

NFPA®

1192

Standard on
Recreational Vehicles

2021



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NFPA® 1192

Standard on

Recreational Vehicles

2021 Edition

This edition of NFPA 1192, *Standard on Recreational Vehicles*, was prepared by the Technical Committee on Recreational Vehicles. It was issued by the Standards Council on March 15, 2020, with an effective date of April 4, 2020, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 1192 was approved as an American National Standard on April 4, 2020.

Origin and Development of NFPA 1192

The earliest activity of NFPA in the field of mobile homes and recreational vehicles was the formation of an NFPA Committee on Trailers and Trailer Camps in 1937. Its first standard was adopted in 1940. That edition remained unchanged until after World War II, when a 1952 revision was approved. These editions were entitled *Standards for Fire Prevention and Fire Protection in Trailer Coaches and Trailer Courts*. In 1960, NFPA acted to approve a revised version, dividing the text into two parts — one designated 501A, covering trailer courts, and the other designated 501B, covering trailer coaches. In 1961, a new edition of 501B was adopted under the title *Standard for Fire Prevention and Fire Protection in Mobile Homes and Travel Trailers*, and in 1963, a revision of it was approved. Revisions of both NFPA 501A and 501B were acted upon in 1964.

In the early 1960s, the Mobile Homes Manufacturers Association (MHMA) and the Trailer Coach Association (TCA) prepared, under the aegis of the American Standards Association (now ANSI), two standards that subsequently were approved as the *American Standard Installations of Plumbing, Heating and Electrical Systems in Travel Trailers* (A119.2-1963) and *Standard for Fire Prevention and Fire Protection in Mobile Homes and Travel Trailers* (A119.1-1963). In 1964, the two standards activities were consolidated with the approval of the United States of America Standards Institute, which is now ANSI. In 1969, the Recreational Vehicle Institute (RVI) was added to the MHMA, NFPA, and TCA as the fourth cosponsor of the project. The first *Standard for Recreational Vehicles*, developed under the consolidated efforts of NFPA, MHMA, TCA, and RVI, was approved by NFPA in 1970 and by ANSI in 1971 and replaced ASA Standard A119.2-1963.

The MHMA and the TCA were merged in 1975 to become the Manufactured Housing Institute (MHI). The RVI was redesignated the Recreation Vehicle Industry Association (RVIA) also in 1975, absorbing the Recreational Vehicle Division of the TCA.

Previous editions of the *Standard on Recreational Vehicles* were published in 1970, 1972, 1974, and 1976.

The only substantive changes in the 1977 edition were revisions to Part 8 on mobile home park electrical systems. Some editorial revisions were made in other parts, and references to other standards were updated.

The 1982 edition and the 1986 edition both excluded all sections of previous editions not considered within the committee scope. Notably excluded were sections dealing with plumbing. Modifications were made in sections dealing with heating, fire, and life safety and included conformance with the NFPA *Manual of Style*. The 1986 edition included minor changes and a new Chapter 5 to replace Appendix C so that all mandatory provisions were contained in the body of the document.

The 1990 edition contained minor revisions to Chapters 2 and 3, and one new definition was added to Chapter 1.

A few definitions were revised in the 1993 edition, and minor changes were incorporated in Chapters 2 and 3, including the size of alternate exits.

Minor changes were made in all chapters of the 1996 edition, including a new section on clothes dryers, the requirement for an LP-Gas detector, and the expansion of provisions for recreational vehicles used for transporting or storing internal combustion engine vehicles.

In the 1999 edition, NFPA 501C was renumbered as NFPA 1192. Chapter 2 requirements on LP-Gas containers and connectors were updated. Changes also included modifications to requirements for exit facilities and special transportation provisions.

The 2002 edition consisted of a major editorial reorganization of the document in accordance with the *Manual of Style for NFPA Technical Committee Documents*, 2000 edition. Other changes occurred in the language of caution and warning labels.

In the 2005 edition, the committee completed the editorial revision to comply with the *Manual of Style for NFPA Technical Committee Documents* and merged the requirements from ANSI A1192.2, which is no longer published, into NFPA 1192.

The 2005 edition was revised to contain minimum requirements for the installation of plumbing, fuel-burning, electrical, and other safety-related systems in recreational vehicles. Technical changes to the standard included clarification of requirements for location and securing of propane containers, requirements for high-pressure piping and automatic generator starting systems, and revision of requirements for fuel tank installation.

The 2008 edition of NFPA 1192 was updated to include minimum requirements for testing regulated high-pressure piping systems for gas leakage and minimum requirements for fuel tank construction. Technical changes included the revision of requirements for recreational vehicle exits and a new annex on product listing standards.

The 2011 edition was updated to include a new definition of *recreational vehicle*. Major technical changes included rewritten sections for gasoline and diesel fuel systems, as well as the piping system requirements of Chapter 5. Additions to the means of egress provisions for recreational vehicles were also made to more clearly address primary and secondary means of escape.

The 2015 edition underwent a communal effort to harmonize requirements with CSA Z240, *Recreational Vehicles*. New definitions were added for *protruding component*, *fuel cell device*, and *fuel cell system*. In addition to the definitions, requirements were incorporated into the standard, such as restrictions on the operability of protruding components while in transit. A new chapter, Chapter 8, Vehicular Requirements, was added to the standard. All labels were revised to conform to ANSI Z535, *Safety Alerting Standard Series*. Additionally, minimum means of escape was revised, providing clarity on primary and secondary means of escape.

Certain material in the 2015 edition of NFPA 1192 was reproduced from the public review draft of CSA Z240 RV Series-14, *Recreational Vehicles*, c 2014 CSA Group, with permission. This material was taken from the CSA Group standard and may not be in the same context as in that standard. This material might include revisions by NFPA. The edition, as revised, shall be the full responsibility of NFPA. CSA Group cannot be responsible for any personal injury or property or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

The 2018 edition added a requirement that allowed the use of registers or grills made of wood and modifications to the size of means of egress for recreational vehicles that cannot provide a height of 48 in. Extinguisher requirements for special transportation areas were clarified, and new requirements on lofts were added to address stairway configuration, handrails, and guardrails. New requirements for retaining in place potable water and waste holding tanks were added. New requirements for axle, tire, and wheel assembly for towable recreational vehicles were added as well.

The 2021 edition of NFPA 1192 provides editorial changes to clarify the intent of existing requirements including, but not limited to, exterior ladders and the reserve capacity for all RV tires. New provisions include the way guardrails are installed, valve locations, minimum bend radius of water distribution systems, exposed interior finish materials, and the safety requirements for wall beds (Murphy beds).

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Committee Scope: This Committee shall have primary responsibility for documents on the fire safety criteria for recreational vehicles and recreational vehicle parks.

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NFPA 1192

Standard on

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2021 Edition

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

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Information on referenced and extracted publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1* Scope. This standard shall cover fire and life safety criteria for recreational vehicles.

1.2 Purpose. The purpose of this standard shall be to provide the minimum criteria for recreational vehicles that are considered necessary to provide protection from loss of life from fire and explosion.

1.3 Application.

1.3.1* The requirements of this standard shall be applied to all new recreational vehicles.

1.3.2 This standard shall not be applied as a stand-alone design specification or instruction manual.

1.4 Retroactivity. This standard shall not be applied retroactively.

1.5 Equivalency. The provisions of this standard shall not be intended to prevent the use of any material, method of construction, or installation procedure not specifically prescribed by this standard, provided any such alternate is acceptable to the authority having jurisdiction. The authority having jurisdiction shall require that sufficient evidence be submitted to substantiate any claims made regarding the safety of such alternatives.

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1.6* Use of International System of Units (SI). In some cases SI equivalents to U.S. customary units have been inserted in this standard. Where used, the conversions have been rounded to the number of digits commensurate with their intended precision. Use of the SI units herein is in accordance with the *Manual of Style for NFPA Technical Committee Documents*. Alternating usage of U.S. and SI units to determine distance, size (capacity), or dimensions shall not be used. Where SI equivalents are not given, it is because the U.S. units shall be employed by anyone enforcing this standard.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.

NFPA 70®, *National Electrical Code®*, 2020 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI B1.20.1, *Pipe Threads, General Purpose (Inch)*, 2013.

ANSI Z21.57, *Standard for Recreational Vehicle Cooking Gas Appliances*, 2010.

ANSI Z97.1, *Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test*, 2009.

