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3.2 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 58 - 2017 Edition**
This is the edition currently adopted by the RRC
The safety rules, exams and study guides refer to this edition
- 25) . **NFPA 54 - 2018 Edition**
This is the edition currently adopted by the RRC
The safety rules, exams and study guides refer to this edition
- 26) . **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:
- 27) . **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.

- 28) . **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.
- 29) . **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.
- 30) . **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
- 31) . **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**.

- 32) . **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.
- 33) . **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
- 34) . **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**
- 35) . **Definitions**
SR §9.2 (49) Trainee--
An Individual who has not yet taken and passed an employee-level rules examination.
- 36) . **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**.

- 37) . **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.

- 38) . **Rules Examination**
SR §9.10 (c)(4) Time Limits
(A)(i) Service and Installation employee-level examination shall be limited to **three hours**.

You can use:

- LP Gas Safety Rules - 2022
- NFPA 54 - 2018
- NFPA 58 - 2017

- 39) . **Employee-Level Certification**
SR §9.10. Rules Examination – (cont.)
(d)(1) Employee-Level Examination:
(H) The **Service and Installation Technician** examination qualifies an individual to perform all LP-gas activities related to **stationary** LP-gas systems including:
- Containers
 - Appliances
 - Stationary engines

- 40) . **Employee-Level Certification**
The Service & Installation examination does **NOT** authorize an individual to:
- Fill containers
 - Operate an LP-gas transport

- 41) . **Certification Card**
Annual Renewals are due by **May 31st**, each year.
- 42) . **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.
- 43) . **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.
- 44) . **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.
- 45) . **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)**

46) . **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.

47) . **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**.

48) . **Employee-Level Certification**

8 hour class (SR §9.51):	\$75
Employee level exam (SR §9.10):	\$40
Renew card annually (SR §9.9):	\$35
CE course within 4 years (SR §9.52):	FREE

Total for today's Service class: **\$115**

49) . **Poll Questions**

50) . **Container Sizing & Installation**

51) . **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.

52) . **System Design & Materials**
SR §9.126 (a) Appurtenances & 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 Assoc. (AGA).

53) . **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.

54) . **Installing Propane Systems**
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.

- 55) . **Containers**
58-§5.2.1.1 Fabrication Codes
Containers shall be designed, fabricated, tested, and marked (or stamped) in accordance with:
- U.S. Department of Transportation (**DOT** 49 CFR)
 - Federal Aviation Administration (**FAA** 14 CFR)
 - The **ASME Boiler and Pressure Vessel Code**, Section VIII
“Rules for the Construction of Unfired Pressure Vessels”
- 56) . **Sizing Containers**
Factors in Sizing a Propane System
- Type of installation
 - Aboveground tank
 - Underground tank
 - Mounded tank
 - Lowest expected **temperature**
 - Highest expected relative humidity
 - Total gas system **demand** (Btuh load)
 - Appliance load factors
- 57) . **Sizing Containers**
Sizing Aboveground ASME Tanks
The heat required to vaporize the liquid propane is transferred from the atmosphere through the walls of the tank. **Vaporization rate** is based on **four factors**:
- (1) **Surface area** of the Tank
 - (2) Lowest Expected Temperature
 - (3) **Liquid level** of the Propane
 - (4) Highest Expected Relative Humidity
- 58) . **Sizing Containers**
Example Vaporization Chart for Aboveground Tanks

59) . **Sizing Containers**

Sizing Underground ASME Tanks

Heat for vaporizing liquid propane in an underground tank is available from the surrounding soil, provided that the tank is installed below the level penetrated by frost.

60) . **Installing Aboveground Containers**

58-§6.4.1 Aboveground Containers.

§6.4.1.1

Containers installed outside of buildings, whether of the **portable type** replaced on a cylinder exchange basis, or **permanently installed** and refilled at the installation,

Shall be located with respect to the adjacent containers, important building, group of buildings, or line of adjoining property that can be built upon in accordance with Table 6.4.1.1

61) . **Container Installation**

Table 6.4.1.1 Separation Distances Between Containers, Important Buildings, and Line of Adjoining Property That Can Be Built Upon

Water Capacity per Container		Minimum Distances					
		Mounded or Underground Containers ^a		Aboveground Containers		Between Containers ^b	
gal	m ³	ft	m	ft	m	ft	m
<125 ^c	<0.5 ^c	10	3	0 ^d	0 ^d	0	0
125–250	0.5–1.0	10	3	10	3	0	0
251–500	>1.0–1.9	10	3	10	3	3	1
501–2,000	>1.9–7.6	10	3	25 ^c	7.6	3	1
2,001–30,000	>7.6–114	50	15	50	15	5	1.5
30,001–70,000	>114–265	50	15	75	23		
70,001–90,000	>265–341	50	15	100	30		
90,001–120,000	>341–454	50	15	125	38		
120,001–200,000	>454–757	50	15	200	61		
200,001–1,000,000	>757–3,785	50	15	300	91		
>1,000,000	>3,785	50	15	400	122		

¼ of sum of
diameters of
adjacent
containers

62) . **Installing Aboveground Containers**

58-§6.4.1.3

The **25 ft.** minimum distance from aboveground 501-2000 gal. ASME containers to a building or the 501-2000 gal. ASME containers to a building or the line of adjoining property that can be built upon shall be **reduced to 10 ft.** for a single container of **1200 gal.** or less where such container is at least 25 ft. from any other LP-Gas container of more than 125 gal. water capacity.

63) . **Container Installation**

64) . **Separation Distance of Relief Valve**

58-§6.4.4 Separation Distance Between Container Pressure Relief Valve and Building Openings.

§6.4.4.4

The distance **measured in any direction** from the point of discharge of a container;

- Pressure relief valve,
- Vent of a fixed liquid level gauge
- Container filling connection
- to -
- Exterior sources of ignition,
- Openings into direct-vent appliances and
- Mechanical ventilation air intakes

65) . **Separation Distance of Relief Valve**

Table 6.4.4.3 Separation Distance Between Container Pressure Relief Valve and Building Openings

Container Type	Exchange or Filled on Site at Point of Use	Distance Horizontally from Relief Valve Discharge to Opening Below Discharge		Discharge from Relief Valve, Vent Discharge, and Filling Connection to Exterior Source of Ignition, Openings into Direct-Vent Appliances, and Mechanical Ventilation Air Intakes	
		ft	m	ft	m
		Cylinder	Exchange	3	0.9
Cylinder	Filled on site at the point of use	3	0.9	10	3.0
ASME	Filled on site at the point of use	5	1.5	10	3.0

- 66) . **Installing Aboveground Containers**
58-§6.9.2 Installation of Pressure Relief Devices.
§6.9.2.3
Pressure relief devices on the following ASME containers shall be so installed that any gas released is vented away from the container upward and unobstructed to the open air:
(1) Containers of **125 gal. or more** water capacity installed in stationary service
(2) Portable storage containers
(3) Portable tanks
- 67) . **Container Installation**
58-§6.5.3.3 Combustible Material
Combustible materials shall not accumulate or be stored within **10 ft.** of a container.
- 68) . **Container Installation**
58-§6.5.3.6 Other Storage Containers
The minimum horizontal separation between aboveground LP-gas containers and aboveground tanks containing liquids having flash points **below 200°F** shall be **20 ft.**
Examples: Gasoline, diesel, kerosene
- 69) . **Container Installation**
58-§6.5.3.13 Electric Power Lines
An aboveground LP-Gas container shall not be located within **6 ft.** of a vertical plane beneath overhead electric power lines that are over **600 volts.**
- 70) . **Container Installation**
- 71) . **Container Installation**

- 72) . **Installing Containers**
58-§6.8.3.1 Installation of Aboveground Containers
Horizontal ASME containers designed for permanent installation in stationary service above ground shall be placed on masonry or other noncombustible structural supports located on **concrete** or **masonry** foundations with the container supports.
Containers shall not be in contact with the soil.
(with changes per SR 9.403)
- 73) . **Installing Aboveground Containers**
58-§6.11.6.1
Flexible connectors shall be installed in accordance with the manufacturer's instructions.
§6.11.6.2
Hose shall be prohibited between the first-stage and second-stage regulator except during temporary use.
§6.11.6.3
Flexible metallic connectors shall not exceed **5 ft.** in overall length when used with liquid or vapor piping on stationary containers of **2000 gal.** capacity or less.
- 74) . **Installing Underground Containers**
58-§6.4.2 Underground or Mounded ASME Containers.
§6.4.2.2
Distances for all underground and mounded ASME containers shall be measured from the container **surface.**
§6.4.2.3
No part of an underground or mounded ASME container shall be less than **10 ft.** from a building or line of adjoining property that can be built upon.
- 75) . **Installing Underground Containers**

- 76) . **Installing Underground Containers**
58-§6.8.6.1 Underground Containers
ASME container assemblies intended for underground installation, including interchangeable aboveground–underground container assemblies, shall be installed underground as follows:
- 77) . **Installing Underground Containers**
58-§6.8.6.1 Underground Containers – (cont.)
(A) Containers installed in areas with no vehicular traffic must be installed at least **6 in. below grade.**
(B) In areas within **10 ft.** of a public vehicular thoroughfare or designated parking location, a noninterchangeable underground container must be **installed at least 18 in. below grade,**
- or -
The container must be protected from damage from vehicles.
- 78) . **Installing Underground Containers**
58-§6.8.6.1 Underground Containers – (cont.)
(J) Prior to burial, the container shall be visually examined for damage to the coating. Damaged areas shall be repaired with a coating recommended for underground service and with the existing coating.
(K) Containers shall be set level and shall be surrounded by **earth or sand** firmly tamped in place.
(M) Backfill shall be free of **rocks and abrasives.**
- 79) . **Installing Underground Containers**
58-§5.2.1.11
ASME containers installed underground, partially underground, or as mounded installations shall incorporate provisions for cathodic protection and shall be **coated** with a material recommended for the service that is applied in accordance with the coating manufacturer's instructions.

