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3.8 RV Gas Appliances Web Workbook

Railroad Commission of Texas
Alternative Fuel Safety

2023 - Rev 4.2

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Administrative Rules

Slide #

17) . **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.

18) . **Texas LP-Gas Safety Rules**

Covers administrative codes, exceptions and enhancements to NFPA standards

Mandated by chapter 113 of the Texas Natural Resource Code

19) . **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

20) . **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**.

21) . **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.

22) . **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**.

23) . **NFPA 1192 - 2018 Edition**

This is the edition currently adopted by the RRC
The safety rules, exams and study guides refer to this edition

24) . **NFPA 1192 - 2005 Edition**

1192-§1.1 Scope.
This standard covers fire and life safety criteria for recreational vehicles.

1192-§1.2 Purpose.
To provide the minimum criteria for recreational vehicles that are considered necessary to provide protection from loss of life from fire and explosion.

25) . **New Certificate**

SR §9.8. Requirements & Application for New Certificate

(a) In addition to complying w/ NFPA 58 §4.4 & §11.2,

- No person shall perform work,
- Directly supervise LP-gas activities, or
- Be employed in any capacity requiring contact with LP-gas unless:

26) . **New Certificate**

SR §9.8. (a) – (cont.)

(1) That individual is a **certificate holder** who is:

(A) In compliance with all applicable training and **continuing education** requirements in §9.51 and §9.52 of this title

(B) In compliance with **renewal requirements** in §9.9 of this title

(C) Employed by a licensee; or

(2) That individual is a trainee who complies with §9.12 of this title.

27) . **New Certificate**

SR §9.8. – (cont.)

(c) An applicant for a new certification shall:

(1) File with AFS a properly completed LPG **Form 16** and the applicable nonrefundable rules examination fee specified in §9.10 of this title;

(2) Pass the applicable rules examination with a score of at least **75%**; and

(3) Complete any required training and/or **AFT** in §9.51 and §9.52 of this title.

28) . **Training Requirements**

58-§4.4 Qualification of Personnel.

§4.4.1 Persons whose duties fall within the scope of this code shall be provided with training that is consistent with the scope of their job activities and that includes:

- Proper handling and
- Emergency response procedures.

29) . **Training Requirements**

58-§4.4 Qualification of Personnel. – (cont.)

§4.4.2 Persons whose primary duties include transporting LP-Gas, transferring liquid LP-Gas into or out of stationary containers, or making stationary installations shall complete training that includes the following components:

(1) Safe work practices
(2) The health and safety hazards of LP-Gas
(3) Emergency response procedures
(4) Supervised, on-the-job training
(5) An assessment of the person's ability to perform the job duties assigned

30) . **Training Requirements**

58-§4.4 Qualification of Personnel. – (cont.)

§4.4.3 Refresher training shall be provided at least every **3 years**.

§4.4.4 Initial and subsequent refresher training shall be **documented**.

31) . **Definitions**

SR §9.2 (12) Company Representative--

The individual designated to the Commission by a license applicant or a licensee as the **principal individual** in authority.

32) . **Definitions**

SR §9.17 (b) Company Representative Requirements

(1) Be an owner or employee of the licensee
(2) Be responsible for **supervising** all LP-Gas activities
(3) Have a working knowledge of the licensee's LP-Gas activities
(4) Pass the appropriate **management** level exam
(5) Complete any required training

33) . **Definitions**

SR §9.17 (b) Company Rep. Requirements - (cont.)

(6) Comply with the work experience or training requirements
(7) Be directly responsible for all employees performing their assigned LP-gas activities
(8) Submit any additional information as deemed necessary by **AFS**

34) . **Definitions**

SR §9.2 (49) Trainee--

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

35) . **Training Requirements**

SR §9.12. Trainees

A licensee may employ an individual as a trainee for a period not to exceed **45 calendar days** without that individual 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.

(2) During a **2 year** period, training shall not exceed any combination of **45 days**, with any number of employers.

36) . **Rules Examination**

SR §9.10. Rules Examination

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

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

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

37) . **Rules Examination**

SR §9.10 (c)(4) Time Limits

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

You can use:

- LP Gas Safety Rules - 2020
- NFPA 1192 - 2018

38) . **Employee-Level Certification**

SR §9.10. Rules Examination – (cont.)

(d)(1) Employee-Level examination:

(G) The **Recreational Vehicle Technician** examination qualifies an individual to install LP-gas **motor or mobile fuel containers,** including cylinders, and to install and repair **LP-gas systems** on recreational vehicles.

It does **NOT** authorize an individual to **fill** LP-gas containers.

39) . **Certification Card**

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

40) . **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.

41) . **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.

42) . **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.

43) . **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)**

44) . **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.

45) . **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**.

46) . **Poll Questions**

47) . # Characteristics of Propane

48) . **Characteristics of Propane**

Propane is a **L**iquefied **P**etroleum **G**as which must be stored under pressure to remain in liquid state at normal temperatures.

