54-§12.3.2 Appliances Not Required to Be Vented. – (cont.)
Where any or all of these appliances are installed so the aggregate input rating exceeds **20 Btu/hr/ft³** of room or space in which it is installed,

One or more shall be provided with venting systems so the total rating of the remaining unvented appliances does not exceed 20 Btu/hr/ft³.

- 166) . **Appliance Venting**
54-§12.3.3 Ventilating Hoods.
The use of ventilating hoods and exhaust systems to vent appliances shall be limited to **industrial appliances** and appliances installed in commercial applications.
§12.3.4 Well-Ventilated Spaces.
The flue gases from industrial-type appliances shall not be required to be vented to the outdoors where such gases are discharged into a large and well-ventilated industrial space.

- 167) . **Appliance Venting**
54-§12.3.5 Direct-Vent Appliances.
Listed direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions and 12.9.3.

- 168) . **Appliance Venting**
54-§12.3.6 Appliances with Integral Vents.
Appliances incorporating **integral venting** means shall be considered properly vented, where installed, in accordance with the manufacturer's installation instructions.
- 169) . **Appliance Venting**
54-§12.4.1 Appliance Draft Requirements.
A venting system shall satisfy the draft requirements of the appliance in accordance with the manufacturer's instructions.
- 170) . **Appliance Venting**
54-§12.6.2.1 Chimney Termination
A chimney for residential-type 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.**
- 171) . **Appliance Venting**
- 172) . **Appliance Venting**
54-§12.7.2 Installation.
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.

173) **54-§12.7.2 Installation. - (cont.)**

(3) Gas vents installed in masonry chimneys shall be installed per the manufacturer's instructions and identified with a permanent label reading *"This gas vent for appliances that burn gas. Do not connect to solid or liquid fuel-burning appliances or incinerators"* installed at the point where the vent enters the chimney.

(4) Screws, rivets, and other fasteners shall not penetrate the inner wall of double-wall gas vents, except at the transition from the appliance draft hood outlet, flue collar, or single-wall metal connector to a double-wall vent.

174) . **Appliance Venting**

54-§12.7.3 Gas Vent Termination.

(1) A gas vent shall terminate in accordance with one of the following:

(a) Gas vents that are **12 inches 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.

175) . **Appliance Venting**

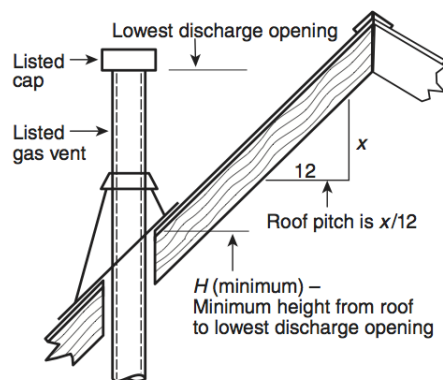


FIGURE 12.7.3 Termination Locations for Gas Vents with Listed Caps 12 in. (300 mm) or Less in Size at Least 8 ft (2.4 m) from a Vertical Wall.

176) .

Appliance Venting

Table 12.7.3 Roof Slope Heights

Roof Slope	<i>H</i> (minimum)	
	ft	m
Flat to 6/12	1.0	0.30
Over 6/12 to 7/12	1.25	0.38
Over 7/12 to 8/12	1.5	0.46
Over 8/12 to 9/12	2.0	0.61
Over 9/12 to 10/12	2.5	0.76
Over 10/12 to 11/12	3.25	0.99
Over 11/12 to 12/12	4.0	1.22
Over 12/12 to 14/12	5.0	1.52
Over 14/12 to 16/12	6.0	1.83
Over 16/12 to 18/12	7.0	2.13
Over 18/12 to 20/12	7.5	2.27
Over 20/12 to 21/12	8.0	2.44

177) .

Appliance Venting

54-§12.7.2 Gas Vent Termination – (cont.)

(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.

178) .

Appliance Venting

54-§12.7.3 Gas Vent Termination – (cont.)