ANSI Z535, *Safety Alerting Standard Series*, 2011.

2.3.2 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME A112.18.8, *In-Line Sanitary Waste Valves for Plumbing Drainage Systems*, 2009.

ASME Boiler and Pressure Vessel Code, Section VIII, Division I, Rules for Construction of Unfired Pressure Vessels, 2015.

2.3.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A53/A53M, *Standard Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless*, 2018.

ASTM B88, *Standard Specifications for Seamless Copper Water Tube*, 2016.

ASTM B280, *Specifications for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2018.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2018.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*, 2016.

2.3.4 CSA Group Publications. CSA Group [corporate office], 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada.

CSA 6.19, *Residential Carbon Monoxide Alarming Devices*, 2001 (reaffirmed 2017).

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*, 2014.

CSA B45.5/IAPMO Z124, *Plastic Plumbing Fixtures*, 2017.

CAN 1-1.16, *Standard for Propane Fired Cooking Appliances for Recreational Vehicles*, 1979.

CAN3-D313, *Trailer Running Gear*, 1985 (reaffirmed 2017).

2.3.5 NATM Publications. National Association of Trailer Manufacturers 2420 SW 17th Street, Topeka, KS 66604.

ANSI TSIC-1 Recommended Practice, *Process Controls for Assembly of Wheels on Trailers*, 2018.

2.3.6 RVIA Publications. Recreation Vehicle Industry Association, 1896 Preston White Drive, Reston, VA 20191.

ANSI/RVIA LV, *Low Voltage Systems in Conversion and Recreational Vehicles*, 2018.

ANSI/RVIA EXTLAD-1 *Recommended Practice Laboratory Test Procedures for Exterior Ladders on Recreational Vehicles*, 2019.

2.3.7 SAE Publications. SAE International, Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J30, *Fuel and Oil Hoses*, 2012.

SAE J476, *Dryseal Pipe Threads*, 2013.

SAE J533, *Flares for Tubing*, 2007.

SAE J684, *Trailer Couplings, Hitches, and Safety Chains — Automotive Type*, 2014.

SAE J1128, *Low Voltage Cable*, 2015.

SAE J1508, *Hose Clamp Specifications*, 2009.

SAE J1527, *Marine Fuel Hose*, 2011.

SAE J2638, *Fifth Wheel and Gooseneck Attachment Performance Up to 13,608/Kg (30,000/Lb) Trailer Grw*, 2003.

SAE Handbook, 2017.

2.3.8 TC Publications. Transport Canada, 330 Sparks Street, Ottawa, ON K1A 0N5, Canada.

TSD 108, *Motor Vehicle Regulations, Lighting System and Retroreflective Devices*, 2011.

2.3.9 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 21, *LP-Gas Hose*, 2014, revised 2017.

UL 94, *Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances*, 2013, revised 2018.

UL 125, *Flow Control Valves for Anhydrous Ammonia and LP-Gas*, 2014, revised 2018.

UL 144, *LP-Gas Regulators*, 2012, revised 2014.

UL 181, *Safety Factory-Made Air Ducts and Air Connectors*, 2013, revised 2017.

UL 217, *Smoke Alarms*, 2015, revised 2016.

UL 299, *Dry Chemical Extinguishers*, 2012.

UL 330, *Hose and Hose Assemblies for Dispensing Flammable Liquids*, 2017.

UL 484, *Room Air Conditioners*, 2014, revised 2016.

UL 569, *Pigtails and Flexible Hose Connectors for LP-Gas*, 2013, revised 2017.

UL 711, *Standard for the Rating and Fire Testing of Fire Extinguishers*, 2018.

UL 723, *Test of Surface Burning Characteristics of Building Materials*, 2018.

UL 1484, *Residential Gas Detectors*, 2016, revised 2017.

UL 2034, *Single and Multiple Station Carbon Monoxide Detectors*, 2017.

UL 2061, *Adapters and Cylinder Connection Devices for Portable LP-Gas Cylinder Assemblies*, 2015.

UL 2227, *Overfilling Prevention Devices*, 2007, revised 2014.

UL 2586, *Hose Nozzle Valves*, 2011.

2.3.10 ULC Publications. Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, ON M1R 3A9, Canada.

CAN/ULC-S504, *Standard for Dry Chemical Fire Extinguishers*, 2012, revised 2018.

CAN/ULC-S508, *Standard for the Rating and Fire Testing of Fire Extinguishers*, 2002, revised 2018.

2.3.11 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 16, Code of Federal Regulations, Part 1201, "Safety Standard for Architectural Glazing Materials."

Title 49, Code of Federal Regulations, *Transportation*, "Specifications for LP-Gas Containers."

Title 49, Code of Federal Regulations, Part 393.67, "Liquid Fuel Tanks."

Title 49, Code of Federal Regulations, Part 567, "Certification."

Title 49, Code of Federal Regulations, Part 571.108, Federal Motor Vehicle Standard, "Lamps, Reflective Devices, and Associated Equipment."

Title 49, Code of Federal Regulations, Part 571.302, Federal Motor Vehicle Safety Standard No. 302, "Flammability of Interior Materials."

2.3.12 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 54, *National Fuel Gas Code*, 2018 edition.
 NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.
 NFPA 70®, *National Electrical Code*®, 2020 edition.
 NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances*, 2019 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

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

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

3.2.5 Shall. Indicates a mandatory requirement.

3.3 General Definitions.

3.3.1 Accessible. Having access to but which first requires the removal of a panel, door, or similar covering of the item described. [54, 2018]

3.3.2 Anti-Siphon Trap Vent Device. A device that automatically opens to admit air to a fixture drain above the connection of the trap arm so as to prevent siphonage and closes tightly when the pressure within the drainage system is equal to or greater than atmospheric pressure so as to prevent the escape of gases from the drainage system into the recreational vehicle.

3.3.3 Appliance.

3.3.3.1 Heating Appliance. An appliance for comfort heating of a recreational vehicle or for water heating.

3.3.3.2 Heat-Producing Appliance. An appliance that produces heat by utilizing electric energy or by burning fuel. [211, 2019]

3.3.4* Axle Height. The distance to the lower connection of the axle spindle assembly and the outboard end of the lower control arm (lever ball joint or kingpin), excluding shock mounting, grease fitting, or similar component.

3.3.5 Backflow. The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended source.

3.3.6 Backflow Preventer. A device or means to prevent backflow.

3.3.7* Bias Ply Tire. A vehicle tire in which the main plies or cords run diagonally across the bead.

3.3.8 Branch. Any part of the piping system other than a riser, main, or vent stack.

3.3.9 Center. The midpoint between the right and left sides of a recreational vehicle.

3.3.10 Clearance Line.

3.3.10.1 Front Clearance Line. The plane extending between lines on each side of the vehicle that connect a point that is 8 in. (203 mm) above the ground on the vertical centerline of the forwardmost wheel spindle to the lowest point of the front chassis cross member.

3.3.10.2 Rear Clearance Line. The plane extending between lines on each side of the vehicle that connect a point that is 8 in. (203 mm) above the ground on the vertical centerline of the rearmost wheel spindle to the lowest point on the intersection of the rear wall and floor lines.

3.3.11 Combination Compartment. A shower stall or recess that provides for or includes the installation of a toilet and is of such size and proportions that it may not be occupied by more than one person.

3.3.12 Compartment. Within a recreational vehicle, a volumetric space designed to provide for a separate area.

3.3.13 Connection.

3.3.13.1 Cross Connection. Any physical connection or arrangement between two otherwise separate systems or sources, one of which contains potable water and the other, either water, steam, gas, or chemical of unknown or questionable safety, whereby there may be a flow from one system or source to the other, the direction of flow depending on the pressure differential between the two systems.

3.3.13.2 Water Service Connection. The fitting or point of connection of the vehicle water distribution system designed for connection to a potable water supply.

3.3.14 Container Pressure. Unregulated pressure from a propane container.

3.3.15 Continuous Waste. A drain connecting the compartments of a set of fixtures to a trap or connecting other permitted fixtures to a common trap.

3.3.16 Diameter. The nominal inside diameter designated commercially.

3.3.17 Dispensing. As applied to gasoline or diesel fuel systems, withdrawing fuel from applicable recreational vehicle fuel tank(s) to other motorized vehicles or approved containers by means of a hose and hose nozzle valve.