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

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

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

49) . **Characteristics of Propane**

Propane is highly flammable

Flammability Limits
Lower: **2.15%** propane in air
Upper: **9.6%** propane in air

Ignition Temperature
960 to 1,120°F

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

50) . **Characteristics of Propane**

Propane at atmospheric pressure boils at -44°F
Propane vapor is heavier than air.
Specific Gravity
Propane liquid = **0.504** (water is 1.0)
Propane vapor =**1.5** (air is 1.0)

This means that propane vapor will sink to the lowest ground level.

51) . **Characteristics of Propane**

The expansion rate of propane liquid into vapor is **270x.**

As it expands it absorbs heat from the surrounding atmosphere, so it poses a freezing hazard to exposed skin. Always wear personal protective equipment.

52) . **Characteristics of Propane**

What is the white fog seen when it is released into the air?

The propane vapor is so cold it condenses the moisture in the air which is visible as fog.

53) . # LP-Gas Containers

54) . **LP-Gas Containers**

1192-§5.2.1 Maximum Container Capacities.

Where propane utilization equipment is installed by the manufacturer, the RV shall be provided with:

- **3 cylinders maximum** having individual water capacities of 45 lbs. LP-Gas

- **1 or more tanks having a maximum** aggregate water capacity of 200 gallons

55) . **LP-Gas Containers**

1192-§5.2.2.1 Cylinders

Cylinders shall be constructed & marked in accordance with **DOT regulations (CFR Title 49).**

- ***240 psig*** *(min) service pressure*

56) . **LP-Gas Containers**

1192-§5.2.2.2 Tanks

Constructed & Marked in accordance with ASME, *Boiler & Pressure Vessel Code*, Section VIII, Division I.

- ***312 psig*** *(min) service pressure*

57) . **LP-Gas Containers**

1192-§5.2.3.1 Location of Propane Containers

Propane containers that do not meet the new, original equipment provision shall not be installed or stored inside any RV **not even temporarily.**

58) . **LP-Gas Containers**

1192-§5.2.3.2 Location of Propane Containers

New propane cylinders shall be permitted to be transported inside the vehicle if:

- They have **never** contained propane and
- Supplied as original equipment.

59) . **LP-Gas Containers**

1192-§5.2.3.3 Location of Propane Containers

Container installation shall comply with either:

(1) Mounted in a **recess or compartment**

- Not on the roof
- Vapor resistant to the interior

60) . **LP-Gas Containers**

1192-§5.2.3.3 Location of Propane Containers - (cont.)

Container installation shall comply with either:

(2) Mounted on **tongue or A-frame**

- Forward of the front bulkhead
- Below the overhang of a fifth wheel
- Not lower than the bottom of the frame

61) . **LP-Gas Containers**

1192-§5.2.3.3 Location of Propane Containers - (cont.)

(3) Mounted on the **chassis or the floor** of a motor home or chassis-mount camper, provided neither the tank nor its support located in front of the front axle.

(a) Tanks mounted between front & rear axle shall **not be lower** than the front axle height.

62) . **LP-Gas Containers**

1192-§5.2.3.3 Location of Propane Containers - (cont.)

(b) Tanks mounted **behind the rear axle** shall be installed so that the bottom of tank & connections are:

- **Not lower than** rear axle height
- Not lower than any section of the frame immediately to the rear of the tank

(c) Clearances are determined from the lowest point on the tank when all axles are loaded to gross axle weight rating.

63) . **LP-Gas Containers**

64) . **LP-Gas Containers**

1192-§5.2.3.4 Location of Propane Containers

Containers shall not be mounted on the exterior of the **rear wall** or the **rear bumper** of the vehicle.

65) . **LP-Gas Containers**

1192-§5.2.22 Mounting of Propane Containers.

§5.2.22.3 Each cylinder shall be permanently and legibly stamped to show the correct mounting position.

§5.2.22.5 The cylinder shall incorporate a method for mounting that keeps it in position for its designed use.

66) . **LP-Gas Containers**

1192-§5.2.4.1 Securing of Propane Containers

Containers shall be secured so they do not become dislodged when a load equal to **eight times** the container's filled weight is applied in any direction.

67) . **LP-Gas Containers**

1192-§5.2.4.2 Securing of Propane Containers

When RVs are supplied with cylinders **not** in place, the recreational vehicle manufacturer must provide **mounting instructions and required materials**.

68) . **LP-Gas Containers**

1192-§5.2.5 Heat Shielding of Propane Containers

Propane containers located less than **18 in.** from exhaust system, transmission, or engine shall be shielded by:

- Vehicle frame member or
- Noncombustible baffle.

69) . **LP-Gas Containers**

70) . **LP-Gas Containers**

1192-§5.2.6 Ventilation of Compartments.

Compartments shall be ventilated:

- At or near the top and
- At the extreme bottom
- With at least **two** vents
- No locks or special tools to access valves

71) . **LP-Gas Containers**

1192-§5.2.6 Ventilation of Compartments. – (cont.)

§5.2.6.2 The compartment shall be ventilated with:

- At least **two** vents
- Each having an aggregate free area equal to at least **0.5 in^2** for each **7 lb.** of the total propane fuel capacity of the maximum number of the largest cylinders the compartment can hold.