(4) A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below eaves or parapets.

(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 manufacturers' installation instructions.

179) .

Appliance Venting

54-§12.7.3 Gas Vent Termination – (cont.)

(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.

180) . **Appliance Venting**

54-§12.11.3.2 Draft Manifolds

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.

181) . **Appliance Venting**

54-§12.11.7 Slope.

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.**

§12.11.9 Support.

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.

182) . **Poll Questions
Break**

183) . **Installation of Specific Appliances**

184) . **Installation of Specific Appliances**

54-§10.1.2 Installation in a Bedroom or Bathroom

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 the indoor combustion air methods.

185) . **Central Heating Boilers and Furnaces**

54-§10.3.1 Location.

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.

186) . **Installation of Specific Appliances**

54-§10.27.1 Water Heaters

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.

187) . **Clothes Dryers**

188) . **Definitions**

54-§3.3.19 Clothes Dryer.

An appliance used to dry wet laundry by means of heat derived from the combustion of fuel gases.

§3.3.19.1 Type 1 Clothes Dryer.

Primarily used in **family living** environment. May or may not be coin operated for public use.

§3.3.19.2 Type 2 Clothes Dryer.

Used in public business.

May or may not be operated by the public or hired attendant.

May or may not be coin operated.

189) . **Installation of Specific Appliances**

54-§10.4.1 Clearance.

The installation of clothes dryers shall comply with the following requirements:

(1) Listed Type 1 clothes dryers shall have a minimum clearance of **6 in. from adjacent combustible material.**

Clothes dryers listed for reduced clearances shall be installed in according to the manufacturer's instructions.

Type 1 clothes dryers installed in closets shall be specifically listed for such installation.

190) . **Installation of Specific Appliances**

54-§10.4.1 Clearance – (cont.)

(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.

Dryers designed and marked "For use only in non-combustible locations" shall not be installed elsewhere.

191) . **Installation of Specific Appliances**

54-§10.4.1 Clearance – (cont.)

(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.

192) . **Installation of Specific Appliances**

54-§10.4.2 Exhausting to the Outdoors.

Type 1 and Type 2 clothes dryers shall be **exhausted to the outdoors.**

193) . **Installation of Specific Appliances**

54-§10.4.3.1 Provision for Make-Up Air

Make-up air shall be provided for Type 1 clothes dryers in accordance with the manufacturers' installation instructions.

§10.4.3.2

Make-up air shall be provided for Type 2 clothes dryers, with a minimum free area of **1 in.²/1000 Btu/hr** total input rating of the dryer(s) installed.

194) . **Installation of Specific Appliances**

54-§10.4.4.1 Exhaust Ducts for Type 1

A clothes dryer exhaust duct shall not be connected into any:

- Vent connector
- Gas vent
- Chimney
- Crawl space,
- **Attic**
- Concealed space.

195) . **Installation of Specific Appliances**

54-§10.4.4.2 Exhaust Ducts for Type 1 Dryers – (cont.)

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.

196) . **Installation of Specific Appliances**

54-§10.4.4.3 Exhaust Ducts for Type 1 Dryers – (cont.)

Exhaust ducts shall be constructed of **rigid** metallic material.

Transition ducts used to connect the dryer to the exhaust duct shall be listed for that application or installed in accordance with the clothes dryer manufacturer's installation instructions.

197) . **Installation of Specific Appliances**

54-§10.4.5.2 Exhaust Ducts for Type 2 Dryers

Exhaust ducts 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 inches thick.

§10.4.5.3

Type 2 dryers shall be equipped with lint-controlling means.

198) . **Dryer Exhaust Ducts**

199) . **Installation of Specific Appliances**

54-§10.4.5.4 Exhaust Ducts for Type 2 Dryers – (cont.)

Exhaust ducts for **unlisted** Type 2 clothes dryers shall be installed with a minimum clearance of **6 in.** from adjacent combustible material.

§10.4.5.5

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

200) . **Installation of Specific Appliances**

54-§10.4.6 Multiple-Family or Public Use.