- 80) . **Corrosion Protection**
58-§6.8.6.1 Underground Containers – (cont.)
(I) A corrosion protection system shall be installed on new installations of underground steel containers, unless technical justification is provided to and is approved by the authority having jurisdiction.
The corrosion protection system shall include the following:
- 81) . **Corrosion Protection**
58-§6.8.6.1 (I) Underground Containers – (cont.)
(1) A container **coating** complying with 5.2.1.11
(2) A **cathodic protection system** that consists of a **sacrificial anode(s)** or an impressed current anode
(3) A means to **test** the performance of the cathodic protection system in accordance with 6.19.3 **(Half-cell and Voltmeter)**
- 82) . **Corrosion Protection**
Illustration of Anode Bags Providing Cathodic Protection
- 83) . **Corrosion Protection**
SR-§9.116. Container Corrosion Protection System
(a) In addition to NFPA 58 requirements, steel containers and steel piping systems installed underground, partially underground, or as mounded installation on or after **March 1, 2014**, shall include a corrosion protection system.
- 84) . **Corrosion Protection**
SR-§9.116. Container Corrosion Protection System – (cont.)
(b) Cathodic protection systems installed on or after March 1, 2014 shall be monitored by every licensee servicing the container in accordance with NFPA 58, §6.19.3.1 through 6.19.3.3.
Such licensees shall document the test results.

- 85) . **Corrosion Protection**
SR-§9.116. Container Corrosion Protection System - (cont.)
(c) The licensee shall retain documentation of test results in accordance with §9.4 of this title (relating to Records).
(d) Steel containers and piping systems installed underground, partially underground, or as mounded installations on or after March 1, 2014, shall not be **filled** unless a cathodic protection system is installed in accordance with this section.
- 86) . **Installing Underground Containers**
58-§6.19.3.1
Cathodic protection systems installed in accordance with this code shall be monitored by testing, the results shall be documented, and confirming tests shall be described by one of the following:
- 87) . **Installing Underground Containers**
58-§6.19.3.1 – (cont.)
(1) Producing a voltage of **-0.85 volts or more** negative, with reference to a saturated **copper–copper sulfate** half-cell.
- 88) . **Installing Underground Containers**
58-§6.19.3.2
Sacrificial anodes shall be tested in accordance with the following schedule:
(1) Upon installation
(or within **180 days** if prohibited by climatic conditions)
(2) **12 to 18** months after the initial test
(3) Follow-up at intervals not to exceed **36 months**

- 89) . **Installing Underground Containers**
58-§6.19.3.2 – (cont.)
(4) Systems **failing** a test shall be repaired as soon as practical unless climatic conditions prohibit this action, in which case the **repair shall be made not more than 180 days thereafter**.
The testing schedule shall be restarted.
(5) Documentation of the results of the **two most recent** tests shall be retained.
- 90) . **Poll Questions**
Break
- 91) . **Installing Stationary DOT Cylinders**
- 92) . **Installing Containers**
Sizing Stationary DOT Cylinders
Consult the vaporization rate for cylinders found in a **manufacturers service handbook** or manual to identify the size and number of cylinders required for an installation.
- 93) . **Container Installation**
- 94) . **Installing Containers**
58-§6.8.2 Installation of Cylinders.
§6.8.2.1
Cylinders shall be installed only aboveground and shall be set upon a firm foundation **concrete, masonry, or metal** and be firmly secured **against displacement**. **(with changes per SR 9.403)**
§6.8.2.2
The cylinder shall **not** be in contact with the soil.
- 95) . **Installing Containers**

- 96) . **Installing Aboveground Containers**
58-§6.8.2 Installation of Cylinders. – (cont.)
§6.8.2.3
Flexibility shall be provided in the connecting piping.
§6.8.2.4
Where flexible connectors are used, they shall comply with 6.11.6.
(Max 5 ft.)
- 97) . **Container Nameplate**
SR §9.129 (a) Manufacturer’s Nameplate
(a) LP-gas shall not be introduced into an ASME container unless the container is equipped with an **original nameplate** or at least one of the nameplates defined in this subsection **permanently attached** to the container.
- 98) . **Container Nameplate**
SR §9.129 (a) Manufacturer’s Nameplate – (cont.)
(1) Commission identification nameplate
(water capacity of 4,001 gallons or more)
(2) Duplicate nameplate
(issued by the original manufacturer)
(3) Modification nameplate
(issued by ASME Code facility)
(4) Replacement nameplate
(issued by original manufacturer)
- 99) . **Container Nameplate**
SR §9.129 Manufacturer’s Nameplate – (cont.)
(b) Nameplate thickness for stainless steel nameplates issued on or after September 1, 1984, shall be sufficient to resist distortion due to the application of markings and fusion welding.
(c) Nameplates shall be attached in a location that will remain visible after installation of the containers.

- 100) . **Container Nameplate**
SR §9.129 Manufacturer's Nameplate – (cont.)
(d) Nameplates on stationary ASME containers built **prior to September 1, 1984**, shall include at least the following legible information:
- (1)** Name of container manufacturer,
 - (2)** Manufacturer's serial number,
 - (3)** Container's working pressure,
 - (4)** Container's water capacity, and
 - (5)** the **ASME Code symbol**
- 101) . **Container Nameplate**
SR §9.129 Manufacturer's Nameplate – (cont.)
(e) Nameplates on stationary ASME containers built on or **after September 1, 1984**, shall be stainless steel and permanently attached by continuous fusion welding around the perimeter of the nameplate, and shall be stamped or etched with the following:
- 102) . **Container Nameplate**
58-§5.2.8.3 (C) Container Marking
- (1)** Service for which the container is designed (e.g., underground, aboveground, or both)
 - (2)** Name and address of container supplier or trade name of container
 - (3)** Water capacity of container in pounds or U.S. gallons
 - (4)** MAWP in pounds per square inch
 - (5)** Wording that reads "This container shall not contain a product that has a vapor pressure in excess of XXX psig at 100°F" (see Table 5.2.4.2)

- 103) . **Container Nameplate**
58-§5.2.8.3 (C) Container Marking – (cont.)
(6) Outside surface area in square feet
(7) Year of manufacture
(8) Shell thickness and head thickness
(9) OL (overall length), OD (outside diameter), and HD (head design)
(10) Manufacturer's serial number
(11) ASME Code symbol
(12) Minimum design metal temperature XXX °F at MAWP XXX psi
(13) Type of construction “W”
(14) Degree of radiography “RT- XXX ”

- 104) . **Container Nameplate**

- 105) . **Container Nameplate**
SR §9.129 Manufacturer’s Nameplate – (cont.)
(h) Where the container is **buried**, insulated, or otherwise covered so the nameplate is obscured, the information contained on the nameplate shall be **duplicate** and installed on adjacent piping or on a structure in a **clearly visible location**.

- 106) . **Painting Containers**

- 107) . **Painting Containers**
SR §9.141. (a)(1) Uniform Safety Requirements
ASME containers must be painted
- **White**
 - **Aluminum**
 - **Any other heat-reflective color**
(light green, light blue, etc.).
Darker, heat-absorbing colors (black, navy blue, etc.) are not permitted.
- 58-§6.8.1.4** Aboveground containers shall be painted.

- 108) . **Painting Containers**

- 109) . **Painting Containers**

110) . **Painting Containers**

111) . **Poll Questions**

112) . **Piping & Tubing Materials**

113) . **Piping Materials**

58-§5.11 Piping (Including Hose), Fittings, and Valves.