72) . **LP-Gas Containers**

1192-§5.2.7.2 Securing Propane Cylinder Housings

Hoods or housings covering valves **shall not** be equipped with locks or require special tools to open.

73) . **LP-Gas Containers**

1192-§5.2.8 Fastenings for Propane Cylinders.

Cylinder compartments shall have hold-down fastenings for each cylinder.

74) . **LP-Gas Containers**

1192-§5.2.10.2 Container Appurtenances & Location

Must be located not more than **18 in.** from outside wall.

This includes the:

- Manual tank shut off valve
- Fill connection
- Fixed liquid level gauge

75) . **LP-Gas Containers**

1192-§5.2.11.1 Remotely Controlled Appurtenances

Vehicles are allowed to be equipped with a remotely controlled, electrically operated shut off valve installed within **9 in.** of the tank shut off valve.

76) . **LP-Gas Containers**

1192-§5.2.11.3 Remotely Controlled Appurtenances

Remotely installed fill connections, fixed liquid level gauges and electrically operated shutoff valves shall be located **within 18 in.** of the outside wall.

77) . **LP-Gas Containers**

1192-§5.2.13.1 Overfill Prevention Device

Containers shall be equipped with a listed **OPD**

78) . **LP-Gas Containers**

1192-§5.2.13.2 Overfill Prevention Device

Cylinders shall be equipped with an overfilling prevention device that complies with ANSI/UL 2227, *Standard for Overfilling Prevention Devices.*

79) . **LP-Gas Containers**

1192-§5.2.14 Protection of Cylinder Valves

Cylinder valves shall be protected by a:

- Ventilated Cap
- Ventilated Collar

80) . **Poll Questions**

Break

81) . # Fuel Systems & Equipment

82) . **Fuel Systems & Equipment**

1192-§5.2.15.1 Propane Regulators

First stage regulators can have an outlet pressure setting up to **10.0 psig** in accordance with ANSI/UL 144.

83) . **Fuel Systems & Equipment**

1192-§5.2.15.2 Propane Regulators

Two stage regulator system or an integral two-stage regulator must be listed to ANSI/UL 144.

84) . **Fuel Systems & Equipment**

1192-§5.2.15.3 Propane Regulators

The regulator(s) must have a capacity that is not less than the **total input of all propane appliances** installed on the RV.

85) . **Fuel Systems & Equipment**

1192-§5.2.15.4 Propane Regulators

Regulators must be installed with the relief valve vent pointing **downward** within 45 degrees of vertical.

This allows for drainage of moisture.

86) . **Fuel Systems & Equipment**

1192-§5.2.15.5 Installation Below Floor Level

Regulator(s) installed below floor level shall be installed in a compartment that provides protection against the weather and wheel spray.

87) . **Fuel Systems & Equipment**

1192-§5.2.15.7 Propane Regulators

Regulator vent outlet must be at least **1 inch** above compartment vent opening.

88) . **Fuel Systems & Equipment**

1192-§5.2.15.8 Propane Regulators

Regulators not installed in a compartment must be:

- Equipped with a **durable cover**
- Withstand -40°F without becoming brittle
- Vent opening protected from sleet, snow, freezing rain, ice, mud, and wheel spray

89) . **Fuel Systems & Equipment**

90) . **Fuel Systems & Equipment**

1192-§5.2.16.2 Manual Shut Off Valves

Cylinders are required to have a manual shutoff vapor service valve that does not allow flow until there is a positive seal between valve and connection.

91) . **Fuel Systems & Equipment**

1192-§5.2.16.3 Back Flow Check Valves

In multiple cylinder systems a backflow check valve must be installed anywhere from the cylinder outlet to the automatic changeover regulator inlet.

92) . **Fuel Systems & Equipment**

1192-§5.2.19.1 Location of Pressure Relief Valves

Discharge from relief valves shall be not less than **3 ft.** horizontally along the surface from any of the following located below the level of discharge:

(1) Openings into the RV

(2) Propane-burning appliance intake and exhaust vents

(3) All internal combustion engine exhaust terminations

93) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge

§5.2.19.3.1 Relief valve discharge shall be directed **upward or downward** within 45 degrees of vertical

- Must not impinge on engine or interior

§5.2.19.3.2 Must be piped away

- With a **breakaway adapter** recommended by the manufacturer
- Discharge opening must have a protective cover

94) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.3 Pipe-away systems must have an internal diameter not less than internal diameter of breakaway adapter.

§5.2.19.3.4 Breakaway adapter must be threaded

- To directly connect to PRV
- Must not interfere with operation of PRV

95) . **Fuel Systems & Equipment**

1192-5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.1.5 Breakaway adapter shall be installed so that it breaks away without **impairing the function** of the PRV

§5.2.19.3.6 Adaptor melting point of not less than 1450°F.
(not aluminum or zinc)

96) . **Fuel Systems & Equipment**

1192-5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.7 Pipe-away Material

- Metallic pipe
- Nonmetallic hose

§5.2.19.3.8 Terminal discharge shall be directed upward or downward within 45 degrees of vertical.

97) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.9 Pipe-away materials shall be resistant to the actions of propane.