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.

201) . **Decorative Appliances for Fireplaces**

54-§10.6.1 Prohibited Installations.

Decorative appliances for installation in **vented fireplaces** shall not be installed in bathrooms or bedrooms unless the appliance is listed and the room has the required volume.

*From #54 Handbook **decorative appliances** can be:*

- *Gas logs*
- *Coal basket*
- *Fireplace insert*
- *Radiant appliance*

202) . **Decorative Appliances for Fireplaces**

54-§10.6.2 Installation.

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.

203) . **Decorative Appliances for Fireplaces**

54-§10.6.2.1 Installation. – (cont.)

A **listed** decorative appliance for installation in a vented fireplace:
Shall be installed in accordance with the manufacturer's installation instructions.

§10.6.2.2

A decorative appliance for installation in a vented fireplace, where installed in a **manufactured home**, shall be listed for installation in manufactured homes.

204) . **Vented Gas Fireplaces**

54-§10.7.1 Prohibited Installations.

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. **(50 ft³/1000 Btu/hr.)**

Exception: Direct-vent gas fireplaces.

205) . **Vented Gas Fireplaces**

54-§10.7.2 Installation.

(1) Listed vented gas fireplaces shall be installed in accordance with the manufacturer's instructions and where installed in or attached to combustible material shall be listed for such installation.

206) . **Vented Gas Fireplaces**

54-§10.7.2 Installation. – (cont.)

(2) Unlisted vented gas fireplaces shall not be installed in or attached to combustible material.

(a) They shall have a clearance at the sides and rear of not less than **18 in.**

207) . **Duct Furnaces**

54-§10.10.1 Clearances.

Listed duct furnace clearance requirements:

(1) At least **6 in.** between adjacent walls, ceilings, & floors of combustible material and the furnace draft hood.

(a) Furnaces listed for lesser clearances shall be installed in accordance with the manufacturer's instructions.

(b) In no case shall the clearance interfere with combustion air and accessibility.

- 208) . **Duct Furnaces**
54-§10.10.4 Location of Draft Hood and Controls.
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.

- 209) . **Food Service Appliances**
54-§10.12.1 Clearance for Listed Appliances.
Listed floor-mounted food service appliances, such as ranges, 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** with at **least a 2 in. between a draft hood** and combustible material.

Appliances listed for installation at **lesser clearances** shall be installed in accordance with the **manufacturer's installation instructions**.

- 210) . **Food Service Appliances**
54-§10.12.6 For Use with Casters.
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.

- 211) . **Food Service Appliances**
54-§10.13.1 Vertical Clearance.
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**.

- 212) . **Food Service Appliances**
54-§10.13.2 Clearance for Listed Appliances.
Listed food service appliances such as hot plates and griddles, shall:
- Be set on their own bases or legs

- 213) . **Food Service Appliances**
54-§10.13.2 Clearance for Listed Appliances – (cont.)
Listed food service appliances such as hot plates and griddles, shall:
- Be installed with a minimum horizontal clearance of **6 in. from combustible material**, except that at least a 2 in. clearance shall be maintained between a draft hood and combustible material.
- 214) . **Household Cooking Appliances**
54-§10.14.2 Clearances.
The clearances shall not interfere with combustion air, accessibility for operation, and servicing:
- (1) Listed floor-mounted household cooking appliances installed on combustible floors, shall be set on their own bases or legs and shall be **installed in accordance with the manufacturer’s installation instructions.**
- 215) . **Household Cooking Appliances**
54-§10.15.1.2 Vertical Clearance Above Cooking Top.
Household cooking appliances shall have a **vertical clearance** above the cooking top of not less than 30” to combustible material or metal cabinets. A minimum clearance of **24 in.** is permitted when one of the following is installed:
- 216) . **Household Cooking Appliances**
54-§10.14.2.1 Vertical Clearance Above Cooking Top. - (cont.)
(2) A metal ventilating hood of sheet metal is installed above the cooking top 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.