3.3.18 Distribution. As applied to gasoline or diesel fuel systems, the flow of fuel from the recreational vehicle fuel tank(s) to an onboard fuel-burning generator by means of a closed system of tubing or hoses.

3.3.19 Drain. A pipe that carries waste, water, or liquid-borne wastes in a drainage system.

3.3.19.1 Fixture Drain. The drain from a fixtures trap to the drain outlet or to the junction of that drain with any other drain pipe.

3.3.19.2 Main Drain(s). The lowest piping of a drainage system that receives the liquid or body waste discharge from all the fixtures within the system and conducts these wastes to the drain outlet(s).

3.3.20 Drain Hose. A hose used for connecting the liquid or body waste drain outlet to a sewer inlet connection.

3.3.21 Drain Outlet. The lowest end of a main or secondary drain to which a sewer connection is made.

3.3.22 Fixed Maximum Liquid Level Gauge. A fixed liquid level gauge that indicates the liquid level at which the container is filled to its maximum permitted filling limit. [58, 2020]

3.3.23 Fixtures (Plumbing). Receptacles, devices, or appliances that are supplied with water or that receive liquid or liquid-borne wastes for discharge into the drainage system.

3.3.24 Flexible Drainage Connector. A bendable tube, hose, or hose assembly used for conveying liquid waste between two drain, waste, vent (DWV) fitting components in a recreational vehicle drainage system.

3.3.25 Flood Level. The level in the receptacle over which water would overflow to the outside of the receptacle.

3.3.26 Frame. Chassis rail and any addition thereto of equal or greater strength.

3.3.27 Fuel Cell Device. An electrochemical system that consumes fuel to produce an electric current.

3.3.28 Fuel Cell System. The complete aggregate of equipment used to convert chemical fuel into usable electricity and typically consists of a reformer, a stack, a power inverter, and auxiliary equipment.

3.3.29 Fuel System. Any arrangement of pipe, tubing, fittings, connectors, tanks, controls, valves, and devices designed and intended to supply or control the flow of fuel.

3.3.30 Grade. See 3.3.54, Slope.

3.3.31* Gross Trailer Area. The total plan area measured to the maximum horizontal projections of exterior walls in the set-up mode.

3.3.32 Hose. A flexible tube for conveying a liquid or gas.

3.3.33 Hose Nozzle Valve. The terminal output end of a dispensing system hose.

3.3.34 Identified (as applied to equipment). Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular code requirement. [70:100]

3.3.35* Interior Finish. For recreational vehicles, the exposed interior surface in combination with the substrate to which it is applied.

3.3.36 Loft. A raised interior area that has at least a 5 ft (1.52 m) vertical drop except for areas intended for sleeping only or storage only, such as motorhome and truck camper cabovers, fifth-wheel upper decks, bunk beds, and bed lift systems.

3.3.37 Low-Pressure Piping. Piping with a pressure of 14 in. water column or less.

3.3.38 Main. The principal artery of the system to which branches may be connected.

3.3.39 Means of Escape (Recreational Vehicle). A way to the outside of a recreational vehicle.

3.3.40 Overfilling Prevention Device (OPD). A device that is designed to provide an automatic means to prevent the filling of a container beyond a predetermined level. [58, 2020]

3.3.41* Pipe. Rigid conduit used to convey fuel gas or other fluids.

3.3.41.1 Horizontal Drainage Pipe. A pipe or fitting that forms an angle of 45 degrees or less with the horizontal.

3.3.41.2 Vertical Pipe. Any pipe or fitting that makes an angle of 45 degrees or less with the vertical.

3.3.42* Piping. For recreational vehicles, the tubing or rigid conduit of the system.

3.3.43 Plumbing Vent. Any pipe provided to ventilate a plumbing system, to prevent trap siphonage and back pressure, or to equalize the air pressure within the drainage system.

3.3.43.1 Common Vent. A vent connecting at the junction of fixture drains and serving as a vent for more than one fixture.

3.3.43.2 Continuous Vent. A vertical vent that is a continuation of the drain to which it connects.

3.3.43.3 Individual Vent. A pipe or anti-siphon trap vent device installed to vent a single fixture drain.

3.3.43.4 Primary Vent. The main vent of the vent system, which is open to the outside atmosphere.

3.3.43.5 Secondary Vent. Any vent other than the primary vent or those serving toilet or holding tanks.

3.3.43.6 Wet Vent. A vent that also serves as a drain for one or more fixtures.

3.3.44 Potable Water Storage Tank. A tank installed in a recreational vehicle for the purpose of storing potable water.

3.3.45* Pressure Relief Valve. A type of pressure relief device designed to both open and close to maintain internal fluid pressure. [58, 2020]

3.3.46 Propane (Liquefied Petroleum Gas, LP-Gas, LPG). Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of

the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylene.

3.3.47 Propane Container. A tank or cylinder.

3.3.47.1 Cylinder. For recreational vehicles, a portable container constructed in accordance with U.S. Department of Transportation *Specifications for LP-Gas Containers* (49 CFR) or fabricated to Transport Canada (TC).

▲ **3.3.47.2 Tank.** A container constructed in accordance with the Section VIII, Division I, "Rules for Construction of Unfired Pressure Vessels" of the ASME *Boiler and Pressure Vessel Code*.

3.3.48 Propane Supply Connection. The terminal end or connection where a propane supply connector is attached to the propane supply source.

3.3.49 Propane Supply Connector. Tubing or pipe connecting the recreational vehicle to the propane supply source.

3.3.50* Protruding Component. Movable component that can protrude beyond the periphery or extend below a recreational vehicle.

3.3.51 Readily Accessible. For recreational vehicles, able to be located, reached, serviced, or removed without removing other components or parts of the apparatus and without the need to use special tools to open enclosures.

3.3.52* Recreational Vehicle (RV). A vehicle or slide-in camper that is primarily designed as temporary living quarters for recreational, camping, or seasonal use; has its own motive power or is mounted on or towed by another vehicle; is regulated by the National Highway Traffic Safety Administration as a vehicle or vehicle equipment; does not require a special highway use permit for operation on the highways; and can be easily transported and set up on a daily basis by an individual.

3.3.53 Regulated High-Pressure Piping. Piping with a pressure in excess of 14 in. water column and less than or equal to 30 psi (207 kPa).

3.3.54 Slope. For recreational vehicles, a grade or fall of a line of pipe in reference to a horizontal plane.

3.3.55 System.

3.3.55.1 Automatic Generator Starting System (AGS). A control system that automatically starts and stops engine generators when pre-set RV conditions occur, such as beginning and end of quiet time, low and high battery charge, availability or loss of shore power connection, or appliance demand changes such as cycling of temperature-controlled air conditioning.

3.3.55.2 Drainage System. All piping within or attached to the structure that conveys body or liquid waste to the drain outlet or outlets.

3.3.55.3* Flexible Drain System. An assembly that consists of a trap, strainer, hose, and connectors for use as a liquid waste drainage system.

3.3.55.4 Water Distribution System. The potable water piping within or attached to the recreational vehicle.

3.3.56 Tank.

3.3.56.1 Liquid Fuel Tank. A fuel tank designed to contain a fuel that is liquid at normal atmospheric pressures and temperatures.

3.3.56.2* Side-Mounted Fuel Tank. A liquid fuel tank that, (a) if mounted on a trailer, extends outboard of the vehicle frame; or (b), if mounted on a motor home, extends outboard of a line parallel to the longitudinal centerline of the motor home and tangent to the outboard side of a front tire in a straight-ahead position.

3.3.57 Toilet.

3.3.57.1 Mechanical Seal Toilet. A toilet fitted with a water flushing device and mechanically sealed trap.

3.3.57.2 Recirculating Chemical Toilet. A self-contained, recirculating toilet in which the waste is chemically treated.

3.3.58 Toilet Trap Arm. The piping between the toilet and its vent that receives the discharge from each toilet.

3.3.59 Trap. A fitting or valve device designed and constructed to provide a liquid or mechanical seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

3.3.60 Trap Arm. That portion of a fixture drain between a water seal trap and its vent.

3.3.61 Trap Seal. The vertical depth of liquid that a water seal trap will retain.

3.3.62* Tubing. Semirigid conduit of copper, steel, aluminum, corrugated stainless steel tubing (CSST), or plastic. [54, 2018]

3.3.63 Vacuum Breaker. A device that prevents back siphonage by allowing atmosphere air pressure into the system.

3.3.64 Valve.

3.3.64.1 Backflow Check Valve. A device designed to allow flow in only one direction.

3.3.64.2 Fullway Termination Valve. A valve that when fully opened has a non-fouling passageway not less than the inside diameter of connected piping.