§5.2.19.3.10 Nonmetallic hose where used shall be able to withstand the downstream pressure from a relief valve in full open position.

98) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.11 Where pipe-away hose is used on PRV discharge from containers mounted on the outside of vehicle,

- Breakaway adapter and any attached fittings, without hose attached, shall direct discharge from PRV upward or downward within 45 degrees of vertical.

99) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.12 Pipe-away system connections shall be mechanically fastened and not depend on adhesives or sealing compounds.

§5.2.19.3.13 Where a pipe-away system is not required the PRV shall have a protective cover.

100) . **Fuel Systems & Equipment**

1192-§5.2.19.3 Relief Valve Discharge - (cont.)

§5.2.19.3.14 On cylinders located in compartments vapor resistant to the vehicle interior, discharge shall be considered to be located at the compartment vents.

101) . **Fuel Systems & Equipment**

1192-§5.2.21 Appliance Pressure Rating.

§5.2.21.1 Vapor at a pressure not over **14 water column** shall be delivered from the system into the propane appliance supply connection.

102) . **Fuel Systems & Equipment**

1192-§5.2.21 Appliance Pressure Rating. - (cont.)

§5.2.21.2 Appliances operating at pressures **higher than 14 in.** water column must:

(1) Provide a separate supply system or a means to prevent high pressure from entering the low-pressure system

(2) Be located entirely on the exterior of the vehicle or in a compartment vapor tight to the vehicle's interior

103) . **Fuel Systems & Equipment**

1192-§5.2.21.2 Appliance Pressure Rating. - (cont.)

(3) Permanent exterior warning label with the word "Warning" indicating:

(a) Operating pressure

(b) Any special precautions

(c) Warning against connecting to another fuel system or another appliance

104) . **Fuel Systems & Equipment**

1192-§5.2.21.2 Appliance Pressure Rating. - (cont.)

105) . **Fuel Systems & Equipment**

1192-§5.2.21.2 Appliance Pressure Rating. - (cont.)

(4) The appliance shall be listed for recreational vehicle use at the specified operating pressure.

106) . **Fuel Systems & Equipment**

1192-§5.3.11.3 Vapor Pressure Maximum

A two-stage regulator system is not required for a high-pressure system.

107) . **Fuel Systems & Equipment**

1192-§5.3.2 Propane Piping System Materials.

§5.3.2.1 Materials used for installation, extension, alteration, or repair must be **new and free of defects** or internal obstructions.

§5.3.2.2 Inferior or defective materials in piping or fittings shall be replaced and **shall not** be repaired.

§5.3.2.4 Melting point not less than 1450°F.

108) . **Fuel Systems & Equipment**

1192-§5.3.2.5 Propane Piping System Materials. (cont.)

Propane piping systems shall consist of the following:

(1) Steel or wrought-iron ASTM A53 pipe

(2) Schedule 40 (less than 125 psig)

(3) Schedule 80 (greater than 125 psig)

(4) Threaded copper or brass pipe

109) . **Fuel Systems & Equipment**

1192-§5.3.2.5 Propane Piping System Materials. (cont.)

(5) Fittings shall be:

- Wrought-iron
- Malleable iron
- Steel
- Brass

(6) Brass flare nuts

- stress relieved
- or forged

110) . **Fuel Systems & Equipment**

1192-§5.3.2.5 Propane Piping System Materials. (cont.)

Tubing shall be:

(7) Copper tubing (annealed K or L)

(9) Brass tubing (Min 0.030 in.)

(10) Flexible nonmetallic hose (listed)

111) . **Poll Questions**

112) . **Fuel Systems & Equipment**

1192-§5.3.4.1 Propane Pipe Sizing

The system must be sized so that the pressure drop to any appliance is not more than 0.5” w.c. drop when all appliances are operated at **maximum capacity**.

§5.3.4.2 System to be sized in accordance with tables 5.3.4.2 (a) through (d).

113) . **Fuel Systems & Equipment**

1192-§5.3.4.2(a)&(b) Propane & Natural Gas Sizing

Table 5.3.4.2(a) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Iron Pipe Sizes in Thousands of Btu per Hour, Combination of Propane/Natural Gas System

Nominal Iron Pipe Size (I.D.)		Length of Piping													
		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
in.	mm	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
¼	6	43	13.1	33	10	29	8.8	27	8.2	24	7.3	22	6.7	20	6.1
⅜	10	95	29	77	23.5	65	19.8	57	17.4	52	15.9	49	14.9	45	13.7
½	13	175	53	135	41	120	37	108	33	97	29.6	90	27.5	82	25
¾	19	360	110	279	85	250	76	225	69	200	61	186	57	170	52
1	25	680	207	536	163	465	142	404	123	375	114	330	101	320	98

Table 5.3.4.2(b) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour, Combination of Propane/Natural Gas System