- 217) . **Illuminating Appliances**
54-§10.15.5 Appliance Pressure Regulators.
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.
- 218) . **Infrared Heaters**
54-§10.17.1 Support.
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.
- 219) . **Infrared Heaters**
54-§10.17.2 Clearance.
Infrared heaters shall meet the following clearance requirements:

(1) Listed heaters shall be installed with clearances from combustible material in accordance the **manufacturer's installation instructions.**
- 220) . **Infrared Heaters**
54-§10.17.3.1 Combustion & Ventilation Air
Where unvented infrared heaters are used, **natural** or **mechanical** means shall be provided to supply and exhaust at least **4 ft³/min/1000 Btu/hr** input of installed heaters.
- 221) . **Unit Heaters**
54-§10.25.1 Support.
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.

222) . **Outdoor Cooking Appliances**

54-§10.19.1 Listed Units.

Listed **outdoor cooking appliances** shall be installed in accordance with the manufacturer's installation instructions.

223) . **Pool Heaters**

54-§10.20.1 Location.

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

224) . **Pool Heaters**

54-§10.20.2 Clearance.

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.

225) . **Pool Heaters**

54-§10.20.2 Clearance – (cont.)

(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.

226) . **Definitions**

54-§3.3.56.6 Unvented Room Heater.

An unvented, self-contained, freestanding, non-recessed, 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.

227) . **Room Heaters**

54-§10.22.1 Prohibited Installations.

Unvented room heaters shall not be installed in **bathrooms** or **bedrooms**.

Exception No. 1: *Where approved by the AHJ, one listed **wall-mounted**, unvented room heater equipped with an **oxygen depletion safety shutoff** system is 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.*

228) . **Room Heaters**

54-§10.22.1 Prohibited Installations – (cont.)

Unvented room heaters shall not be installed in **bathrooms** or **bedrooms**.

Exception No. 2: *Where approved by the AHJ, one listed **wall-mounted** unvented room heater equipped with an **oxygen depletion safety shutoff** system is 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.*

229) . **Oxygen Depletion Sensor**

230) . **Room Heaters**

231) . **Room Heaters**

SR §9.306 Room Heaters in Public Buildings

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 (ODS)**.

232) . **Room Heaters**

54-§10.22.3 Installations in Institutions.

Room heaters shall not be installed in the following occupancies:

- (1) Residential board and care
- (2) Health care

233) . **Wall Furnaces**

54-§10.26.1.1 Installation.

Listed **wall furnaces** shall be installed in accordance with the manufacturer's installation instructions.

Wall furnaces installed in or attached to combustible material shall be listed for such installation.

234) . **Wall Furnaces**

54-§10.27.1.3 Installation – (cont.)

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.

235) . **Wall Furnaces**

54-§10.26.2 Location.

Wall furnaces shall be located to avoid hazards to:

- Walls
- **Floors**
- Curtains
- Furniture
- **Doors**

236) . **Wall Furnaces**

237) . **Water Heaters**

238) . **Water Heaters**

54-§10.27.2.2 Clearance.

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.

239) . **Water Heaters**

54-§10.27.3 Pressure-Limiting Devices.

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
- **Not exceed** the **maximum pressure rating** of the water heater.

240) . **Water Heaters**

241) . **Manufactured Housing**

54-§10.29 Appliances for Manufactured Housing.

Appliances installed in manufactured housing after the initial sale must be listed for installation in manufactured housing or approved

- And -

Shall be installed in accordance with #54 and the manufacturer's installation instructions.

242) . **Manufactured Housing**

243) . **Poll Questions**

244) . **Placing Appliances in Operation**

245) . **Inspection, Testing and Purging**
54-§8.1 Pressure Testing and Inspection

§8.1.1 General

§8.1.1.1 Pressure Testing and Inspection

Prior to acceptance and initial operation, all piping installations shall be **inspected** and **pressure tested** to determine that the materials, design, fabrication, and installation practices comply with this code.

