UL 147A

STANDARD FOR SAFETY

Nonrefillable (Disposable) Type Fuel Gas Cylinder Assemblies

UL Standard for Safety for Nonrefillable (Disposable) Type Fuel Gas Cylinder Assemblies, UL 147A

Fourth Edition, Dated June 6, 2018

Summary of Topics

This revision of ANSI/UL 147A dated September 17, 2024 includes removing reference to MPS-gas from Table 18.1

Text that has been changed in any manner or impacted by ULSE's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated August 9, 2024.

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Comments or proposals for revisions on any part of the Standard may be submitted to ULSE at any time. Proposals should be submitted via a Proposal Request in the Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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CONTENTS

INTRODUCTION

1 Scope 5
2 Components 5
3 Units of Measurement 5
4 Undated References 6
5 Glossary 6
6 Pressure and Temperature Ratings 6
7 Size and Filling Limitations 6

CONSTRUCTION

8 General 7
9 Assembly 7
10 Materials 7

PERFORMANCE

11 General 8
12 Leakage Test 8
13 Connection Valve Endurance Test 9
14 Hydrostatic Pressure Strength Test 9
15 Start-to-Discharge and Resealing-Pressure Tests of Pressure Relief Valves 10
16 Fire Test 10
17 Accelerated Aging Test 11
18 Fuel Gas Compatibility Test 11
18.1 General 11
18.2 Volume change 11
18.3 Weight loss 11
19 Low Temperature Test 12
20 Moist Ammonia-Air Stress Cracking Test 12

MANUFACTURING AND PRODUCTION TESTS

21 General 12

MARKING

22 General 13

No Text on This Page

INTRODUCTION

1 Scope

1.1 These requirements cover nonrefillable cylinder assemblies for use with propane and propylene.

1.2 Nonrefillable cylinder assemblies covered by these requirements are used with equipment for such purposes as, and not limited to, camping, cooking, heating, lighting, soldering, or brazing, and as covered in the following standards:

a) Liquefied Petroleum Gas Code, NFPA 58-2004.

b) Standard for Hand-Held Torches for Fuel Gases, UL 147.

c) Portable Catalytic Camp Heaters for Use with Propane Gas, ANSI Z21.62-1977(1992).

d) Portable Type Gas Camp Heaters, ANSI Z21.63-2000.

e) Portable Type Gas Camp Stoves, ANSI Z21.72-2000.

f) Portable Type Gas Camp Lights, ANSI Z21.73-2000.

g) Portable Refrigerators for Use with HD-5 Propane Gas, ANSI Z21.74-1992 (1998).

1.3 *Deleted*

1.4 These requirements do not cover aerosol type containers covered by the requirements in the Standard for Nonrefillable (Disposable) Type Metal Container Assemblies for Butane, UL 147B.

2 Components

2.1 Except as indicated in 2.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3 Units of Measurement

3.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

4 Undated References

4.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

5 Glossary

5.1 For the purpose of this standard the following definitions apply.

5.2 CTC REGULATIONS – The Canadian Transport Commission Regulations for the Transportation of Dangerous Commodities by Rail.

5.3 CYLINDER – A portable container that complies with the specification for cylinders constructed under Subpart C of Part 178 of the DOT Regulations and similar cylinder specifications of the CTC Regulations.

5.4 DOT REGULATIONS – The U.S. Department of Transportation (DOT) Regulations for the Transportation of Hazardous Materials, under Code of Federal Regulations (CFR), Title 49, Parts 100 – 199.

5.5 PRESSURE-RELIEF DEVICE – A pressure or temperature, or both, activated device used to prevent the pressure from rising a predetermined maximum, and thereby prevent rupture of a normally charged cylinder when subjected to a standard fire test as required by 49CFR 173.34(f) of the TC and CTC regulations. The term "pressure relief device" is synonymous with "safety relief device" as used by DOT, TC or CTC regulations.

5.6 TC REGULATIONS – The regulations of Transport Canada as published in Transportation of Dangerous Goods Regulations.

6 Pressure and Temperature Ratings

6.1 The marked service pressure rating of the nonrefillable cylinder assembly shall not exceed 80 percent of the marked test pressure.