Tubing Size				Length of Piping											
in.		mm		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
O.D.	I.D.	O.D.	I.D.	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
⅜	¼	10	6	27	8.2	21	6.4	18	5.5	16	4.9	15	4.6	14	4.3	13	4
½	⅜	13	10	56	17.1	42	12.8	38	11.6	34	10.4	31	9.5	28	8.5	26	7.9
⅝	½	16	13	113	34	86	26.2	78	23.8	70	21.3	62	18.9	59	18	53	16.2
¾	⅝	19	16	197	60	157	48	136	41	122	37	109	33	99	30	93	28.4
⅞	¾	22	19	280	85	227	69	193	59	172	52	155	47	141	43	132	40

114) . **Fuel Systems & Equipment**

1192-§5.3.4.2(c)&(d) Propane Only Sizing

Table 5.3.4.2(c) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Iron Pipe Sizes in Thousands of Btu per Hour, Propane System

Nominal Iron Pipe Size (I.D.)		Length of Piping													
		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
in.	mm	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
¼	6	67	20.4	52	15.9	46	14	41	12.5	37	11.3	34	10.4	31	9.5
⅜	10	147	45	112	34	101	31	87	26.5	81	24.7	74	22.6	70	21.3
½	13	275	84	212	65	189	58	166	51	152	46	138	42	129	39
¾	19	567	173	500	152	393	120	338	103	315	96	276	84	267	81
1	25	1071	326	1005	306	732	223	667	203	590	180	530	162	504	154

Table 5.3.4.2(d) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour, Propane System

Tubing Size				Length of Piping											
in.		mm		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
O.D.	I.D.	O.D.	I.D.	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
⅜	¼	10	6	39	11.9	32	9.8	26	7.9	23	7	21	6.4	19.5	5.9	19	5.8
½	⅜	13	10	92	28.1	72	21.9	62	18.9	56	17.1	50	15.3	45	13.7	41	12.5
⅝	½	16	13	199	61	159	49	131	40	118	36	107	33	94	28.7	90	27.5
¾	⅝	19	16	329	100	249	76	216	66	193	59	181	55	154	47	145	44
⅞	¾	22	19	501	153	380	116	346	106	300	91	277	84	246	75	233	71

115) . **Fuel Systems & Equipment**

1192-§5.3.5 Joints for Propane Pipe.

§5.3.5.1 Pipe joints should be welded, brazed or screwed.

§5.3.5.2 Right/left nipples or couplings shall not be used.

116) . **Fuel Systems & Equipment**

1192-§5.3.5 Joints for Propane Pipe.

§5.3.5.3 Ground joint type unions only

§5.3.5.4 Material for welded or brazed connections shall have melting temperature in excess of 1000°F.

117) . **Fuel Systems & Equipment**

1192-§5.3.6.1 Propane Tubing Joints

Joints are permitted to be made with:

- Single or Double flare of 45 degrees
- Listed vibration-resistant fittings
- Brazed with a material with a melting point exceeding 1000°F

§5.3.6.2 Brazing alloys shall not contain phosphorus.

118) . **Fuel Systems & Equipment**

1192-§5.3.6 Propane Tubing Joints – (cont.)

§5.3.6.3 No sealants on joints

§5.3.6.4 No ball sleeve or one-piece internal compression type fittings

119) . **Fuel Systems & Equipment**

1192-§5.3.7 Pipe Joint Materials.

§5.3.7.1 Threaded joints, made up tight, with joint compound **approved for propane.**

§5.3.7.2 Should be applied **only to male threads**

120) . **Fuel Systems & Equipment**

1192-§5.3.8 Routing & Protection of Tubing Hose.

§5.3.8.1 Tubing shall not be run inside walls, floors, partitions, or ceilings.

§5.3.8.2 Where tubing passes through, it should be protected by weather resistant grommets.

§5.3.8.3 Protected from physical damage, sharp edges, and moving parts

121) . **Fuel Systems & Equipment**

122) . **Fuel Systems & Equipment**

1192-§5.3.9 Restrictions on Concealing Joints

Pipe or tubing joints shall:

§5.3.9.1 Not be located in any floor, wall, partition, or **concealed construction space**.

§5.3.9.2 Be within **2 in.** of compartment's ceiling when located in storage areas below the floor.

§5.3.9.3 Be physically protected, if under the **2 in.** requirement.

123) . **Fuel Systems & Equipment**

1192-§5.3.11 Regulated High-Pressure Piping

§5.3.11.1 Shall be located entirely on the **exterior** of the vehicle or in a vapor resistant compartment to the interior

§5.3.11.2 System pressure shall be regulated to 30-psi or less within **60 inches** of container outlet

124) . **Fuel Systems & Equipment**

1192-§5.3.12.3 Supply Connections - High Pressure

§5.3.12.3.1 If the high-pressure regulator is not connected directly to the shutoff valve of a tank, it shall be connected by a listed high-pressure flexible hose conforming to 5.3.2.

§5.3.12.3.3 A regulator shall not be directly attached to the shutoff valve of a cylinder.

125) . **Fuel Systems & Equipment**

1192-§5.3.12.4 Supply Connections - Low Pressure

Low-pressure connections shall be:

§5.3.12.4.1 Listed flexible hose or material conforming to 5.3.2 (for regulator **fixed** in place)

§5.3.12.4.2 Listed flexible hose connector (for regulator **not fixed** in place)

§5.3.12.4.3 Two-stage regulator shall not be connected directly to the shut-off valve of a cylinder

126) . **Fuel Systems & Equipment**

1192-§5.3.13 Flexible Nonmetallic Tubing

Flexible nonmetallic tubing or hose shall not be permitted to enter the burner box of a range or cook top as the final connection.