Appliance Technician certification does NOT allow Pressure Testing.

246) . **Inspection, Testing and Purging**

54-§8.1.1.2 Inspection shall consist of visual examination, during or after manufacture, fabrication, assembly, or pressure tests.

§8.1.1.3 Where repairs or additions are made following the pressure test, the affected piping shall be tested.

Minor repairs and additions are not required to be pressure tested, provided that the work inspected and connections are tested with a **noncorrosive leak detecting fluid** or other leak-detecting methods approved by the authority having jurisdiction.

247) . **Inspection, Testing and Purging**

248) . **Inspection, Testing and Purging**

54-§8.1.1.4 Where **new** branches are installed to **new appliance(s)**, only the newly installed branch(es) shall be required to be pressure tested.

Connections between the new piping and the existing piping shall be tested with a **noncorrosive leak detecting fluid** or approved leak-detecting methods.

249) . **Inspection, Testing and Purging**

54-§8.1.4.1 Test Pressure

Test pressure shall be measured with a manometer or with a pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period.

250) . **Inspection, Testing and Purging**

54-§8.1.4.1 Test Pressure – (cont.)

The source of pressure shall be isolated before the pressure tests are made.

Mechanical gauges shall have a range not greater than **5 times** the test pressure.

251) . **Pressure Measurement**

252) . **Detection of Leaks**

54-§8.1.5.2 Detection of Leaks

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

- Matches
- Candles
- Open Flames or
- Other Ignition Sources

*Shall **NOT** be used.*

253) . **Detection of Leaks**

54-§8.2 Piping System Leak Check

54-8.2.1 Test Gases

Leak checks using fuel gas shall be permitted in piping systems that have been **pressure tested** (with air or an inert gas).

254) . **Leak Check**

54-§8.2.2 Before Turning Gas On

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**
- All valves at unused outlets are closed and **plugged** or **capped**.

255) . **Leak Check**

54-§8.2.3 Leak Check.

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.

256) . **Leak Check**

58-§3.3.42 Leak Check.

An operation performed on a gas piping system to verify that the system **does not leak**.

This is **NOT** a pressure test.

Appliance Technicians ARE authorized to perform Leak Checks.

257) . **Placing Appliances in Operation**

54-§8.2.3 Leak Check. – (cont.)

This would include the following scenarios:

- *A new or modified system placed into service*
- *Gas leakage is suspected*
- *A gas meter is replaced*
- *An appliance or appliance connector is replaced*
- *An out-of-gas call*

- 258) . **Leak Testing**
54-Annex C.3 suggests a leak check on interior gas piping can be performed by the following method:
(2)(c) For systems with an integral two-stage, one or more second-stage, or one or more line pressure regulators serving appliances that receive gas at pressures of 1/2 psi or less, insert a water manometer or inches water column gauge into the system **downstream** of the **final** stage regulator, pressurizing the system with either fuel gas or air to a test pressure of **9 inches w.c. ± 1/2 inch w.c.**, and observing the device for a pressure change.
- 259) . **Leak Testing**
54-Annex C.3 (2)(c) – (cont.)
If fuel gas is used as a pressure source, pressurize the system to full operating pressure, close the container service valve, and then release enough gas from the system through a range burner valve or other suitable means to drop the system pressure to **9 inches w.c. ± 1/2 inch w.c.** This ensures that all regulators in the system upstream of the test point are **unlocked** and that a leak anywhere in the system is communicated to the gauging device. The gauging device should indicate no loss or gain of pressure for a period of **3 minutes**.
- 260) . **Connection Points For Testing**
- 261) . **Leak Check**
54-§8.2.4 Placing Appliances in Operation
Appliances and equipment shall not be placed in operation until after the piping system has been **tested** in accordance with 8.2.3 and **purged** in accordance with 8.3.2.