§5.11.1.1

Material specifications for piping, tubing, fittings, valves (including hydrostatic relief valves), hose, hose connections, and flexible connectors shall be in accordance with Section 5.11.

§5.11.1.2

Piping, tubing, fittings, and valves used to supply utilization equipment within the scope of **NFPA 54** shall comply with that code.

114) . **Piping Materials**

58-§5.11.3 Pipe and Tubing.

§5.11.3.1 Pipe shall be wrought iron or steel (black or galvanized), brass, copper, polyamide or polyethylene:

Wrought iron, ASTM B 36.10M

Steel pipe, ASTM A 53

Steel pipe, ASTM A 106

Brass pipe, ASTM B 43

Copper pipe, ASTM B 42

Polyamide / Polyethylene, **ASTM D 2513**

115) . **Piping Materials**

54-§5.6.2 Metallic Pipe.

§5.6.2.1 Cast Iron.

Cast-iron pipe shall **not** be used.

- 116) . **Piping Materials**
54-§5.6.2.2 Steel, Stainless Steel, and Wrought Iron.
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*
- 117) . **Piping Materials**
54-§5.6.3 Metallic Tubing.
§5.6.3.4 Copper and Copper Alloy.
Copper tubing shall comply with standard **Type K** or **Type L** of ASTM B88, *Standard Specification Copper Water Tube*, or ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*.
§5.6.3.6 Corrugated Stainless Steel.
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*.
- 118) . **Piping Materials**
58-§5.11.3 Pipe and Tubing.
§5.11.3.2 Tubing shall be steel, stainless steel, brass, copper, polyamide or polyethylene:
Steel tubing, ASTM A 539
Brass tubing, ASTM B 135
Copper tubing, ASTM B 88 or B 280
Polyamide / Polyethylene, ASTM D 2513
Corrugated Stainless Steel Tubing, ANSI 6.26

119) . **Piping Materials**
58-§5.11.4 Fittings for Metallic Pipe and Tubing.

Fittings shall be:

- Steel
- Brass
- Copper
- Malleable Iron
- Ductile Iron

120) . **Piping Materials**
58-5.11.5.1 Fittings for Poly Pipe & Tubing

Joints in polyamide and polyethylene pipe and polyethylene tubing shall be made by:

- Heat fusion,
- Compression-type mechanical fittings
- Factory-assembled transition fittings

121) . **Piping System Service Limitations**
58-§6.11.1.1

The physical state (vapor or liquid) and pressure at which LP-Gas is transmitted through piping systems shall be in accordance with 6.11.1.1(A) through 6.11.1.1(E).

(A) Outdoor LP-Gas liquid or vapor metallic piping systems shall have **no** pressure limitations.

(B) Outdoor underground LP-Gas liquid or vapor polyamide piping systems shall have pressure limitations as defined by the design pressure of the piping being installed.

122) . **Piping System Service Limitations**
58-§6.11.1.1 – (cont.)

(C) Polyethylene piping systems shall be limited to the following:

- (1)** Vapor service not exceeding **30-psig**
- (2)** Installation **outdoors and underground**

- 123) . **Piping System Service Limitations**
58-§6.11.1.1 – (cont.)
(D) LP-Gas vapor at pressures exceeding **20-psig** or LP-Gas liquid shall not be piped into any building. (*with specific exceptions*)
(E) **Corrugated stainless-steel** piping systems shall be limited to **vapor service** service not exceeding the listed pressure rating of the product.

- 124) . **Poll Questions**

125) **.Installation of Metallic Pipe, Tubing, and Fittings**

- 126) . **Piping Installation**
SR §9.308. Installation of Piping
(a) **In addition to the requirements of NFPA 54, Chapter 7**, Gas Piping Installation, LP-gas piping shall be installed, altered, repaired, pressure tested, and leakage tested only by persons **properly certified** by the Commission pursuant to §9.10 and §9.13 of this title.
(b) Licensees and registrants shall document and **retain** such documentation of all pressure and leakage tests pursuant to §9.4 of this title.

- 127) . **Piping Installation**
SR §9.308. Installation of Piping – (cont.)
(c) When connecting to or supplying a new piping system with **corrugated stainless-steel tubing (CSST)**, the licensee or registrant shall verify the system is **bonded**.
(d) In addition to NFPA 58 §5.11.5, licensees and registrants shall retain written proof regarding any **current certifications** required by the **manufacturer** for installation and repair methods for **CSST, polyethylene, and polyamide** pipe and tubing, including heat-fusion.

- 128) . **Piping Installation**
58-§6.11.3 Installation of Metallic Pipe, Tubing, and Fittings.
§6.11.3.5
Metallic **pipe** joints shall be permitted to be threaded, flanged, welded, press-connected, or brazed.
§6.11.3.6
Metallic **tubing** joints shall be flared or brazed.
- 129) . **Piping Installation**
58-§6.11.3 Installation of Metallic Pipe, Tubing, and Fittings. – (cont.)
§6.11.3.10
Aboveground piping shall be **supported and protected** against physical damage by vehicles.
§6.11.3.11
The portion of aboveground piping in contact with a support or a corrosion-causing substance shall be protected against **corrosion**.
- 130) . **Piping Installation**
54-§7.2 Installation of Aboveground Piping.
§7.2.1
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 from corrosion by **coating or wrapping** with an inert material approved for such applications.
- 131) . **Piping Installation**
54-§7.2.1 – (cont.)
The piping shall be **sealed** around its circumference at the point of the exterior penetration to prevent the entry of water, insects, and rodents.
Where piping is encased in a protective pipe sleeve, the annular spaces between the gas piping and the sleeve and between the sleeve and the wall opening shall be sealed.

132) . **Piping Installation**

54-§7.2.2 Protective Coating.

Where piping is in contact with a material or an atmosphere corrosive to the piping system, the piping and fittings shall be coated with a corrosion-resistant material.

133) . **Underground Piping**

54-§7.1.2 Protection Against Damage.

Means shall be provided to prevent excessive stressing of the piping where vehicular traffic is heavy or soil conditions are unstable and settling of piping or foundation walls could occur.

Piping shall be **buried** or covered in a manner so as to protect the piping from physical damage.

Piping shall be protected from physical damage where it passes through flower beds, shrub beds, and other such cultivated areas where such damage is reasonably expected.

134) . **Underground Piping**

58-§6.11.3.12

Buried metallic pipe and tubing shall be installed underground with a minimum **12 in.** of cover.

(A) The minimum cover shall be increased to **18 in.** if external damage to the pipe or tubing from external forces is likely to result.

(B) If a minimum **12 in.** of cover cannot be maintained, the piping shall be installed in **conduit** or shall be bridged (shielded).

- 135) . **Piping Installation**
58-§6.11.3.15
LP-Gas piping systems shall **not** be used as a grounding electrode.
§6.11.3.16
Underground metallic piping, tubing, or both that convey LP-Gas from a gas storage container shall be provided with **dielectric fittings** installed above ground and outdoors at the building to electrically **isolate** it from the aboveground portion of the fixed piping system that enters a building.
- 136) . **Dielectric Fittings**
- 137) . **Piping Installation**
54-§5.6.7.1 Pipe Joints.
Schedule 40 and **heavier** pipe joints shall be threaded, flanged, brazed, welded, or assembled with press-connect fittings listed to ANSI LC 4/CSA 6.32, *Press-Connect Metallic Fittings for Use in Fuel Gas Distribution Systems*.
(A) Pipe **lighter** than Schedule 40 shall be connected using press-connect fittings, flanges, brazing, or welding.
- 138) . **Piping Installation**
54-§5.5.4 Maximum Operating Pressure in Buildings.
The maximum 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.

- 139) . **Piping Installation**
54-§5.5.4 Maximum Operating Pressure in Buildings. – (cont.)
(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.

- 140) . **Piping Installation**
54-§5.5.4 Maximum Operating Pressure in Buildings. – (cont.)
(6) The piping serves appliances or 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**.

- 141) . **Poll Questions**

- 142) . **Plastic Piping**

- 143) . **Plastic Piping**
54-§7.1.7.1 Connection of Plastic Piping.
Plastic piping shall be installed **outdoors, underground only**.
Exception No. 1: *Plastic piping shall be permitted to terminate aboveground where an anodeless riser is used.*

- 144) . **Plastic Piping**
54-§5.6.4.3 Anodeless Risers.
Anodeless risers shall comply with the following:
(1) Factory-assembled anodeless risers shall be recommended by the manufacturer for the gas and shall be leak tested by the manufacturer in accordance with written procedures.
- 145) . **Plastic Piping**
54-§5.6.4.3 Anodeless Risers. – (cont.)
(2) Service head adapters and field-assembled anodeless risers incorporating service head adapters shall be recommended by the manufacturer for the gas used and shall be design-certified to meet the requirements of Category 1 of **ASTM D2513**, *Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings*, and 49 CFR 192.281(e). The manufacturer shall provide the user qualified installation instructions as prescribed by 49 CFR 192.283(b).
- 146) . **Plastic Piping**
54-§5.6.4.3 Anodeless Risers. – (cont.)
(3) The use of plastic pipe, tubing, and fittings in undiluted LP-Gas piping systems shall be in accordance with **NFPA 58**.
58-§6.11.4.1
Polyethylene and polyamide pipe, tubing, and fittings shall be installed outdoors underground **only**.