127) . **Fuel Systems & Equipment**

1192-§5.3.14 Quick Disconnect Devices.

Quick disconnects downstream of a regulator shall be:

§5.3.14.1 Listed for propane for indoor, outdoor, or both

§5.3.14.3 Have an integral or manual shutoff upstream

128) . **Fuel Systems & Equipment**

1192-§5.3.18 Propane Piping Support.

§5.3.18.1 Piping shall be supported at intervals of **not more than 4 ft.**

§5.3.18.2 Rigidly supported within **6 in.** of the supply connection

129) . **Fuel Systems & Equipment**

1192-§5.3.18 Propane Piping Support. – (cont.)

§5.3.18.3 Anchored within **6 in.** of tubing connections at the end of piping runs.

§5.3.18.4 All piping shall be anchored within **12 in.** of tubing connections within piping runs.

130) . **Fuel Systems & Equipment**

131) . # Leak Testing

132) . **System Leak Testing**

1192-§5.3.19 Leak Testing <u>Before</u> Connecting Appliances

§5.3.19.1 Piping systems shall be tested for leakage by:

- Maintaining an air pressure of **3 psi**
- For at least **10 minutes**

§5.3.19.2 Prior to testing, the temperature of air and piping must be approximately the same and be maintained during test.

133) . **System Leak Testing**

1192-§5.3.19 Leak Testing <u>Before</u> Connecting Appliances

§5.3.19.3 Leaks shall be located and repaired

§5.3.19.4 Defective material shall be replaced

§5.3.19.5 No **ammonia or chlorine** in the test solution

134) . **System Leak Testing**

1192-§5.3.19 Leak Testing <u>Before</u> Connecting Appliances

§5.3.19.6 Tests shall use either of the following:

(1) Air pressure

(a) System pressurized to not less than 3-psi, and then isolated from pressure source.

(b) Observe for **10 minutes** with a gauge read in increments not greater than 1/10 psi.

(c) No pressure drop shall be observed.

135) . **System Leak Testing**

1192-§5.3.19 Leak Testing <u>Before</u> Connecting Appliances

§5.3.19.6 Tests shall use either of the following:

(2) Bubble leak detector

(a) A bubble leak detector can be installed between the source and piping system.

(b) No air flow during a **1 min.** period.

136) . **System Leak Testing**

1192-§5.3.20 Leak Testing <u>After</u> Connecting Appliances

§5.3.20.1 Piping systems shall be tested for leakage by:

- Maintaining an **air** pressure of
  Not less than **8 in.** w.c.
  or
  More than **14 in.** w.c.

137) . **System Leak Testing**

1192-§5.3.20 Leak Testing <u>After</u> Connecting Appliances

§5.3.20.2 The temperature of air and piping must be approximately the same and be maintained during test.

§5.3.20.3 Leaks shall be located and corrected.

§5.3.20.4 No ammonia or chlorine in the test solution.

§5.3.20.5 Defective material shall be replaced.

138) . **System Leak Testing**

1192-§5.3.20 Leak Testing <u>After</u> Connecting Appliances

§5.3.20.6 A pressure drop test is conducted as follows:

(1) Pressurize between **8 in. to 14 in.** water column

- Appliance shutoff valves closed / System isolated

(2) Lower pressure to **8 in. ± 0.5 in.** water column to open the appliance regulator.

- When gauge is downstream of the appliance regulator

(3) No drop in a **3 min.** period

139) . **System Leak Testing**

1192-§5.3.20 Leak Testing <u>After</u> Connecting Appliances

§5.3.20.7 As an alternative to the pressure drop test the appliance and regulator connections shall be permitted to be tested in in accordance with **5.3.20.1** using either **soapy water** or bubble solution.

140) . **System Leak Testing**

141) . **Poll Questions**
Break

142) . # RV Gas Appliances

143) . **RV Gas Appliances**

1192-§5.4 Fuel Burning Appliances.

§5.4.1 Appliances & vents shall be listed for RVs.

§5.4.2 Fuel-burning, heat producing, and refrigeration appliances, except **ranges and ovens** shall be vented to the outside

144) . **RV Gas Appliances**

1192-§5.4 Fuel Burning Appliances. - (cont.)

§5.4.3 Appliances shall be listed for propane only or convertible (NG to Propane / Propane to NG).

§5.4.4 Appliances shall not be converted from one fuel to another unless converted according to the listing and the manufacturer's instructions.

145) . **RV Gas Appliances**

1192-§5.4.5 Installation of Fuel-Burning Appliances.

§5.4.5.1 Must comply with terms of listing and installation instructions.

§5.4.5.2 Floor-mounted appliances shall not be installed on carpeting unless it is listed for such installation.

§5.4.5.3 Mounted to avoid displacement.