3.3.65* Vapor Resistant. Constructed so that gas or air is inhibited from entering or leaving except through vents or piping provided for the purpose.

3.3.66 Vent System (Waste). A pipe or pipes installed to provide a flow of air to or from a waste drainage system to protect trap seals from siphonage and back pressure and to equalize the air pressure within the drainage system.

3.3.67 Waste.

3.3.67.1 Body Waste. The discharge from any fixture, appliance, or appurtenance containing fecal matter or urine.

3.3.67.2 Liquid Waste. The discharge from any fixture, appliance, area, or appurtenance that does not contain body waste.

3.3.68 Waste Holding Tank. A liquidtight tank for the temporary retention of body or liquid waste.

3.3.69 Water Seal Trap. A fitting or device designed and constructed to provide a liquid seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

Chapter 4 General Requirements

4.1 Differing Standards. Wherever nationally recognized standards and this standard differ, the requirements of this standard shall apply.

4.2 U.S. Federal Regulations. Where federal regulations under the National Highway Traffic Safety Administration supersede all or part of this standard as applied to any category of regulated motor vehicles, the federal regulations shall apply.

4.3 Labels.

4.3.1 Labels required by Chapters 5, 6, and 7 shall conform to ANSI Z535, *Safety Alerting Standard Series*.

4.3.2 These labels shall be permanently affixed and be compatible with the surface to which they are applied.

4.4 Electrical Requirements.

4.4.1 All electrical installations, systems, and equipment shall comply with Article 551, Parts I through V, of *NFPA 70*.

4.4.2 All low-voltage electrical installations, systems, and equipment shall comply with ANSI/RVIA LV, *Low Voltage Systems in Conversion and Recreational Vehicles*.

Chapter 5 Fuel Systems and Equipment

5.1 Quality of Design and Installation. All design, construction, and workmanship shall be in conformance with accepted engineering practices.

5.2 Propane Systems.

Δ 5.2.1 Maximum Container Capacities.

N 5.2.1.1 Where propane utilization equipment is installed by the recreational vehicle manufacturer, the recreational vehicle shall be provided with one of the following:

- (1) One but not more than **four** cylinders having maximum individual water capacities of 105 lb (47.6 kg) (approximately 45 lb [20.4 kg] propane capacity)
- (2) One or more tanks having a maximum aggregate water capacity of 200 gal (0.8 m³)

5.2.1.2 No provisions shall be made that could allow the installation and securement of more than **four** cylinders.

5.2.2 Construction of Propane Containers.

5.2.2.1 Cylinders shall be constructed and marked in accordance with the specifications for propane cylinders of the U.S. Department of Transportation (DOT) or the specifications of Department of Transportation and Transport Canada.

5.2.2.2 Tanks utilizing vapor withdrawal shall be constructed and marked in accordance with the Rules for Construction of Unfired Pressure Vessels, ASME *Boiler and Pressure Vessel Code*, Section VIII, Division I, or with CSA B51, and shall have a design gauge pressure of at least 312 psi (2155 kPa).

5.2.3 Location of Propane Containers.

5.2.3.1 Propane containers that do not meet the provisions of 5.2.3.2 shall not be installed, nor shall provisions be made for installing or storing any propane containers, even temporarily, inside any recreational vehicle.

5.2.3.2 New propane cylinders that have never contained propane and are supplied as original equipment shall be permitted to be transported inside the vehicle.

5.2.3.3 Propane containers with their control valves shall be installed in compliance with one of the following:

- (1) Mounted in a recess or compartment, other than on the roof, that is vapor resistant to the inside of the recreational vehicle
- (2) Mounted on the tongue or A-frame of a travel or camping trailer or forward of the front bulkhead below the overhang of a fifth-wheel trailer and not lower than the bottom of the trailer frame
- (3) Mounted on the chassis or to the floor of a motorhome or chassis-mount camper, provided neither the tank nor its support is located in front of the front axle, as follows:
 - (a) Tanks mounted between the front and rear axles shall be installed not lower than the front axle height.
 - (b) Tanks mounted behind the rear axle of a motorhome or chassis-mount camper shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than either the rear axle height (excluding the differential) or any section of the frame immediately to the rear of the tank, whichever is higher.
 - (c) All clearances shall be determined from the bottom of the tank or from the lowest fitting, support, or attachment on the tank or tank housing, whichever is lower when all axles are loaded to their gross axle weight rating.
- (4) Mounted on the chassis or to the floor of a travel trailer or fifth-wheel trailer as follows:
 - (a) Tanks mounted behind the rear axle of a travel trailer or fifth-wheel trailer shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than either the rear axle(s) height or the lowest section of the frame to the rear of the tank, whichever is higher.
 - (b) Tanks mounted forward of the rear axle(s) shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than the lowest section of the frame in front of the tank.

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

5.2.4 Securing of Propane Containers.

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

5.2.4.2 Where the recreational vehicle is supplied with cylinders not in place, the recreational vehicle manufacturer shall provide mounting instructions and required materials with the vehicle.

5.2.5 Heat Shielding of Propane Containers and Piping.

5.2.5.1 Propane containers located less than 18 in. (457 mm) from the exhaust system, the transmission, or a heat-producing component of a combustion engine or hydronic heating appliance exhaust shall be shielded by a vehicle frame member or by a noncombustible baffle with an air space on both sides of the frame member or baffle.

5.2.5.2 Propane piping and hose located less than 4½ in. (114 mm) from the exhaust system, the transmission, or a heat-producing component of an internal combustion engine or hydronic heating appliance exhaust shall be shielded by a vehicle frame member or by a noncombustible baffle with an air space on both sides of the frame member or baffle.

5.2.6 Ventilation of Compartments Containing Propane Containers.

5.2.6.1 Compartments shall be ventilated at or near the top and at the extreme bottom to facilitate diffusion of vapors.

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 (323 mm²) for each 7 lb (102 mm²/kg) of the total propane fuel capacity of the maximum number of the largest cylinders the compartment can hold.

5.2.6.3 If the lower vent is located in the access door or wall, the bottom edge of the vent shall be flush with the floor level of the compartment.

5.2.6.4 The top vent shall be located in the access door or wall, with the bottom of the vent within 12 in. (305 mm) of the ceiling of the compartment.

5.2.6.5 Vents shall have an unrestricted discharge to the outside atmosphere.

5.2.6.6 Doors or panels providing access to valves shall not be equipped with locks or require special tools to open.

5.2.7 Securing Propane Cylinder Housings.

5.2.7.1 Doors, hoods, domes, housings (or portions of housings), and enclosures required to be removed or opened for replacement of cylinders shall incorporate means for clamping them in place to prevent them from working loose during transit.

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

5.2.8 Fastenings for Propane Cylinders in Compartments. Cylinder compartments or carriers shall be provided with hold-down fastenings complying with 5.2.4 for as many cylinders as the carriers or compartments are capable of holding.

5.2.9 Elimination of Ignition Sources. Propane containers shall not be installed in compartments or under hoods or housings that contain flame- or spark-producing equipment.

5.2.10 Propane Container Appurtenances and Location.

5.2.10.1 Pressure relief valves, container shutoff valves, overfilling prevention devices, backflow check valves, excess flow valves, and fixed maximum liquid level gauges shall be listed.

5.2.10.2 Where a remotely controlled shutoff valve is not used as permitted in 5.2.11.1, the manual control of the tank shutoff valve, the propane fill connection, and the fixed maximum

liquid level gauge shall be located not more than 18 in. (457 mm) from the vehicle's outside wall when the vehicle is in the travel mode.

5.2.11 Location of Remotely Controlled Appurtenances.

5.2.11.1 Vehicles shall be permitted to be equipped with a remotely controlled, normally closed, electrically operated shutoff valve installed within 9 in. (228 mm) of the outlet of the tank shutoff valve using piping or tubing.

5.2.11.2 A double check filler valve shall be installed in the tank fill opening, and a backflow check valve shall be installed at the remote fill valve location.

5.2.11.3 Where the fill connection, the fixed maximum liquid level gauge, and electrically operated shutoff valve control are remotely installed, they shall be located not more than 18 in. (457 mm) from the vehicle's outside wall, whether installed on the vehicle's exterior or within a compartment when the vehicle is in the travel mode.