147) . **Plastic Piping**
**58-§6.11.4 Installation of Polyamide and Polyethylene
Pipe, Tubing, and Fittings.**

§6.11.4.2

Polyethylene and polyamide pipe and tubing shall be **buried**:

- (1) With a minimum of **12 in.** of cover
- (2) With a minimum of **18 in.** of cover if external damage to the pipe or tubing is likely to result
- (3) With piping installed in conduit or bridged (shielded) if a minimum of **12 in.** of cover **cannot** be provided

148) . **Plastic Piping**

58-§6.11.4.3

Assembled anodeless risers shall be used to terminate underground polyamide and polyethylene fixed piping systems above ground.

- (A) The horizontal portion of risers shall be buried at least **12 in.** below grade, and the casing material used for the risers shall be protected against corrosion in accordance with Section 6.19.

149) . **Anodeless Risers**

58-§6.11.4.4

Field assembled risers shall be supplied in kit form with all the hardware necessary for installation.

- (A) Field-assembled risers shall be:
 - (1) Design certified
 - (2) Sealed and pressure tested by **the installer**
 - (3) Installed in accordance with manufacturer's instructions

150) . **Anodeless Risers**

58-§6.11.4.6

An electrically continuous corrosion-resistant tracer wire (minimum **AWG 14**) or tape shall be buried with the polyamide or polyethylene pipe to facilitate locating the pipe.

(A) One end of the tracer wire shall be brought above ground at a building wall or **riser**.

(B) The tracer wire or tape shall not be in direct contact with the polyamide or polyethylene pipe.

151) . **Anodeless Risers**

152) . **Plastic Piping**

58-§6.11.4.8

Polyamide and polyethylene piping shall be installed in accordance with the manufacturer's installation instructions.

153) . **Gas Pressure Regulators**

154) . **Gas Pressure Regulators**

58-§6.10.2.1 Regulator Selection

- A **two-stage regulator** system,
- **Integral two-stage regulator**, or a
- **2-psi regulator** system

is required on all fixed piping systems that serve ½-psig appliance systems [normally operated at **11 in. water column** pressure].

155) . **Definitions**

58-§3.3.74.11 Two Stage Regulator System.

An LP-Gas vapor delivery system that combines a first-stage regulator and a second-stage regulator(s) or utilizes a separate integral two-stage regulator.

- 156) . **Definitions**
58-§3.3.74.2 First-Stage Regulator.
A pressure regulator for LP-Gas vapor service designed to reduce pressure from the container to **10-psig** or less.
- 157) . **Definitions**
58-§3.3.74.7 Second-Stage Regulator.
A pressure regulator for LP-Gas vapor service designed to reduce **first-stage regulator** outlet pressure to the pressure required at the point of delivery. **(14 inches W.C. or less)**
- 158) . **Definitions**
58-§3.3.74.5 Integral Two-Stage Regulator.
A pressure regulator for LP-Gas vapor service that combines a **high-pressure** regulator and a **second-stage** regulator into a single unit.
- 159) . **Definitions**
58-§3.3.74.9 2-psi Regulator System.
An LP-Gas vapor delivery system that combines a
- **First-stage regulator**, a
 - **2-psi service** regulator, and a
 - **Line pressure** regulator(s).
- 160) . **Definitions**
58-§3.3.74.10 2-psi Service Regulator.
A pressure regulator for LP-Gas vapor service designed to reduce first-stage regulator outlet pressure to a nominal **2-psig**.
- 161) . **Definitions**
58-§3.3.74.6 Line Pressure Regulator
A pressure regulator with no integral overpressure protection device for LP-Gas vapor service to reduce a nominal inlet pressure.
- 162) . **Gas Pressure Regulators**

163) . **Gas Pressure Regulators**

164) . **Gas Pressure Regulators**

58-§3.3.74.8 Single Stage Regulator.

A pressure regulator for LP-Gas vapor service designed to reduce pressure from the **container to 1.0-psig** or less.

§6.10.2.3

Single-stage regulators shall not be installed in fixed piping systems on or after February 1, 2001 except for Installations covered in 6.10.2.4.

[With Changes] (see 9.403)

165) . **Gas Pressure Regulators**

58-§6.10.1 Regulator Installation.

§6.10.1.1 (A) Regulators connected to **single** container permanent installations shall be installed with one of the following methods:

- (1)** Attached to the vapor service valve using metallic pipe, tubing, fittings, or adapters that do not exceed **60 in.** in total length.
- (2)** Attached to the vapor service valve with a single flexible metallic connector

166) . **Gas Pressure Regulators**

58-§6.10.1 Regulator Installation. – (cont.)

§6.10.1.4 All regulators for outdoor installations shall be designed, installed, or protected so their operation will not be affected by the elements:

- Freezing rain
- Sleet
- Snow
- Ice
- Mud
- Debris

167) . **Gas Pressure Regulators**

- 168) . **Gas Pressure Regulators**
58-§6.10.1.5 Regulator Installation
The point of **discharge** from the relief device on the regulator shall be located **not less than 3 ft.** horizontally away from any building **opening below the level of discharge**, and
Not beneath or inside any building unless this space is not enclosed for more than 50% of its perimeter.
- 169) . **Gas Pressure Regulators**
58-§6.10.1.6 Regulator Installation
The point of **discharge** shall also be located **not less than 5 ft.** in any direction away from any source of ignition, openings into direct-vent appliances, or mechanical ventilation air intakes.
- 170) . **Pipe for Regulator Venting**
58-§6.8.6.1 (H) Regulator Venting
The discharge of the regulator vent shall be **above** the highest probable water level.
- 171) . **Pipe for Regulator Venting**
58-§5.10.3.1
Pipe or tubing used to **vent** regulators shall be one of the following:
(1) Metal pipe and tubing in accordance with 5.11.3
(2) PVC conduit meeting the requirements of UL 651, *Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings*
§5.10.3.2 Other PVC piping materials, polyethylene and polyamide pipe and tubing **shall not** be permitted to be used to vent regulators..

- 172) . **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** exceeds the maximum allowable inlet pressure of the appliance served.
§5.8.2 Line pressure regulators shall be Listed where the outlet pressure is set to **2-psi or less**.
- 173) . **Gas Pressure Regulators**
54-§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.
- 174) . **Propane Vapor Meters**
- 175) . **Propane Vapor Meters**
54-§5.7.2 Location.
§5.7.2.1
Gas meters shall be located **in ventilated spaces readily accessible** for examination, reading, replacement, or necessary maintenance.
§5.7.2.2
Gas meters shall not be placed where they will be subjected to damage, or where they will be subject to excessive corrosion or vibration.
- 176) . **Propane Vapor Meters**
54-§5.7.2 Location. – (cont.)
§5.7.2.3
Gas meters shall not be located where they will be subjected to extreme temperatures or sudden extreme changes in temperature.

177) . **Propane Vapor Meters**

54-§5.7.3 Supports.

Gas meters shall be **supported or connected** to rigid piping so as not to exert a strain on the meters.

Where flexible connectors are used to connect a gas meter to downstream piping at **mobile homes** in mobile home parks, the meter shall be supported by a post or bracket placed in a firm footing or by other equivalent support.

178) . **Poll Questions**

179) . **Sizing Piping Systems**

180) . **Sizing Piping Systems**

54-§5.4.1 General Considerations.

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.

58-§6.11.2.2

LP-Gas vapor piping systems shall be sized and installed to provide a supply of gas to meet the **maximum** demand of all gas utilization equipment.

181) . **Sizing Piping Systems**

58-§16.1 Sizing Pipe and Tubing.

When the pipe sizing method of 6.11.2.2 is used, Table 16.1(a) through (p), or other approved piping tables, shall be used to size piping systems.

182) .