146) . **RV Gas Appliances**

1192-§5.4.6 Direct Vent System Appliances

§5.4.6.1 Designed & installed to provide complete **separation of combustion system from the interior** (except ranges and ovens)

§5.4.6.2 Combustion air inlets and flue gas outlets shall be listed as components of the appliance.

147) . **RV Gas Appliances**

1192-§5.4.6 Direct Vent System Appliances

§5.4.6.4 Refrigerators can be installed using panels supplied by the RV manufacturer provided the refrigerator manufacturer furnishes the necessary vents and grilles required for the listing.

148) . **RV Gas Appliances**

1192-§5.4.6.5 Appliance does not need to be of the direct vent type if:

(1) It is a vented appliance

(2) Gets combustion air from outside

(3) Incorporates safety control to prevent discharge of flue gas to the interior

(4) Protects against ignition of flammable materials contacting **any heat source** or the appliance

(5) Listed for RVs and installed accordingly.

149) . **RV Gas Appliances**

1192-§5.4.7 Exterior Appliances.

§5.4.7.1 Fuel-burning appliances installed or intended to be used only outside shall be listed.

§5.4.7.2 Cannot operate when in **storage** or **travel** position.

150) . **RV Gas Appliances**

1192-§5.4.7 Exterior Appliances.

§5.4.7.3 Manufacturer specifies clearances in both operational and storage modes

§5.4.7.4 Installed so as not to obstruct any path to exits

151) . **RV Gas Appliances**

152) . **RV Gas Appliances**

1192-§5.5.1 Venting, Ventilation, and Combustion Air

(1) Components shall be assembled and aligned in accordance with the **manufacturer's instructions**.

(2) Vent connectors shall be firmly attached to flue collars with screws or their equivalent, as specified in the manufacturer's instructions.

(3) Every **joint** of a vent, vent connector, exhaust duct and combustion air intake shall be secure and in alignment.

153) . **RV Gas Appliances**

1195-§5.5.2 Location of Flue Gas Outlets

§5.5.2.1 Flue gas outlets shall be **not less than 3 ft.** from any motor driven **air intake** discharging into the interior

§5.5.2.2 Shall not terminate **underneath** the RV

154) **RV Gas Appliances**

1192-§5.5.3 Location of Air Inlets & Flue Gas Outlets

§5.5.3.1 Any portion of a combustion air inlet or flue gas outlet of a fuel-burning heating appliance shall be located at **least 3 ft.** from any **gasoline filler spout** on the vehicle if the inlet or outlet is located **above or at the same level.**

§5.5.3.2 If any portion of inlet or outlet located **below** the spout, the distance shall be the sum of the vertical distance below the spout plus **3 ft**.

155) . **RV Gas Appliances**

1192-§5.5.4 Ventilation of Appliance Areas

§5.5.4.1 The space shall be ventilated by a gravity or mechanical vent extending through the roof

§5.5.4.2 Vehicles with fabric exterior walls can:

- Utilize an opening through the sidewall
- Not more than **15 in.** below highest point of roof
- Within 5 ft. of point directly above appliance

156) . **RV Gas Appliances**

1192-§5.5.4 Ventilation of Appliance Areas - (cont.)

§5.5.4.4 Gravity vents shall have

- Free, Clear, Openable Area
- Not less than 1 in^2 for every **2000** BTU/hr

§5.5.4.5 Location of vents

- In the roof
- Within 5 ft. directly above
- Unobstructed flow from the cooking appliance

157) . **RV Gas Appliances**

1192-§5.5.4 Ventilation of Appliance Areas - (cont.)

§5.5.4.6 Hooded gravity vents

- Located directly above appliance
- Permitted to exhaust through the side wall

158) . **RV Gas Appliances**

1192-§5.5.4 Ventilation of Appliance Areas - (cont.)

§5.5.4.7 Mechanical Vents

- Flow rate 2 cubic ft./min. per **1000** BTU/hr
- Located on adjacent wall
- Higher than appliance
- Horizontal distance <5 ft. from edge of appliance

§5.5.4.8 Vent hood duct design

- Shall not trap products of combustion

159) . **RV Gas Appliances**

1192-§5.6 Marking Appliances

§5.6.1.1 Information to be attached to the appliance

- Clearances
- Input Ratings
- Lighting
- Shutdown

§5.6.1.2 For appliances with manual pilots

- Must include **lighting** and **shutdown** requirements
- Instructions visible after installation

160) . **RV Gas Appliances**

1192-§5.6.2 Type(s) of Fuel.

§5.6.2.1 Appliance shall have manufacturer's **permanent marking designating the type of fuel** for its listing

§5.6.2.2 For convertible listed appliances, the manufacturer's instructions for conversion must be permanently attached.

161) . **RV Gas Appliances**

1192-§5.6.3 Accessibility for Service and Operation.

§5.6.3.1 Every appliance shall be accessible for

- **Inspection**
- Service
- Repair
- Replacement

162) . **RV Gas Appliances**

1192-§5.6.3 Accessibility for Service - (cont.)

§5.6.3.2 Room shall be provided to

- Operate controls
- Start appliance
- Observe ignition

§5.6.4 Doors and **window treatments** shall be installed so they cannot be placed or swung closer to a heat producing appliance than clearances specified on the appliance label.