6.2 The marked test pressure is the maximum pressure of contents at 130°F (54°C), but not less than 180 psig (1240 kPa).

6.3 Nonrefillable cylinder assemblies covered by these requirements are intended for use and storage at ambient temperatures within the range of minus 4 to plus 130°F (minus 20 to plus 54.4°C).

7 Size and Filling Limitations

7.1 The maximum size of the nonrefillable cylinder assembly shall not exceed 75 cubic inches (1.23 L), 2.71 pounds (1.23 kg) water capacity.

7.2 The maximum fuel gas content in a nonrefillable cylinder assembly shall be that quantity which equals the maximum permitted filling density in accordance with the Code of Federal Regulations (CFR), Title 49, Chapter 1, Part 173.304.

7.3 Propane contained in nonrefillable cylinder assemblies shall be odorized in accordance with the Liquefied Petroleum Gas Code, NFPA 58-2004.

CONSTRUCTION

8 General

8.1 A nonrefillable cylinder assembly shall incorporate a pressure vessel constructed in accordance with Specification 39 of the DOT regulations, Code of Federal Regulations, Title 49, Chapter I, Part 178.65 and be so marked.

8.2 A nonrefillable cylinder assembly shall incorporate pressure relief device(s) in accordance with U.S. DOT regulations, Code of Federal Regulations, Title 49, Chapter I, Part 173.301(f) and this standard.

8.3 A nonrefillable cylinder shall be designed for vapor withdrawal in its position of normal use. The cylinder shall not have provisions for liquid withdrawal.

8.4 A nonrefillable cylinder assembly shall be made of corrosion-resistant material or be provided with a corrosion-resistant exterior coating equivalent to that afforded by paint.

9 Assembly

9.1 A nonrefillable cylinder assembly shall include all of the components required for its intended function and installation, and shall be furnished as a single unit or assembly.

9.2 The cylinder assembly shall be provided with an integral shutoff valve that closes automatically when the cylinder assembly is disconnected from the gas-consuming equipment.

9.3 The valve stem shall be recessed, or otherwise protected so that the valve is not subjected to direct impact when the container is dropped onto a flat surface.

9.4 The cylinder assembly shall incorporate a Type CGA No. 600 connection in accordance with the Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections, CGA V-1-2003.

9.5 A nonrefillable metal container assembly shall incorporate pressure relief device(s) or system(s) that will operate to reduce the risk of rupture or propulsion of container parts from pressure buildup from a fire condition. See the Fire Test, Section 16.

10 Materials

10.1 Operating and pressure-containing parts of shutoff and relief valve assemblies shall have the strength and durability to provide reliable service of the assembly.

10.2 To comply with the requirement of 10.1, a material for gas-confining parts shall have a melting point (solidus temperature) of at least 950°F (510°C) and a tensile strength of at least 10,000 psi (68.9 MPa) at 204°C (400°F).

Exception: A valve disc, soft seat, seal ring, diaphragm, or gasket is not required to comply with this requirement.

10.3 Materials shall be resistant to the action of the fuel gas to which they are exposed to during servicing.

10.4 With reference to the requirement in 10.3, elastomeric and polymeric materials shall be subjected to the Accelerated Aging Test, Section 17, the Fuel Gas Compatibility Test, Section 18, and the Low Temperature Test, Section 19.

Exception: Chlorotrifluoroethylene polymers, tetrafluoroethylene, fluorinated ethylene propylene polymers, and polyamides with a composition of polyhexamethylene adipamide or polycapromide polymers (nylon 6 or 6/6) are not prohibited from being used without additional testing.

10.5 If atmospheric corrosion of a ferrous part impairs the intended operation, the part shall be provided with a corrosion-resistant protective coating.

10.6 A protective coating shall resist corrosion to the degree not less than that provided by the protective coatings specified in 10.7.

10.7 Cadmium plating shall have a thickness of not less than 0.0003 inch (0.008 mm), and zinc plating shall have a thickness of not less than 0.0005 inch (0.013 mm).

Exception: When threads constitute the major portion of the area of a part, the thickness of the cadmium or zinc plating shall not be less than 0.00015 inch (0.0038 mm).

10.8 A fuel-confining part of an inlet or relief valve that is made of drawn brass or machined from a brass rod made of copper alloy containing more than 15 percent zinc and incorporating internal threads shall withstand without cracking, the Moist Ammonia-Air Stress Cracking Test, Section 20.