Sizing Piping Systems

Table 16.1(a) Schedule 40 Metallic Pipe

		Gas: Undiluted Propane							
		Inlet Pressure: 10.0 psi							
		Pressure Drop: 1.0 psi							
		Specific Gravity: 1.50							
INTENDED USE: Pipe Sizing Between Single- or Second-Stage (Low Pressure) Regulator and Appliance.									
Nominal:	½	¾	1	1¼	1½	2	2½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	3,320	6,950	13,100	26,900	40,900	77,600	124,000	219,000	446,000
20	2,280	4,780	9,000	18,500	27,700	53,300	85,000	150,000	306,000
30	1,830	3,840	7,220	14,800	22,200	42,800	68,200	121,000	246,000
40	1,570	3,280	6,180	12,700	19,000	36,600	58,400	103,000	211,000
50	1,390	2,910	5,480	11,300	16,900	32,500	51,700	91,500	187,000
60	1,260	2,640	4,970	10,200	15,300	29,400	46,900	82,900	169,000
70	1,160	2,430	4,570	9,380	14,100	27,100	43,100	76,300	156,000
80	1,080	2,260	4,250	8,780	13,100	25,200	40,100	70,900	145,000
90	1,010	2,120	3,990	8,190	12,300	23,600	37,700	66,600	136,000
100	956	2,000	3,770	7,790	11,600	22,300	35,600	62,900	128,000

183) .

Sizing Piping Systems

54-§5.4.2 Maximum Gas Demand.

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

§5.4.2.3 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.

184) .

System Design & Materials

Table A.5.4.2.1 Approximate Gas Input for Typical Appliances		<i>Water heater, automatic instantaneous</i>	
Appliance	Input Btu/hr (Approx.)		
		Capacity at 2 gal/min	142,800
		Capacity at 4 gal/min	285,000
		Capacity at 6 gal/min	428,400
Space Heating Units		Water heater, domestic, circulating or side-arm	35,000
<i>Warm air furnace</i>		Cooking Appliances	
Single family	100,000	Range, freestanding, domestic	65,000
Multifamily, per unit	60,000	Built-in oven or broiler unit, domestic	25,000
<i>Hydronic boiler</i>		Built-in top unit, domestic	40,000
Single family	100,000	Other Appliances	
Multifamily, per unit	60,000	Refrigerator	3,000
Space and Water Heating Units		Clothes dryer, Type 1 (domestic)	35,000
<i>Hydronic boiler</i>		Gas fireplace direct vent	40,000
Single family	120,000	Gas log	80,000
Multifamily, per unit	75,000	Barbecue	40,000
<i>Water Heating Appliances</i>		Gas light	2,500
Water heater, automatic storage 30 gal to 40 gal tank	35,000		
Water heater, automatic storage 50 gal tank	50,000		

185) . **Sizing Piping Systems**

54-§5.4.3 Sizing Methods.

Gas piping shall be sized in accordance with one of the following:

- (1) Pipe sizing tables** in Chapter 6
- (2) Other approved engineering methods**
- (3) Sizing tables included in a listed piping system manufacturer's installation instructions**

186) . **Sizing Piping Systems**

54-§5.1.1 Installation of Piping System.

Where required by the authority having jurisdiction, a **piping sketch or plan** or plan shall be prepared before proceeding with the installation.

This plan shall show the proposed location of piping, the size of different branches, the various load demands, and the location of the point of delivery.

187) . **Sizing Piping Systems**

54-§6.1 Pipe Sizing Methods.

Where the pipe size is to be determined by:

- Longest length method
- Branch length method
- Hybrid pressure

The diameter of each pipe segment shall be obtained from the pipe sizing tables (Section 6.3) or from the sizing equations (Section 6.4).

188) . **Sizing Piping Systems**

54-§6.1.1 Longest Length Method.

The pipe size of each section is determined by using:

- The longest **length** of piping from the point of delivery to the most remote outlet and
- The **load** of the section.

- 189) . **Sizing Piping Systems**
54-§6.1.2 Branch Length Method.
Pipe shall be sized as follows:
(1) Longest Pipe Run
From the point of delivery to the most remote outlet and the load of the section.
(2) Each Branch
From the point of delivery to the most remote outlet in each branch and the load of that section.
- 190) . **Sizing Piping Systems**
54-§6.1.3 Hybrid Pressure Method.
The pipe size for each section of the **higher-pressure gas piping** shall be determined using the longest length of piping from the point of delivery to the most remote line pressure regulator.
The pipe size from the line pressure regulator to each outlet shall be determined using the length of piping from the regulator to the most remote outlet served by the regulator.
- 191) . **Sizing Piping Systems**
- 192) . **Sizing Piping Systems**
54-§6.3 Sizing Propane Piping Systems.
Sizing of piping systems shall be in accordance with 6.3.1 or 6.3.2
§6.3.1
Table 6.3.1(a) through Table 6.3.1(m) shall be used in conjunction with one of the methods described in 6.1.1 through 6.1.3 for piping materials **other than** non-corrugated stainless-steel tubing.

193) . **Sizing Piping Systems**

Table 6.3.1(d) Schedule 40 Metallic Pipe

		Gas: Undiluted Propane							
		Inlet Pressure: 11.0 in. w.c.							
		Pressure Drop: 0.5 in. w.c.							
		Specific Gravity: 1.50							
INTENDED USE: Pipe Sizing Between Single- or Second-Stage (Low-Pressure) Regulator and Appliance.									
		Pipe Size (in.)							
Nominal Inside:	½	¾	1	1¼	1½	2	2 ½	3	4
Actual:	0.622	0.824	1.049	1.380	1.610	2.067	2.469	3.068	4.026
Length (ft)	Capacity in Thousands of Btu per Hour								
10	291	608	1,150	2,350	3,520	6,790	10,800	19,100	39,000
20	200	418	787	1,620	2,420	4,660	7,430	13,100	26,800
30	160	336	632	1,300	1,940	3,750	5,970	10,600	21,500
40	137	287	541	1,110	1,660	3,210	5,110	9,030	18,400
50	122	255	480	985	1,480	2,840	4,530	8,000	16,300
60	110	231	434	892	1,340	2,570	4,100	7,250	14,800
80	101	212	400	821	1,230	2,370	3,770	6,670	13,600
100	94	197	372	763	1,140	2,200	3,510	6,210	12,700
125	89	185	349	716	1,070	2,070	3,290	5,820	11,900
150	84	175	330	677	1,010	1,950	3,110	5,500	11,200

194) . **Poll Questions Break**

195) . **Piping Installation**

196) . **Connecting a Container**

SR §9.134. Connecting Container to Piping

LP-gas piping shall be installed only by:

- A licensee authorized to perform such installation,
- A licensed plumber or air conditioning contractor registered with the RRC, **(Licensing Exemption)**
- An individual exempted by the Texas Natural Resource Code.

197) . **Connecting a Container**

SR §9.134. Connecting Container to Piping – (cont.)

A licensee shall not connect an LP-gas container or cylinder to a piping installation made by a person who is not licensed to make such installation.

Exception: That connection may be made to piping installed by an individual on **that individual's** single-family residential home.

- 198) . **Connecting a Container**
SR §9.134. Connecting Container to Piping – (cont.)
A licensee may connect to piping installed by an unlicensed person provided the licensee has:
- Verified that the piping is free of leaks and
 - Has been installed according to the rules of this chapter, and
 - Filed with **AFS** a completed **LPG Form 22**, identifying the unlicensed person who installed the LP-gas piping.
- 199) . **Piping Installation**
54-§7.2.7 Corrugated Stainless Steel Tubing
CSST piping systems shall be installed in accordance with this code and the **manufacturer’s installation instructions.**
- 200) . **Piping Installation**
54-§7.12 Electrical Bonding and Grounding.
§7.12.1 Pipe and Tubing Other than CSST.
Each aboveground portion of a gas piping system, **other than CSST**, that is likely to become energized shall be electrically continuous and **bonded** to an effective ground-fault current path.
Gas piping, **other than CSST**, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.
- 201) . **Piping Installation**
54-§7.12 Electrical Bonding and Grounding. – (cont.)
§7.12.2 CSST gas piping systems, and gas piping systems containing one or more segments of CSST, shall be electrically continuous and bonded to the electrical service grounding electrode system or, where provided, lightning protection grounding electrode system.
§7.12.2.1 The bonding jumper shall connect to a metallic pipe, pipe fitting, or CSST fitting.

- 202) . **Piping Installation**
54-§7.12 Electrical Bonding and Grounding. – (cont.)
§7.12.3 Arc-Resistant Jacketed CSST.
CSST listed with an arc-resistant jacket or coating system shall be electrically continuous and bonded to an effective ground fault current path.
- 203) . **Piping Installation**
54-§7.12.3 Arc-Resistant Jacketed CSST. – (cont.)
Where any CSST component of a piping system does not have an arc-resistant jacket or coating system, the bonding requirements of 7.12.2 apply. **(previous slides)**
Arc-resistant jacketed CSST shall be considered to be bonded when it is connected to appliances that are connected to the appliance **grounding conductor** of the circuit supplying that appliance.
- 204) . **Piping Installation**
54-§7.12.4 Prohibited Use.
Gas piping shall **not** be used as a grounding conductor or electrode.
- 205) . **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**.
- 206) . **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.