5.2.12* Valves for Multiple Propane Cylinder Assembly System. Valves in a multiple propane cylinder assembly system shall be arranged so that replacement of cylinders can be made without shutting off the flow of propane to the appliance(s).

5.2.13 Overfilling Prevention Devices.

5.2.13.1 Containers shall be equipped with a listed overfilling prevention device.

▲ **5.2.13.2** Cylinders shall be equipped with an overfilling prevention device that complies with UL 2227, *Overfilling Prevention Devices*.

5.2.14 Protection of Propane Cylinder's Shutoff Valves.

5.2.14.1 Cylinder shutoff valves shall be protected by a ventilated cap or collar fastened to the cylinder, capable of withstanding a blow from any direction equivalent to that of a 30 lb (13.6 kg) weight dropped 4 ft (1.2 m).

5.2.14.2 Construction of the ventilated cap or collar shall be such that the blow is not transmitted to the valve.

5.2.15 Propane Regulators.

▲ **5.2.15.1** First-stage regulators shall have an outlet gauge pressure setting up to 10.0 psi (69 kPa) in accordance with UL 144.

▲ **5.2.15.2** A two-stage regulator system or an integral two-stage regulator shall be listed to the requirements of UL 144.

5.2.15.3 The regulator(s) shall have a capacity that is not less than the total input of all propane appliances installed in the recreational vehicle.

5.2.15.4 The regulator(s) shall be installed with the pressure relief valve vent opening pointing downward within 45 degrees of vertical to vertical to allow for drainage of any moisture collected on the diaphragm of the regulator.

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

5.2.15.6 The compartment shall be of sufficient size to permit tool operation for connection to and replacement of the regulator(s); shall be vapor resistant to the interior of the vehicle; shall have a 1 in.² (6.5 cm²) minimum and 2 in.² (12.9 cm²) maximum vent opening to the exterior located within 1 in.

(25 mm) of the bottom of the compartment; and shall not contain flame- or spark-producing equipment.

5.2.15.7 The regulator vent outlet shall be at least 1 in. (25 mm) above the compartment vent opening.

5.2.15.8 Regulators installed elsewhere and not installed in compartments as specified in 5.2.15.5 shall be equipped with a durable cover [that does not become brittle at temperatures as low as -40°F (-40°C)] designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray.

5.2.15.9 If the regulator is not mounted by the recreational vehicle manufacturer, instructions for installation shall be supplied.

5.2.16 Propane Shutoff Valves, Excess Flow Valves, and Backflow Check Valves.

5.2.16.1 A listed propane excess flow valve shall be provided in accordance with 5.2.16.1.1 and 5.2.16.1.2.

Δ 5.2.16.1.1 Tanks shall require a manual shutoff valve equipped with a listed internal excess flow valve listed to the requirements of UL 125 and designed to close automatically at the rated closed flow of vapor or liquid specified by the manufacturer.

5.2.16.1.2 The internal excess flow valve shall be designed with a bypass not to exceed a number 60 drill size opening to allow equalization of pressure.

5.2.16.2 Cylinders shall require a manual shutoff valve for vapor service that does not allow propane to flow until a positive seal is achieved between that valve and its mating connection.

5.2.16.3 In multiple cylinder systems, a backflow check valve shall be provided anywhere from the cylinder outlet to the automatic changeover regulator inlet.

Δ 5.2.16.4 The mating connection shall be listed to the requirements of UL 2061 and installed with the regulator and vehicle as follows:

- (1) The mating connection to the cylinder valve shall be furnished with a thermal element that activates at a temperature range of 240°F to 300°F (116°C to 149°C) and positively shuts off the flow of propane from the cylinder valve.
- (2) The mating connection to the cylinder valve shall also incorporate a listed excess flow valve that closes at a flow not greater than 200 ft³/hr at a gauge pressure of 100 psi (5.66 m³/hr at 689 kPa) and has a bypass area that does not allow a flow greater than 10 ft³/hr at a gauge pressure of 100 psi (0.28 m³/hr at 689 kPa).
- (3) The mating connection to the cylinder valve shall be provided with a CGA 791 female connection that does not attach to a CGA 510 female POL connector.

5.2.17 Propane Container Pressure Relief Valves.

5.2.17.1 Cylinders shall be provided with pressure relief valves as required by the regulations of the U.S. Department of Transportation.

5.2.17.2 Tanks for recreational vehicle use shall be provided with full internal or flush-type full internal pressure relief valves in accordance with NFPA 58.

5.2.17.3 Containers shall have pressure relief valves in direct communication with the vapor space of the container.

5.2.18 Regulator Pressure Relief Valves.

Δ 5.2.18.1 A separate first stage of a two-stage regulator system shall incorporate an integral pressure relief valve having a start-to-discharge setting within the limits specified in UL 144.

Δ 5.2.18.2 The second stage of a two-stage regulator system shall be equipped with one or both of the following:

- (1) An integral pressure relief valve on the outlet pressure side that has a start-to-discharge pressure setting within the limits specified in UL 144 and that limits the outlet gauge pressure of the second stage of a two-stage regulator system to 2.0 psi (14 kPa) when the regulator seat disc is removed and the inlet gauge pressure to the regulator is 10.0 psi (69 kPa) or less as specified in UL 144
- (2) An integral overpressure shutoff device that shuts off the flow of propane vapor when the outlet pressure of the regulator reaches the overpressure limits specified in UL 144 and that does not open to permit flow of propane until it has been manually reset

5.2.19* Discharge from Propane Container Pressure Relief Valves.

5.2.19.1 Propane containers shall be so located that the discharge from their pressure relief valves shall be not less than 3 ft (0.9 m) measured horizontally along the surface of the vehicle from any of the following located below the level of such discharge:

- (1) Openings into the recreational vehicle
- (2) Propane-burning appliance intake and exhaust vents
- (3) All combustion engine and hydronic heating appliance exhaust terminations

5.2.19.2 Unventilated compartment doors containing either door or body side seals, and entry doors not containing screens or openable windows below the level of the propane discharge outlet(s), shall be permitted to be omitted from the requirements of 5.2.19.1.

5.2.19.3 The propane tank pressure relief valve discharge system(s) shall be installed in accordance with 5.2.19.3.1 through 5.2.19.3.14.

5.2.19.3.1 The pressure relief valve discharge shall be directed upward or downward within 45 degrees of vertical so that its discharge does not directly impinge on the prime mover engine or is not directed into the interior of the vehicle.

5.2.19.3.2 Where the pressure relief valve discharge must be piped away, the pipeaway system shall consist of a breakaway adapter recommended by the pressure relief valve manufacturer, and at the terminal discharge end of the pipeaway system, a protective cover shall be installed to minimize the possibility of the entrance of water or dirt into either the pressure relief valve or its pipeaway discharge system.

5.2.19.3.3 No portion of the pipeaway system shall have an internal diameter less than the internal diameter of the recommended breakaway adapter.

5.2.19.3.4 The breakaway adapter shall be threaded for direct connection to the pressure relief valve and shall not interfere with the operation of the pressure relief valve.

5.2.19.3.5 The breakaway adapter shall be installed so that it breaks away without impairing the function of the pressure relief valve; however, the breakaway adapter shall be permitted to be an integral part of the pressure relief valve.

5.2.19.3.6 The breakaway adapter shall have a melting point of not less than 1450°F (788°C).

5.2.19.3.7 Metallic pipe or a length of nonmetallic hose shall be permitted as a part of the pipeaway system and located after the breakaway adapter and before the terminal discharge end of the pipeaway system.

5.2.19.3.8 The terminal discharge end of the pipeaway system shall be directed upward or downward within 45 degrees of vertical.

5.2.19.3.9 Metallic pipe or nonmetallic hose used in the pipeaway system shall be fabricated of materials resistant to the action of propane.

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

5.2.19.3.11 Where hose is used to pipe away the pressure relief valve discharge from propane containers installed on the outside of the vehicle, the breakaway adapter and any attached fittings, without the hose attached, shall deflect the pressure relief valve discharge upward or downward within 45 degrees of vertical and shall meet the other requirements of 5.2.19.2. All fittings shall have a melting point of not less than 1450°F (788°C).

5.2.19.3.12 The pipeaway system connections shall be mechanically fastened and shall not depend on adhesives or sealing compounds.