163) . **RV Gas Appliances**

1192-§5.6.6 Clearances of Heat-Producing Appliances.

§5.6.6.5 Ranges & cooktops shall have a vertical clearance between cooking top and combustible materials or metal cabinets in accordance with Table 5.6.6.5 or their listing.

164) . **RV Gas Appliances**

1192-§5.6.7 Clothes Dryers.

§5.6.7.1 All propane & electric clothes dryers shall be exhausted to the outside with:

- Moisture-lint exhaust duct
- Termination fitting

165) . **RV Gas Appliances**

1192-§5.6.7 Clothes Dryers. - (cont.)

§5.6.7.3 Exhaust Duct Installation

Where a clothes dryer is supplied by the manufacturer the exhaust duct & termination fittings shall:

(1) Not connected to any other **duct**, **vent**, or **chimney.**

(2) Not terminate beneath the vehicle

(3) Not be connected with screws that **penetrate** into the interior of the duct

(4) Installed according to manufacturer's instructions

166) . **RV Gas Appliances**

1192-§5.6.7 Clothes Dryers. - (cont.)

§5.6.7.4 Fuel-Burning Clothes Dryers

- Receive combustion air and drying air from **outside** the vehicle
- Exhaust combustion products and drying air from **inside** the vehicle

167) . **RV Gas Appliances**

1192-§5.6.7 Clothes Dryers. - (cont.)

§5.6.7.5 Future Installations

Propane piping can be provided for **future** clothes dryer installation by the owner if the:

(1) Propane outlet has a **shutoff valve** which is plugged or capped

(2) Propane outlet **permanently labeled** as the supply connection for propane clothes dryer only

(3) Manufacturer provides written instructions on how to complete the exhaust duct installation

168) . **RV Gas Appliances**

1192-§5.6.7 Clothes Dryers. - (cont.)

§5.6.7.7 Clothes dryers installed in closets shall be listed for such installation.

§5.6.7.8 Closets containing clothes dryers shall have ventilation openings sized according to manufacturer's installation instructions.

169) . **RV Gas Appliances**

1192-§5.9.1 Required Information.

§5.8.1.1 Each appliance shall be provided with **operating instructions.**

§5.8.1.2 Each RV shall be provided with an **owners manual** with the information contained in 5.8.1.2.1 through 5.8.1.2.8 (propane safety warnings).

170) . **RV Gas Appliances**

1192-§5.8.1 Required Information. – (cont.)

§5.8.1.2.1 The warning shown in Figure 5.8.1.2.1 shall be provided.

171) . **RV Gas Appliances**

1192-§5.8.1 Required Information. – (cont.)

§5.8.1.2.2 The label shown in Figure 5.8.1.2.2 shall be located in the cooking area to remind the user to provide a supply of fresh air for combustion.

172) . **Poll Questions**

173) . **Fire & Life Safety**

1192-§6.4.1 Provisions for Portable Fire Extinguishers.

§6.4.1.2 Each motor home shall have:

- Listed portable fire extinguisher
- Minimum **10-B:C**

§6.4.1.3 RV equipped with fuel-burning appliances

- Listed portable fire extinguisher
- Minimum **5-B:C**

174) . **Fire & Life Safety**

1192-§6.4.6 Special Transportation Provisions.

§6.4.6.1 On RVs with 36” or wider entrance door and access ramp for that door for the transport and storage of internal combustion engines:

§6.4.6.5 Minimum 10-B:C listed fire extinguisher

§6.4.6.6 Propane ranges and ovens with a pilot light shall be equipped with **pilot light shutoff**.

175) . **Fire & Life Safety**

176) . **Fire & Life Safety**

1192-§6.3.3 Propane Detectors.

All RVs equipped with a propane appliance and electrical system shall be equipped with a listed **propane detector** suitable for RVs and installed according to its listing.

177) . **Fire & Life Safety**

1192-§7.3.11 Temperature & Pressure Relief Valve.

§7.3.11.1 Every water heater shall be protected against over-temperature and over-pressure by an approved or listed T&P valve.

§7.3.12.1 If T&P valve is located inside an RV it shall be equipped with a drain extending outside and directed downward

- Not required if T&P valve discharges into an area **sealed off** from the inside and drained to the outside

178) . **Accident Reporting**

SR §9.36 Report of LP-Gas Incident / Accident

(a) At the earliest practical moment or within **two hours** following discovery a licensee shall notify AFS by telephone of any event involving LP-Gas which:

(1) Caused a death or personal injury requiring hospitalization

(2) Required taking an operating facility out of service

(3) Resulted in gas ignition requiring an emergency response

179) . **Accident Reporting**

SR §9.36 Report of LP-Gas Incident / Accident

(4) Involved the LP-Gas installation on any vehicle propelled by or transporting LP-Gas

(5) Caused an estimated damage totaling $5000 or more

(6) Could reasonably be judged as significant because of rerouting of traffic, evacuation of buildings or media interest

(7) Is required to be reported to any other state or federal agency such as DPS or DOT.