207) . **Piping Installation**

54-§5.6.6.4 Thread Joint 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.

208) . **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.

209) . **Piping Installation**

54-§7.7.1 Location and Installation.

§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.

210) . **Piping Installation**

54-§7.7.1 Location and Installation. – (cont.)

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

211) . **Piping Installation**

54-§7.7.2 Cap All Outlets.

§7.7.2.1 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.

212) . **Piping Installation**

54-§7.8.2.1 Accessibility of Gas Valves

Main gas shutoff valves controlling several gas piping systems shall be readily accessible for operation and installed so as to be protected from physical damage.

They shall be marked with a metal tag or other permanent means attached by the **installing agency** so that the gas piping systems supplied through them can be readily identified.

213) . **Piping Installation**

58-§6.15 Hydrostatic Relief Valve Installation.

A hydrostatic relief valve or a device providing pressure-relieving protection shall be installed in each section of piping and hose in which liquid LP-Gas can be **isolated between shutoff valves**, so as to relieve the pressure that could develop from the trapped liquid to a safe atmosphere or product-retaining section.

214) . **Inspection & Pressure Testing of Piping Systems**

215) . **Upstream #58 Pressure Testing**
58-§6.16 Testing New or Modified Piping Systems.

§6.16.1.1 After installation or modification, piping systems (including hose) shall be proven free of leaks at not less than the **normal operating pressure**.

§6.16.3 Piping within the scope of **NFPA 54** shall be tested in accordance with that code.

216) . **Connection Point For #58 Testing**

217) . **Downstream #54 Pressure Testing**
54-§8.1 Pressure Testing and Inspection.

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

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

218) . **Definitions**

58-§3.3.66 Pressure Test.

An operation performed to verify the **gastight integrity** of gas piping following its installation or modification.

This is **NOT** a leak test.

219) . **Downstream #54 Pressure Testing**
54-§8.1 Pressure Testing and Inspection. – (cont.)

§8.1.1.5 A piping system shall be tested as a complete unit or in sections. Under no circumstances shall a valve in a line be used as a bulkhead between gas in one section of the piping system and test medium in an adjacent section unless a double block and bleed valve system is installed.

220) . **Downstream #54 Pressure Testing**

221) . **Downstream #54 Pressure Testing**

54-§8.1.1.5 – (cont.)

A valve shall not be subjected to the test pressure unless it can be determined that the valve, **including the valve closing mechanism**, is designed to safely withstand the pressure.

§8.1.1.7 Prior to testing, the interior of the pipe shall be cleared of all foreign material.

222) . **Inspection and Pressure Testing**

54-§8.1 Pressure Testing and Inspection. – (cont.)

§8.1.2 The test medium shall be:

- **Air**
- Nitrogen
- Carbon Dioxide, or
- An Inert Gas.

Oxygen shall **not** be used as a test medium

223) . **Inspection and Pressure Testing**

54-§8.1.3 Test Preparation.

§8.1.3.3 Appliances and equipment that are not to be included in the test shall be either **disconnected** from the piping or **isolated** by blanks, blind flanges or caps.

§8.1.3.4 Where the piping system is connected to appliances or equipment designed for operating pressures of **less than** the test pressure, such appliances or equipment shall be isolated from the piping system by **disconnecting** them and **capping** the outlet(s).

- 224) . **Inspection and Pressure Testing**
54-§8.1.3 Test Preparation. – (cont.)
§8.1.3.5 Where the piping system is connected to appliances or equipment designed for operating pressures **equal to or greater than** the test pressure, such appliances and equipment shall be **isolated** from the piping system by **closing** the individual appliance shutoff valve(s).
- 225) . **Inspection and Pressure Testing**
54-§8.1.3 Test Preparation. – (cont.)
§8.1.3.6 All testing of piping systems shall be performed in a manner that protects the safety of **employees** and the **public** during the test.
- 226) . **Inspection and Pressure Testing**
54-§8.1.4.1 Test Pressure
Test pressure shall be measured with:
A manometer
- Or -
A pressure measuring device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period.
- 227) . **Pressure Measurement**
- 228) . **Inspection and Pressure Testing**
54-§8.1.4.1 Test Pressure – (cont.)
The source of pressure shall be **isolated** before the pressure tests are made. Mechanical gauges used to measure test pressures shall have a range such that the highest end of the scale is not greater than **5 times** the test pressure.

- 229) . **Inspection and Pressure Testing**
54-§8.1.4.2 Test Pressure – (cont.)
The test pressure to be used shall be:
No less than 1 1/2 times the proposed maximum working pressure,
- but -
Not less than 3-psi, irrespective of design pressure.
- 230) . **Inspection and Pressure Testing**
54-§8.1.4.3 Test Pressure – (cont.)
Test duration shall be not less than 1/2 hour for each 500 ft.³ of pipe volume or fraction thereof.
When testing a system having a volume less than 10 ft.³ or a system in a **single-family dwelling**, the test duration shall be a minimum of **10 minutes**.
The duration of the test shall not be required to exceed 24 hours.
- 231) . **Inspection and Pressure Testing**
54-§8.1.5 Detection of Leaks and Defects.
§8.1.5.1 The piping system shall withstand the test pressure specified without showing any evidence of **leakage** or other defects.
Any reduction of test pressures as indicated by pressure gauges shall be deemed to indicate the **presence of a leak** unless such reduction can be readily attributed to some other cause.
- 232) . **Inspection and Pressure Testing**
54-§8.1.5 Detection of Leaks and Defects. – (cont.)
§8.1.5.2 The leakage shall be located by means of an approved gas detector, a noncorrosive leak detection fluid, or other approved leak detection methods.
§8.1.5.3 Where leakage or other defects are located, the affected portion of the piping system shall be **repaired** or **replaced** and **retested**.
- 233) . **Poll Questions**

234) . **Appliance Installation Requirements**

235) . **Appliance & Equipment Installation**

54-§9.1.1

Appliances, equipment, and accessories shall be approved.

54-§9.1.1.2

Listed appliances, equipment, and accessories shall be installed in accordance with Chapter 9 and the **manufacturer's installation instructions**.

236) . **Appliance & Equipment Installation**

54-§9.1.1.3

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

54-§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.

237) . **Appliance & Equipment 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:

238) . **Appliance & Equipment 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

- 239) . **Appliance & Equipment Installation**
54-§9.1.3 Type of Gas(es).
The appliance shall be connected to the fuel gas for which it was designed.
- 240) . **Appliance & Equipment 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**
 - **Serving gas supplier**, or
 - **Appliance manufacturer** for complete instructions.
- 241) . **Appliance Installation**
- 242) . **Appliance & Equipment Installation**
54-§9.1.10 Installation in Residential Garages.
§9.1.10.1
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.
- 243) . **Appliance & Equipment Installation**
54-§9.1.10 Installation in Residential Garages. – (cont.)
§9.1.10.2
Such appliances shall be located or protected so they are not subject to physical damage by a moving **vehicle**.
- 244) . **Appliance & Equipment Installation**
54-§9.1.10 Installation in Residential Garages. – (cont.)
§9.1.10.3
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.

- 245) . **Appliance & Equipment 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.
- 246) . **Appliance & Equipment Installation**
54-§3.3.84.2 Gas Appliance Pressure Regulator.
A pressure regulator for controlling pressure to the **appliance manifold**.
54-§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.
- 247) . **Appliance & Equipment 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
- 248) . **Appliance & Equipment 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**.

- 249) . **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 KAIR shall be used.
- 250) . **Combustion and Ventilation Air**
54-§9.3.2.1 Standard Method.
The minimum required volume shall be 50 ft.³ per 1000 Btu/hour.
- 251) . **Combustion and Ventilation Air**
54-§9.3.2.3 Indoor Opening Size and Location.
(1) Minimum free area of 1 in²/1000 Btu/hr. of total input rating of appliances.
 - Not less than **100 square inches**.
 - One opening within **12 in.** of the **top**.
 - One opening within **12 in.** of the **bottom**.
- 252) . **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.**
- 253) . **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**.

- 254) . **Combustion and Ventilation Air**
54-§9.3.3.1 Two Permanent Openings. – (cont.)
(1) Each vertical duct:
Shall have free area of **1 in²/4000 Btu/hr.** of the total input rating of all appliances.
- 255) . **Combustion and Ventilation Air**
54-§9.3.3.1 Two Permanent Openings. – (cont.)
(2) Each horizontal duct:
Shall have free area of **1 in²/2000 Btu/hr.** of total input rating of all appliances.
- 256) . **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 **6 in.** from the front.
 - Free area of **1 in²/3000 Btu/hr.** of the total input rating of all appliances.
- 257) . **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 **when known.**
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.
- 258) . **Combustion and Ventilation Air**
- 259) . **Combustion and Ventilation Air**
54-§9.3.7.2 Minimum Screen Mesh Size.
Screens shall not be smaller than **1/4 in.** mesh.