5.2.19.3.13 Where a pipeaway system is not required, the pressure relief valve shall have a protective cover in accordance with 5.2.19.3.2.

5.2.19.3.14 Where the pressure relief valve outlets on cylinders are located in a compartment vapor resistant to the vehicle interior, discharge from these devices shall be considered to be located at the compartment vents and shall meet the location requirements of 5.2.19.1.

5.2.20 Propane System Design.

5.2.20.1 Systems shall be of the vapor withdrawal type.

5.2.20.2 Liquid withdrawal systems shall be permitted to supply propane as engine fuel.

5.2.21 Appliance Pressure Rating.

5.2.21.1 Vapor, at a pressure not over 14 in. water column (3.49 kPa), shall be delivered from low-pressure piping systems into the propane appliance or fuel cell supply connection.

Δ 5.2.21.2 Propane appliances or fuel cells connected to regulated high-pressure piping systems shall comply with the following:

- (1) The appliance or fuel cell shall provide for a separate propane supply system or provide a means to prevent high pressure from entering the recreational vehicle's low-pressure system.

- (2) The high-pressure propane system shall be located entirely on the exterior of the vehicle or in a compartment that is vapor resistant to the vehicle's interior and vented to the outside at or near the bottom of compartment.
- (3) Warning labels, with the word "Warning" a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on contrasting background, shall be affixed to the appliance or appliance compartment in a visible location and shall read as shown in Figure 5.2.21.2.
- (4) The appliance or fuel cell shall be listed for recreational vehicle use at the specified operating pressure.

5.2.22 Mounting of Propane Containers.

5.2.22.1 Container openings for vapor withdrawal shall be located in the vapor space when the container is in service or shall be provided with a permanent internal withdrawal tube that communicates with the vapor space in or near the highest point in the container when it is mounted in the service position with the vehicle on a level surface.

5.2.22.2 Tanks shall have vapor withdrawal located midway between tank ends.

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

5.2.22.4 Stamping shall be ¼ in. (6 mm) minimum letter height.

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

5.3 Propane Piping Systems.

5.3.1 General.

5.3.1.1 The requirements of this section shall govern the installation of all propane piping attached to any recreational vehicle intended for carrying propane in the vapor state.

5.3.1.2 None of the requirements listed in this section shall apply to the piping supplied as a part of a listed appliance.

Δ 5.3.1.3 Liquid withdrawal piping shall comply with the requirements of Section 5.9 and 6.9.1 of NFPA 58.

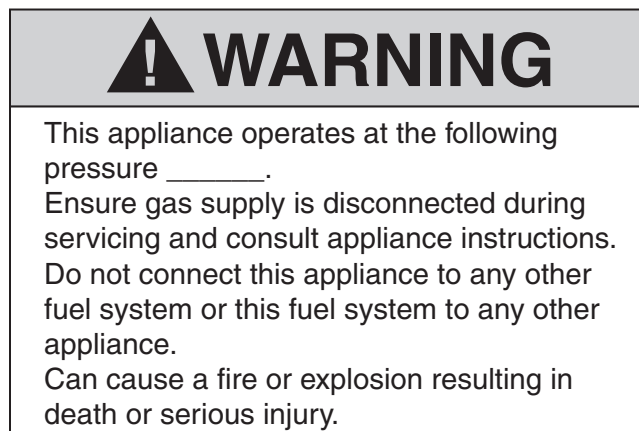


FIGURE 5.2.21.2 Appliance or Appliance Compartment Warning Label.

5.3.1.4 Low-pressure piping systems for propane shall require at least two stages of pressure regulation to reduce container pressure to appliance utilization pressure.

5.3.2 Propane Piping System Materials.

5.3.2.1 Materials used for the installation, extension, alteration, or repair of any propane piping system shall be new and free from defects or internal obstructions.

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

5.3.2.3 Inferior or defective materials shall be removed and replaced with acceptable material.

▲ 5.3.2.4 The system shall be made of materials having a melting point of not less than 1450°F (788°C), except as provided in 5.3.2.5, 5.3.4, 5.3.6.1, 5.3.12, and 5.3.13, or of materials (used in piping or fittings) listed for the specific use intended.

5.3.2.5 Propane piping system materials shall be permitted to consist of one or more of the following materials:

- (1) Propane pipe shall be steel or wrought-iron pipe and comply with ASTM A53/A53M.
- (2) Schedule 40 steel or wrought-iron pipe shall be permitted to be used where system gauge pressure is less than 125 psi (862 kPa).
- (3) Schedule 80 steel or wrought-iron pipe shall be used where system gauge pressure is 125 psi (862 kPa) or greater.
- (4) Threaded copper or brass pipe in iron pipe sizes shall be permitted to be used.
- (5) Fittings for propane piping shall be wrought-iron, malleable iron, steel, or brass (containing not more than 75 percent copper).
- (6) Brass flare nuts shall be stress-relieved or of the forged type.
- (7) Copper tubing shall be annealed Type K or L, conforming to ASTM B88, or shall comply with ASTM B280.
- (8) Copper tubing shall be internally tinned where used on systems designed for natural gas.
- (9) Seamless brass tubing shall be composed of not more than 75 percent copper (cartridge brass 70 percent) and shall have a minimum thickness of 0.030 in. (0.76 mm).
- (10) Flexible nonmetallic tubing or hose shall be either listed and used with listed fittings or part of a listed assembly.

5.3.3 Propane Piping Design. Each recreational vehicle requiring propane for any purpose shall be equipped with a propane piping system that is designed for propane only or with a natural gas piping system acceptable for propane.

5.3.4 Propane Pipe Sizing.

5.3.4.1 Propane piping systems shall be sized so that the pressure drop to any appliance inlet connection from the propane supply connection or connections, where all appliances are in operation at maximum capacity, is not more than 0.5 in. water column (0.125 kPa) where used with natural gas if the system is designed for both natural gas and propane, or where used with propane if the system is designed for propane only.

5.3.4.2 Conformance shall be permitted to be determined on the basis of testing, or the propane piping system shall be permitted to be sized in accordance with Table 5.3.4.2(a) through Table 5.3.4.2(d) or other approved method.

5.3.4.3 The natural gas supply connection shall be not less than ¾ in. (19 mm) nominal pipe size. (See Annex B for further guidance on how to calculate propane piping size.)

5.3.5 Joints for Propane Pipe.

5.3.5.1 Pipe joints in the piping system, unless welded or brazed, shall be screw joints that comply with ANSI B1.20.1.

5.3.5.2 Right and left nipples or couplings shall not be used.

5.3.5.3 Unions, if used, shall be of the ground joint type.

5.3.5.4 The material used for welding or brazing pipe connections shall have a melting temperature in excess of 1000°F (538°C).

5.3.6 Propane Tubing Joints.

5.3.6.1 Propane tubing joints shall be permitted to be made with a single or double flare of 45 degrees conforming to SAE J533, as recommended by the tubing manufacturer, or by means of listed vibration-resistant fittings, or the joints shall be brazed with a material having a melting point exceeding 1000°F (538°C).

5.3.6.2 Brazing alloys shall not contain phosphorus.

5.3.6.3 Sealants shall not be used on tubing joints.

5.3.6.4 Ball sleeve or one-piece internal compression-type tubing fittings shall not be used.

5.3.7 Pipe Joint Materials.

5.3.7.1 Threaded joints shall be made up tight with approved pipe joint material that is insoluble in propane.

5.3.7.2 Pipe joint material shall be applied only to the male threads.

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	
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	10.0	29	8.8	27	8.2	24	7.3	22	6.7	20	6.1		
⅜	10	95	29.0	77	23.5	65	19.8	57	17.4	52	15.9	49	14.9	45	13.7		
½	13	175	53.0	135	41.0	120	37.0	108	33.0	97	29.6	90	27.5	82	25.0		
¾	19	360	110.0	279	85.0	250	76.0	225	69.0	200	61.0	186	57.0	170	52.0		
1	25	680	207.0	536	163.0	465	142.0	404	123.0	375	114.0	330	101.0	320	98.0		

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
3/8	1/4	10	6	27	8.2	21	6.4	18	5.5	16	4.9	15	4.6	14	4.3
1/2	3/8	13	10	56	17.1	42	12.8	38	11.6	34	10.4	31	9.5	28	8.5
5/8	1/2	16	13	113	34.0	86	26.2	78	23.8	70	21.3	62	18.9	59	18.0
3/4	5/8	19	16	197	60.0	157	48.0	136	41.0	122	37.0	109	33.0	99	30.0
7/8	3/4	22	19	280	85.0	227	69.0	193	59.0	172	52.0	155	47.0	141	43.0