- 262) . **Leak Procedure**
SR §9.35. Written Procedure for Leaks
(a) Each licensee shall:
- Maintain a written procedure to be followed when any employee receives notification of a possible leak.
 - Ensure that all employees are familiar with the procedure
 - Authorize employees to implement the procedure without management oversight.
- 263) . **Leak Procedure**
SR §9.35. Written Procedure for Leaks
(b) The written procedures shall include the classification of the leak grade as defined in §9.2.
- 264) . **LP Gas Leak Classification**
Grade 1: Requires prompt action to protect life and property
- 265) . **LP Gas Leak Classification**
Grade 2: Can be scheduled for repair on a normal routine basis.
- 266) . **Purging**
54-§8.3.1.2 Placing in Operation
When piping full of air is placed in operation, the air in the piping must be displaced with fuel gas.
- 267) . **Purging**
54-§8.3.1.3 Outdoor Discharge of Purged Gases.
The open end of piping systems being purged shall not discharge into confined spaces or areas where there are sources of ignition unless precautions are taken to:
- Ventilate the space
 - Control of purging rate (with shutoff valve)
 - Eliminate all hazardous conditions.

268) . **Purging**
54-§8.3.3 Purging Appliances and Equipment.
After the piping system has been placed in operation, all appliances and equipment shall be **purged** and then placed in operation.

269) . **Placing Appliances in Operation**
54-§11.1.1 Adjusting Input.
The input rate of the burner shall be adjusted to the proper value in accordance with the manufacturer's instructions.

Firing at a rate in **excess** of the nameplate rating is prohibited.

270) . **Placing Appliances in Operation**
54-§11.1.1.1 Adjusting Input – (cont.)
The input rate can be adjusted by either:

- Changing the size of a fixed orifice
- Changing the adjustment of an adjustable orifice
- Readjusting the appliance's gas pressure regulator outlet pressure if provided

271) . **Placing Appliances in Operation**
54-§11.1.1.2 Adjusting Input – (cont.)
Input rate can be determined by either:
Checking burner input by using a gas meter
Checking burner input by using orifice pressure drop and orifice size

§11.1.1.3
Over firing shall be prohibited.

272) . **Placing Appliances in Operation**

54-§11.1.2 High Altitude

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

273) . **Placing Appliances in Operation**

54-§11.2 Primary Air Adjustment.

The primary air for injection (Bunsen)-type burners shall be adjusted for proper flame characteristics in accordance with the manufacturers' instructions.

After setting the primary air, the adjustment means shall be **secured** in position.

274) . **Placing Appliances in Operation**

54-§11.3 Safety Shutoff Devices.

Where a safety shutoff device is provided, it must be **checked for proper operation** and adjustment in accordance with the manufacturer's instructions.

If the device does **not turn off the gas supply** in the event of pilot outage or other improper operation, it shall be **serviced or replaced** with a new device.

275) . **Placing Appliances in Operation**

54-§11.4 Automatic Ignition.

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.

276) . **Placing Appliances in Operation**

54-§11.5 Protective Devices.

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

Must be checked for proper operation.

277) . **Placing Appliances in Operation**

54-§11.6 Checking the Draft.

Draft hood-equipped appliances shall be checked to verify that there is no draft hood spillage after **5 minutes** of main burner operation.

278) . **Placing Appliances in Operation**

279) . **Placing Appliances in Operation**

54-§11.7 Operating Instructions.

Operating instructions shall be furnished and shall be **left** in a prominent position near the appliance for the use of the consumer.

280) . **Placing Appliances in Operation**

SR §9.307. Identification of Converted Appliances

(a) In addition to *NFPA 54, §9.1.3*, and *NFPA 58, §5.20*,

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.

281) . **Placing Appliances in Operation**

282) . **Placing Appliances in Operation**

SR §9.307. Identification of Converted Appliances

(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*.

283) . **Reporting Unsafe Activities**

SR §9.38 (a) Reporting Unsafe LP Gas Activities

A person may report any unsafe or noncompliant LP-gas activities to LP-Gas Operations by

Mail,

Telephone,

Electronic mail or

Fax

When possible, the person shall make the report using **LPG Form 22**.

(Available on Website)