- 260) . **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.
- 261) . **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.
- 262) . **Combustion and Ventilation Air**
54-§9.3.8 Combustion Air Ducts. – (cont.)
§9.3.8.4 Combustion Air Ducts
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.
- 263) . **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.

- 264) . **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.
- 265) . **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.**
- 266) . **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. x 30 in.** shall be provided in front of the service side of the appliance.
- 267) . **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.

- 268) . **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.
- 269) . **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** and
Shall be in the **same room** as the appliance.
Only one connector shall be used per appliance.
- 270) . **Appliance Installation**
- 271) . **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.
- 272) . **Appliance Installation**
54-§9.6.1 Connecting Appliances – (cont.)
(6) Listed nonmetallic gas hose connectors.

- 273) . **Appliance Installation**
54-§9.6.1 Connecting Appliances – (cont.)
§9.6.1.1 Connectors and tubing addressed in 9.6.1(2) through (6) shall be installed to be protected against physical and thermal damage.
§9.6.1.2 Materials addressed in 9.6.1(2) through (6) shall not be installed through an opening in an appliance housing, cabinet, or casing, unless the tubing or connector is protected against damage.
- 274) . **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:
- 275) . **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.
- 276) . **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:

277) . **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**.

278) . **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

279) . **Appliance Installation**

280) . **Appliance Installation**

281) . **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 **nondisplaceable valve member**, or
- A **listed gas convenience outlet**.
- Appliance shutoff valves and convenience outlets shall serve a single appliance only.

- 282) . **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.
- 283) . **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.
- 284) . **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**.
- 285) . **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**.
- 286) . **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.
- 287) . **Appliance Installation**

288) . **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.

289) . **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.

290) . **Appliance Installation**

291) . **Appliance Installation**

292) . **Appliance Installation**

293) . **Appliance Installation**

294) . **Poll Questions**
Break

295) . **Appliance Venting**

296) . **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.

297) . **Definitions**

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 **from** appliances or their vent connectors **to** the outdoors.

298) . **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.

§3.3.53.4 Type B-W Gas Vent.

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

§3.3.53.5 Type L Gas Vent.

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

299) . **Appliance Venting**

300) . **Appliance Venting**

301) . **Appliances 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 dryers

- 302) . **Appliances Venting**
54-§12.3.2 Appliances Not Required to Be Vented.- (cont.)
(5) Listed dish washer 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 listed unvented appliances
(11) Specialized appliances of limited input such as laboratory burners or gas lights

- 303) . **Appliances Venting**
54-§12.3.2 Appliances Not Required to Be Vented. – (cont.)
Where any or all of the appliances in 12.3.2 (5) through (11) are installed so the aggregate input rating exceeds **20 Btu/hr/ft.³** 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/ft.³.

- 304) . **Appliances 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.

- 305) . **Appliances 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.

306) . **Appliances 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.**

307) . **Appliances Venting**

308) . **Appliances 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.

309) . **Appliances Venting**

54-§12.7.3 Gas Vent Termination.

The termination of gas vents shall comply with the following requirements:

- (1)** A gas vent shall terminate in accordance with one of the following:
 - (a)** Gas vents that are **12 in.** 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.

310) .

Gas Vent Termination

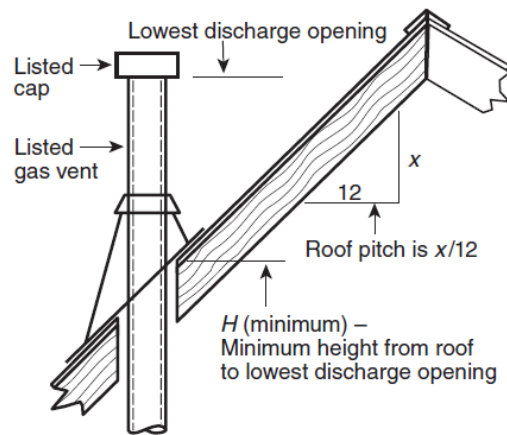


FIGURE 12.7.3 Termination Locations for Gas Vents with Listed Caps 12 in. (300 mm) or Less in Size at Least 8 ft (2.4 m) from a Vertical Wall.

311) .

Gas Vent Termination

Table 12.7.3 Roof Slope Heights

Roof Slope	H (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

312) . **Appliances Venting**
54-§12.7.3 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.

313) . **Appliances 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.

314) . **Appliances 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.

315) . **Appliances 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.

316) . **Installation of Specific Appliances**

317) . **Installation of Specific Appliances**

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.

318) . **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.

319) . **Definitions**

54-§3.3.5.3 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.

320) . **Clothes Dryers**

321) **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 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.

322) . **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.

323) . **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.

- 324) . **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.
- 325) . **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.**
- 326) . **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 in²/1000 Btu/hr** total input rating of the dryer(s) installed.
- 327) . **Installation of Specific Appliances**
54-§10.4.4.1 Exhaust Ducts for Type 1 Clothes Dryers
A clothes dryer exhaust duct shall not be connected into any:
- Vent connector
 - Gas vent
 - Chimney
 - Crawl space,
 - **Attic,**
 - Concealed space.
- 328) . **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.

- 329) . **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** and **labeled** in accordance with ANSI/UL 2158A, and installed in accordance with the clothes dryer manufacturer’s installation instructions.
- 330) . **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.
- 331) . **Dryer Exhaust Ducts**
- 332) . **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.
Where exhaust ducts are installed with reduced clearances, the adjacent combustible material shall be protected in accordance with Table 10.2.3(b).
§10.4.5.5
Where ducts pass through **walls, floors, or partitions**, the space around the duct shall be sealed with noncombustible material.
- 333) . **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.

- 334) . **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.
- 335) . **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.
- 336) . **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 ft.³/1000 Btu/hr.)**
Exception: Direct-vent gas fireplaces.
- 337) . **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.
- 338) . **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.**

339) . **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.

340) . **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.

341) . **Food Service Appliances**

342) . **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**.

343) . **Food Service Appliances**

54-§10.12.6 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.

- 344) . **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**.
- 345) . **Household Cooking Appliances**
54-§10.14.1 Installation.
Listed floor-mounted and built-in household cooking appliances shall be installed in accordance with the manufacturer's installation instructions.
- 346) . **Household Cooking Appliances**
54-§10.15.1.1 Clearances.
The clearances shall not interfere with combustion air, accessibility for operation, and servicing:
(1) Listed floor-mounted household cooking appliances, where installed on combustible floors, shall be set on their own bases or legs.
- 347) . **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:
- 348) . **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.
- 349) . **Illuminating Appliances**
54-§10.15.1 Clearances for Listed Appliances.
Listed illuminating appliances shall be installed in accordance with the manufacturer's installation instructions.

- 350) . **Illuminating Appliances**
54-§10.16.5 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.
- 351) . **Infrared Heaters**
54-§10.18.1 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.
- 352) . **Infrared Heaters**
54-§10.17.3 Combustion & Ventilation Air.
§10.17.3.1
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.
§10.17.3.2
Exhaust openings for removing flue products shall be **above** the level of the heaters.
- 353) . **Suspended-Type 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.
- 354) . **Outdoor Cooking Appliances**
54-§10.20.1 Listed Units.
Listed **outdoor cooking appliances** shall be installed in accordance with the manufacturer's installation instructions.

355) . **Outdoor Cooking Appliances**

54-§10.19.2 Unlisted Units.

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.

356) . **Pool Heaters**

54-§10.21.1 Location.

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

357) . **Pool Heaters**

54-§10.21.2 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.

358) . **Pool Heaters**

54-§10.21.2 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.

359) . **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.

360) . **Room Heaters**

54-§10.23.1 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.*

361) . **Room Heaters**

54-§10.23.1 Prohibited Installations. – (cont.)

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.*

362) . **Oxygen Depletion Sensor**

363) . **Room Heaters**

No ODS = **Red Tag**

364) . **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)**.

365) . **Room Heaters**

54-§10.23.2 Prohibited Installations.

Room heaters shall not be installed in the following occupancies:

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

366) . **Wall Furnaces**

54-§10.27.1.1 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.

367) . **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.

368) . **Wall Furnaces**

369) . **Wall Furnaces**

54-§10.26.2 Location.

Wall furnaces shall be located to avoid hazards to:

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

370) . **Poll Questions**

371) . **Water Heaters**

372) . **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.

373) . **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 and shall **not exceed** the **maximum pressure rating** of the water heater.

374) . **Water Heaters**

375) . **Manufactured Housing**

54-§10.29 Appliances for Installation In Manufactured Housing.

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.

376) . **Manufactured Housing**

377) . **Placing Appliances in Operation**

378) . **Placing Appliances in Operation**

54-§8.2 Piping System Leak Check.