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
in.	mm	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7
1/4	6	67	20.4	52	15.9	46	14	41	12.5	37	11.3	34	10.4
3/8	10	147	45.0	112	34.0	101	31	87	26.5	81	24.7	74	22.6
1/2	13	275	84.0	212	65.0	189	58	166	51.0	152	46.0	138	42.0
3/4	19	567	173.0	500	152.0	393	120	338	103.0	315	96.0	276	84.0
1	25	1071	326.0	1005	306.0	732	223	667	203.0	590	180.0	530	162.0

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
3/8	1/4	10	6	39	11.9	32	9.8	26	7.9	23	7.0	21	6.4	19.5	5.9
1/2	3/8	13	10	92	28.1	72	21.9	62	18.9	56	17.1	50	15.3	45	13.7
5/8	1/2	16	13	199	61.0	159	49.0	131	40.0	118	36.0	107	33.0	94	28.7
3/4	5/8	19	16	329	100.0	249	76.0	216	66.0	193	59.0	181	55.0	154	47.0
7/8	3/4	22	19	501	153.0	380	116.0	346	106.0	300	91.0	277	84.0	246	75.0

5.3.8 Routing and Protection of Tubing and Hose.

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

Δ 5.3.8.2 Tubing and hose shall be protected where passing through walls, floors, partitions, roofs, or similar installations.

5.3.8.3 Tubing or hose shall be routed to be protected from physical damage, sharp edges, and moving parts.

5.3.8.4 Unprotected tubing or hose shall not be located in storage areas.

5.3.8.5 Where nonmetallic tubing or hose is used within the propane piping system, it shall be permitted to pass directly through any floor, wall, partition, or ceiling, provided the entire length of hose is accessible for visual inspection, provision is made to protect against chafing, and no part of the flexible nonmetallic tubing or hose is concealed in the hollow space of a floor, wall, partition, or ceiling.

N 5.3.8.6 Bends in installed sections of hose shall be equal to or greater than the minimum bend radius specified by the hose manufacturer.

5.3.9 Restrictions on Concealing Joints in Propane Piping or Tubing.

5.3.9.1 Pipe or tubing joints shall not be located in any floor, wall, partition, or concealed construction space.

5.3.9.2 Pipe and tubing joints shall be permitted to be located in storage areas if they are located within 2 in. (51 mm) of the compartment's ceiling with the tubing joints protected from physical damage.

5.3.9.3 Pipe joints shall be permitted to be located below the 2 in. (51 mm) requirement if protected from physical damage.

5.3.10 Propane and Natural Gas Supply Connection Location.

5.3.10.1 For propane-only systems and for combination propane and natural gas systems, the supply connection shall be located at the container location.

5.3.10.2 An additional propane or combination propane and natural gas supply connection shall be permitted to be installed, located on the left (road) side or at the rear left of the longitudinal center of the vehicle, within 18 in. (457 mm) of the outside wall, and shall be within 15 ft (4.6 m) of the rear of the vehicle.

5.3.11 Special Requirement for Regulated High-Pressure Piping.

5.3.11.1 The regulated high-pressure piping shall be located entirely on the exterior of the vehicle or in a compartment vapor resistant to the vehicle interior.

5.3.11.2 Propane system pressure shall be regulated to a pressure of 30 psi (207 kPa) or less within 60 in. (1.5 m) of the container outlet.

5.3.11.3 A two-stage regulator system shall not be required for the high-pressure system.

5.3.12 Propane and Natural Gas Supply Connections.

5.3.12.1 A listed minimum ½ in. (13 mm) nominal (I.D.) gas supply connector, with ¾ in. (19 mm) NPT terminal fittings, 6 ft (1.8 m) in length, shall be supplied by the manufacturer where the fuel gas piping system is designed for the use of natural gas.

▲ 5.3.12.2 Propane supply connectors used in propane systems shall be listed as an assembly using UL 569 or UL 21 hose.

5.3.12.3 High-pressure propane connections shall be in accordance with 5.3.12.3.1 through 5.3.12.3.3.

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

5.3.12.3.2 The connection between the shutoff valve of a cylinder intended to be removed (A-frame) and a regulator shall be made with a listed high-pressure flexible hose connector.

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

5.3.12.4 Low-pressure propane connections shall be in accordance with 5.3.12.4.1 through 5.3.12.4.3.

5.3.12.4.1 The connection between a regulator fixed in place and the propane supply system shall be made with a listed flexible hose connector or with material conforming to 5.3.2.

5.3.12.4.2 The connection between a regulator not fixed in place and the propane supply system shall be made with a listed flexible hose connector.

5.3.12.4.3 A two-stage regulator shall not be directly attached to the shutoff valve of a cylinder.

5.3.13 Flexible Nonmetallic Tubing and Hose Connections. Flexible nonmetallic tubing or hose shall not be permitted to enter the burner box of the range or cooktop as the final connection.

5.3.14 Quick Disconnect Devices.

5.3.14.1 Quick disconnect devices used downstream of the propane regulator shall be listed for use with propane and for the specific environment (indoor, outdoor, or both).

5.3.14.2 Quick disconnect devices shall not be capable of connection to the cylinder portion of a cylinder connection device.

5.3.14.3 Quick disconnect devices either shall have integral shutoff or shall have a manual shutoff upstream, capable of operation from the same user position as the quick disconnect device.

5.3.15 Propane Shutoff Valves. Shutoff valves used in connection with propane piping shall be listed for use with propane and shall have non-displaceable rotors.

5.3.16 Propane Inlet Cap.

5.3.16.1 For combination propane and natural gas systems, suitable cap(s) to effectively close the propane inlet(s) when disconnected from the source of supply and not in use shall be attached to the recreational vehicle.

5.3.16.2 Inlets shall be effectively capped when disconnected from the source of supply.

5.3.16.3 The propane-only supply inlet shall be effectively capped to prevent entrance of water and foreign materials when the recreational vehicle is shipped with the propane containers disconnected from the system.

5.3.17 Prohibiting Use of Propane Piping as Electrical Ground. Propane piping shall not be used as a grounding electrode.

5.3.18 Propane Piping Support.

5.3.18.1 All propane piping shall be secured and supported in place at intervals of not more than 4 ft (1.2 m).

5.3.18.2 All piping shall be rigidly anchored to a structural member within 6 in. (152 mm) of the supply connection(s) by galvanized, painted, or equivalently protected metal straps, hangers, or fittings.

5.3.18.3 All piping shall be anchored within 6 in. (152 mm) of tubing or hose connections at the end of piping runs.

5.3.18.4 All piping shall be anchored within 12 in. (305 mm) of tubing or hose connections within piping runs.

5.3.19 Testing Low-Pressure Piping Systems for Propane Leakage Before Appliances Are Connected.

5.3.19.1 The piping systems shall be proven by test to be leak-free by maintaining an air pressure of at least 3 psi (20.7 kPa) for a period of at least 10 minutes.

5.3.19.2 Before the test is begun, the temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the period.

5.3.19.3 Leaks, if observed, shall be located and corrected.

5.3.19.4 Defective material shall be replaced.

5.3.19.5 Products that contain ammonia or chlorine shall not be used for testing.

5.3.19.6 Tests shall be conducted by either of the following methods:

(1) Air pressure as follows:

- (a) The entire system shall be pressurized to not less than 3 psi (20.7 kPa), and the system then shall be isolated from all sources of pressure.
- (b) The pressure in the system shall be measured over a period of 10 minutes with a manometer, or with a pressure sensing device calibrated so as to be read in increments of not greater than a pressure of $\frac{1}{10}$ psi (0.7 kPa).
- (c) During the 10-minute period, a drop in pressure shall not occur.
- (2) Bubble-type leak detector as follows:
 - (a) A bubble-type leak detector shall be installed between the source of air pressure and the piping system.
 - (b) The bubble detector shall not indicate any airflow for a period of 1 minute.

5.3.20 Testing Low-Pressure Piping Systems for Propane Leakage After Appliances Are Connected.

5.3.20.1 After appliances are connected to the piping system, the entire piping system shall be proven by test to be leak-free by maintaining an air pressure of not less than 8 in. water column (1.99 kPa) or more than 14 in. water column (3.5 kPa).