§8.2.1 Test Gases.

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

§8.2.2 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 and that all valves at unused outlets are closed and plugged or capped.

379) . **Placing Appliances in Operation**

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.

380) . **Definitions**

54-§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.

381) . **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*

382) . **Placing Appliances in Operation**

54-§8.2.4 Placing Appliances and Equipment in Operation.

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.

383) . **Leak Testing**

NFPA 58-Annex L suggests a leak check on upstream gas piping can be performed by using one of the following methods:

(1) Inserting a gauge between the container shutoff valve and the first-stage regulator or integral two-stage regulator in the system, admitting **full container pressure** to the system and then closing the container shutoff valve.

- Enough gas should then be released from the system to lower the pressure gauge reading **by 10-psi**.

384) . **Leak Testing**

58-Annex L

(4) When testing a system that has a **first-stage** regulator, or an **integral** two-stage regulator, insert a 30-psi pressure gauge on the downstream side of the first-stage regulator or at the intermediate pressure tap of an integral two-stage regulator, admitting normal operating pressure to the system and then closing the container valve.

- Enough gas should be released from the system to lower the pressure gauge reading **by a minimum of 2-psi** so that the first-stage regulator is **unlocked**.

385) . **Leak Testing**

Leak testing piping systems:

- **Outside** a building (**upstream** of 2nd stage regulator) shall be in accordance with **NFPA 58**.
- **Inside** a building (**downstream** of 2nd stage regulator) shall be in accordance with **NFPA 54**.

Both NFPA 58 **Annex L** and NFPA 54 **Annex C** state:

- The system should then be allowed to stand for **3 minutes** without showing an increase or a decrease in the pressure gauge reading.

386) . **Connection Points For Testing**

387) . **Leak Testing**

The **NFPA 54 Annex C.3** suggests three methods for leak checking a gas piping system:

- (a) Upstream of the first stage regulator using tank pressure reduced **by 10-psi** for 3 minutes.
- (b) Between the first and second stage regulators with pressure reduced **by 2-psi** for 3 minutes.
- (c) Downstream of the second stage regulator with pressure reduced **to 9 in. water column +/- ½ in.** for 3 minutes.

388) . **Purging Requirements**

54-§8.3.2.1 Purging Procedure.

§8.3.2.1 The piping system shall be purged in accordance with one or more of the following:

- (1) The piping shall be purged with **fuel gas** and shall discharge to the outdoors.
- (2) The piping shall be purged with fuel gas and shall discharge to the indoors or outdoors through an appliance burner not located in a combustion chamber.

Such burner shall be provided with a continuous source of ignition.

- 389) . **Purging Requirements**
54-§8.3.2.1 Purging Procedure. – (cont.)
(3) The piping shall be purged with fuel gas and shall discharge to the indoors or outdoors through a **burner** that has a continuous source of ignition and that **is designed for such purpose**.
(4) The piping shall be purged with fuel gas that is discharged to the indoors or outdoors, and the point of discharge **shall be monitored with a listed combustible gas detector** in accordance with 8.3.2.2.
Purging shall be stopped when fuel gas is detected.
- 390) . **Purging Requirements**
54-§8.3.3 Purging Appliances and Equipment.
After the piping system has been placed in operation, appliances and equipment shall be purged before being placed into operation.
- 391) . **Placing Appliances in Operation**
54-§11.1.1 Adjusting Burner 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.
- 392) . **Placing Appliances in Operation**
54-§11.1.1 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
- 393) . **Placing Appliances in Operation**
54-§11.1.1.2 Adjusting Input – (cont.)
Input rate can be determined by either:
(1) Checking burner input by using a gas meter
(2) Checking burner input by using manifold pressure and orifice size
§11.1.1.3 Overfiring shall be prohibited.

394) . **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

395) . **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.

396) . **Placing Appliances in Operation**

54-§11.3 Safety Shutoff Devices.

Where a safety shutoff device is provided, it shall 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.

397) . **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.

398) . **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

Shall be checked for proper operation within the parameters provided by the manufacturer.

399) . **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.

This is done by passing a lighted match or taper around the edge of the relief opening of the draft hood.

- Where the gas vent is drawing **properly**, the match flame will be drawn into the draft hood.
- Where **not**, the combustion products will tend to extinguish this flame.

400) . **Placing Appliances in Operation**

401) . **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.

402) . **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.

403) . **Placing Appliances in Operation**

404) . **Reported Leaks**

405) . **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**.

406) . **Leak Procedure**

SR §9.35. Written Procedure for Leaks – (cont.)

(b) The written procedures shall include the classification of the leak grade as defined in §9.2.

407) . **LP Gas Leak Classification**

Grade 1: Requires prompt action to protect life and property.

408) . **LP Gas Leak Classification**

Grade 2: Can be scheduled for repair on a normal routine basis.

409) . **Leak Procedure**

58-§6.29.2 Fire Protection Planning

§6.29.2.1 The planning for the response to incidents including the inadvertent release of LP Gas, fire, or security breach shall be coordinated with local emergency response agencies.

§6.29.2.2 Planning shall include consideration of the safety of emergency personnel, workers, and the public.

410) . **Poll Questions**

411) . **Leak Testing School Facilities**

412) . **Testing School Facilities**

SR §9.41 (b) School District Requirements.

A district shall ensure that a **leakage test** is performed on each school LP-Gas system.

Testing shall be performed by an LP-Gas licensee or an employee of the school district who has been certified by the Commission to perform the test.

413) . **Testing School Facilities**

SR §9.41 (b) School District Requirements. – (cont.)

(1) If a leak is found, the school district shall immediately **remove** the facility from LP-gas service until:

- Repairs are made and
- It passes a subsequent LP-gas leakage test

414) . **Testing School Facilities**

SR §9.41 (b) School District Requirements. – (cont.)

(2) Each school district must provide the supplier with a copy of the most current LPG **Form 30** as proof the system has been tested.

(3) School district must retain LPG Form 30 for a minimum of **5 years** from the date each test was performed.

415) . **Testing School Facilities**

SR §9.41 (c) Leakage Test Requirements.

(1) The results of the leakage test for each building or structure shall be immediately **documented** on LPG Form 30.

(2) LP-gas shall be used as the test medium.

(3) Leakage test pressure shall not exceed **normal** operating pressure.

- 416) . **Testing School Facilities**
SR §9.41 (c) Leakage Test Requirements. – (cont.)
(4) Leakage test duration shall not be less than **30 minutes**.
(5) Test pressure shall be monitored with a manometer or with a pressure-measuring instrument designed and calibrated to read, record, or indicate a pressure loss caused by leakage during the test period. Mechanical gauges used to measure test pressures shall have a range such that the highest end of the scale is not greater than **5 times** the test pressure.
- 417) . **Testing School Facilities**
SR §9.41 (c) Leakage Test Requirements. – (cont.)
(6) The manual shutoff valve installed in the piping upstream of each appliance must be open and must supply pressure to the appliance. To prove the integrity of the 100% pilot shutoff valve on each appliance so equipped, the manual control on 100% safety valve must be turned to the **ON** position.
Pilots **not** incorporating a 100 % safety valve and manual valves not incorporating safety shutoff systems must be in the **OFF** position
- 418) . **Testing School Facilities**
SR §9.41 (d) Methods for Conducting a Leak Test.
(1) **Upstream** of the first stage regulator
(2) **Between** the first stage and second stage regulators
(3) **Downstream** of the final stage regulator
- 419) . **Testing School Facilities**
SR §9.41 (e) Supplier Requirements.
A supplier shall terminate service to a district if:
- Receives notification from the district, LP-Gas licensee or the person conducting the test that there is **leakage** in a school LP-gas system;
 - Leak test was not performed in accordance with the requirements of this section; or
 - The supplier has not received a **copy** of the LPG Form 30 from the school district.

420) . **Testing School Facilities**

SR §9.41 (g) Compliance Deadline.

(1) Each school district shall ensure leakage testing is performed at **least once every two years.**

(3) Testing may be performed on a two-year cycle provided that at least **one-half** of the school district's facilities are tested each year.

421) . **LP-Gas Installations**

SR §9.135. Unsafe Containers, Cylinders, or Piping

A licensee or the licensee's employees shall not introduce LP-gas into any container or cylinder if the licensee or employee has knowledge or reason to believe that such container, cylinder, piping, or the system or the appliance to which it is attached is **unsafe** or is not installed in accordance with the statutes or the LP-Gas Safety Rules.

422) . **Reporting Unsafe Activities**

SR §9.38. Reporting Unsafe Activities

A person may report any unsafe or noncompliant LP-gas activities by:

- Mail
- Telephone – **512-463-6788**
- E-mail
- Fax
- When possible make the report using LPG **Form 22 (Available on Website)**