5.3.20.2 Before the test is begun, the temperature of both air and piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.20.3 Leaks, if observed, shall be located and corrected.

5.3.20.4 Products containing ammonia or chlorine shall not be used for locating leaks.

5.3.20.5 Defective material shall be replaced.

5.3.20.6 A pressure drop test shall be permitted to be conducted as follows:

- (1) The entire system shall be pressurized to not less than 8 in. water column (1.99 kPa) or more than 14 in. water column (3.5 kPa), the appliance shutoff valves shall be closed, and the system shall be isolated from all sources of pressure.
- (2) When the test gauge is installed downstream of an appliance regulator, one valve shall be opened before the test is begun, and the pressure lowered to 8 in. $\pm$ 0.5 in. water column (1.99 kPa $\pm$ 0.125 kPa) so that the appliance regulator is in an open condition.
- (3) The pressure in the system shall be measured over a period of 3 minutes with a manometer or with a pressure-sensing device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period.
- (4) If during the 3-minute period, a drop in pressure occurs, the system shall be deemed to have failed the test.

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

5.3.21 Pressure Testing Regulated High-Pressure Piping Systems.

5.3.21.1 The regulated high-pressure piping systems, except those constructed only of listed hose assemblies and not including regulators, shall be proven by test to be leak-free by main-

taining an air pressure of at least 1.5 times the operating pressure for a period of at least 10 minutes.

5.3.21.2 Before the test is begun, the temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.21.3 Leaks, if observed, shall be located and corrected.

5.3.21.4 Defective material shall be replaced.

5.3.21.5 Products that contain ammonia or chlorine shall not be used for testing.

5.3.21.6 Tests shall be conducted by the following method:

- (1) The source of the air pressure to the piping system shall be shut off.
- (2) The pressure in the system shall be measured over a period of 10 minutes with a device calibrated so as to be read in increments of not greater than 2 psi (14 kPa).
- (3) During the 10-minute period, a drop in pressure shall not occur.

5.3.22 Leak Testing the Regulated High-Pressure Piping Systems.

5.3.22.1 After the piping system regulators, related fittings, and connections are installed in the RV, the entire regulated high-pressure piping system shall be proven by test to be leak-free by maintaining a pressure of not less than 15 psi (103 kPa) nor more than 30 psi (207 kPa) from the high-pressure regulator side of the system, and all connections shall be tested with either soapy water or a bubble solution.

5.3.22.2 Before the test is begun, the temperature of both air and piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.22.3 Leaks, if observed, shall be located and corrected.

5.3.22.4 Products containing ammonia or chlorine shall not be used for locating leaks.

5.3.22.5 Defective material shall be replaced.

5.4 Fuel-Burning Appliances.

▲ 5.4.1 Listing Requirements.

N 5.4.1.1 Fuel-burning appliances and vents necessary for their installation shall be listed for installation in recreational vehicles.

N 5.4.1.2 Cooking gas appliances shall be listed in accordance with ANSI Z21.57, *Standard for Recreational Vehicle Cooking Gas Appliances*; or CAN 1-1.16, *Standard for Propane Fired Cooking Appliances for Recreational Vehicles*.

5.4.2 Basic Venting Requirements. Fuel-burning, heat-producing, and refrigeration appliances, except ranges and ovens, shall be of the vented type and vented to the outside.

5.4.3 Propane Appliance Utilization. Propane appliances shall be listed for use with propane only or for use with both natural gas and propane where convertible from natural gas to propane and vice versa.

5.4.4 Conversion of Appliances. Fuel-burning appliances shall not be converted from one fuel to another unless conver-

ted in accordance with the terms of their listings and the appliance manufacturer's instructions.

5.4.5 Installation of Fuel Burning Appliances.

5.4.5.1 The installation of each appliance shall conform to the terms of its listing and the appliance manufacturer's installation instructions.

5.4.5.2 Floor-mounted fuel-burning appliances shall not be installed on carpeting unless the appliance is listed for such installation.

5.4.5.3 Every appliance shall be mounted in place to avoid displacement.

5.4.6 Requirement for Direct Vent System Appliances.

5.4.6.1 All fuel-burning appliances, except ranges and ovens, shall be designed and installed to provide for the complete separation of the combustion system from the interior atmosphere of the recreational vehicle.

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

5.4.6.3 The required separation shall be obtained by the installation of direct vent system (sealed combustion system) appliances.

5.4.6.4 A fuel-burning refrigerator shall be permitted to be installed to meet the requirements of 5.4.6, using panels supplied by the recreational vehicle manufacturer, provided that the refrigerator manufacturer furnishes the necessary vents and grilles as specified by the listing requirements and, in addition, the refrigerator is equipped with the necessary means to ensure the integrity of the separation of the combustion system when the refrigerator is removed for field service and reinstalled.

5.4.6.5 A fuel-burning appliance shall not need to be of the direct vent type, provided that it conforms to all of the following:

- (1) It is a vented appliance.
- (2) It incorporates provisions for introduction of combustion air from outside the vehicle.
- (3) It incorporates a safety control system that prevents burner operation under any operating conditions that allow products of combustion to discharge into the interior of the recreational vehicle.
- (4) It incorporates provisions either integral to the appliance design or by use of a safety control system(s) to protect against ignition of flammable materials that could come into contact with any heat source or part of the appliance.
- (5) It is listed for recreational vehicle installation and is installed with the terms of the listing.

5.4.7 Exterior Appliances.

5.4.7.1 Exterior fuel-burning appliances intended to be used outside and attached to recreational vehicles shall be listed for recreational vehicle use but shall not be required to be of the direct vent, sealed combustion type.

5.4.7.2 The installation shall preclude the possibility of appliance operation or propane flow when the appliance is in its storage (travel) position.

5.4.7.3 The appliance manufacturer shall specify clearance to adjacent surfaces as applicable in both the operational and storage positions.

5.4.7.4 Fuel-burning appliances shall be so installed as not to obstruct any path to exit(s).

5.4.8 Auxiliary Heating Devices.

5.4.8.1 Primary mover engine auxiliary devices for heating interior living or storage space or for heating potable water shall not be required to be listed.

5.4.8.2 Heat exchangers used in the potable water system shall be identified by the device manufacturer as being of a double-wall construction.

5.4.8.3 Exhaust termination of engine block heaters with a gasoline- or diesel-fired source other than the primary mover engine shall comply with 6.4.3.

5.4.9 Special Requirement for Forced-Air Heating Appliances.

A forced-air heating appliance and its return-air system shall be designed and installed so that negative pressure created by the air-circulating fan cannot affect its, or another appliance's, combustion air supply or act to mix products of combustion with circulating air.

5.5 Venting, Ventilation, and Combustion Air.

5.5.1 Installation of Venting and Combustion Air Systems.

Venting and combustion air systems shall be installed in accordance with the following:

- (1) Components shall be assembled and aligned using the method shown in the appliance manufacturer's instructions.
- (2) Vent connectors shall be firmly attached to flue collars by sheet metal screws, their equivalent, or as specified in the manufacturer's installation instructions.
- (3) Every joint of a vent, vent connector, exhaust duct, and combustion air intake shall be secure and in alignment.

Δ 5.5.2 Location of Flue Gas Outlets of Fuel-Burning Appliances.

N 5.5.2.1 Any portion of a combustion air inlet or a flue gas outlet of a fuel-burning appliance shall be located at least 3 ft (0.9 m) from any gasoline filler spout on the vehicle if the inlet or outlet is located above or at the same level.

Δ 5.5.2.2 Flue gas outlets from fuel-burning appliances shall be not less than 3 ft (0.9 m) from any motor-driven air intake discharging into habitable areas of the recreational vehicle.

5.5.2.3 Flue gas outlets shall not terminate underneath a recreational vehicle.

5.5.2.4 Flue gas outlets shall not terminate within 36 in. (0.9 m) vertically under an expandable portion of a recreational vehicle or the front bulkhead of a fifth-wheel trailer.

5.5.3* Location of Combustion Air Inlets and Flue Gas Outlets of Fuel-Burning Appliances.

Δ 5.5.3.1 Any portion of a combustion air inlet or a flue gas outlet of a fuel-burning appliance shall be located at least 3 ft (0.9 m) from any gasoline filler spout on the vehicle if the inlet or outlet is located above or at the same level.