10.9 Parts made of metals having widely varying coefficients of thermal expansion and exposed to heat shall not be used in combination when threaded together with the intent to reduce the risk of external leakage of fuel.

10.10 *Deleted*

10.11 A brazing material used for joining parts of a cylinder assembly shall have a melting point (solidus temperature) not less than 1000°F (538°C).

PERFORMANCE

11 General

11.1 A representative sample of each size and specific construction of cylinder assembly and parts constructed of nonmetallic materials are to be subjected to the tests specified in Sections 12 – 20, as appropriate.

11.2 For the leakage tests a source of aerostatic pressure such as air or nitrogen is to be used.

11.3 Water or other liquid of comparable or lighter viscosity is not prohibited from being used for producing the required pressure in a hydrostatic-pressure strength test.

12 Leakage Test

12.1 A representative sample of the cylinder assembly shall not show evidence of external leakage at the inlet connection fitting or cylinder joints when subjected to a pressure of 375 psig (2588 kPa) when tested in accordance with 12.2.

12.2 Three empty cylinder assemblies shall be connected to a system of adequate pressure. A positive shutoff valve and pressure indicating device are to be installed in the pressure supply piping. The samples shall have the relief valve removed for this test. The pressure shall be applied through the relief valve opening and there shall not be mating fitting attached to the cylinder connection. The pressure shall be applied for 1 minute. Leakage is to be determined by immersing the sample in a water bath or by using a soap and water or other equivalent leakage detection solution. The pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range of not less than 1-1/2 times nor more than two times the test pressure;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other device that is equivalent to the devices in (a) or (b).

13 Connection Valve Endurance Test

13.1 Each type of connection valve core is to be subjected to repeated cycles of opening and closing as specified in 13.2. After the endurance test, the valve shall comply with the leakage test requirements specified in 12.1.

13.2 One sample of each different style of valve is to be subjected to a 1500 cycle test conducted in the following manner. The valve is to be connected to a source of aerostatic pressure maintained at 100 psig (690 kPa) for the duration of the test. A mating probe is to be used to depress the valve pin to fully unseat the valve poppet and then backed off to close the valve poppet. The rate of cycling shall not exceed 30 cycles per minute.

14 Hydrostatic Pressure Strength Test

14.1 A representative sample of each size and specific construction of cylinder assembly shall not rupture or burst when subjected for 1 minute to a pressure of 900 psig (6211 kPa). The ultimate burst pressure shall exceed this pressure and the manner of failure shall be in the side wall of the cylinder parallel with its longitudinal axis. The failure shall not initiate in a brazed joint.

14.2 Three empty cylinder assemblies with the relief valve removed and the opening plugged shall be used. Each sample shall be connected to a source of hydrostatic pressure. The pressure supply system shall include a shutoff valve and a calibrated pressure indicating device. The pressure indicating device is to be installed in the pressure supply piping between the shutoff valve and the sample. Each sample is to be completely filled with liquid and all air is to be expelled. The pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range of not less than 1-1/2 times nor more than two times the test pressure;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other device that is equivalent to the devices in (a) or (b).

14.3 During the test sequence, the pressure is to be increased at a rate of 500 psig per minute (3450 kPa/min) until the hydrostatic pressure is reached. After the pressure is maintained for 1 minute, the pressure is to be increased at a rate of 100 psig per minute (690 kPa/min), until rupture occurs.

15 Start-to-Discharge and Resealing-Pressure, Tests of Pressure Relief Valves

15.1 A pressure relief valve incorporated in a nonrefillable cylinder assembly shall have start-to-discharge and resealing pressures within the limits as specified in Table 15.1 when tested in accordance with 15.2 – 15.4.

Table 15.1
Start-to-discharge (S-T-D) and resealing-pressure limits

Fuel gas	S-T-D pressure range psig (kPa)	Minimum reseal pressure psig (kPa)
Propane	360 – 480 (2480 – 3307)	240 (1656)
Propylene	390 – 520 (2691 – 3588)	260 (1794)

15.2 Three samples are to be used and each sample is to be tested twice. Each valve is to be installed in its container or holder and connected to an air or other aerostatic supply source capable of maintaining a pressure of at least 50 psig (345 kPa) above the upper start-to-discharge limit of the valve being tested. A shutoff valve and a calibrated pressure indicating device, are to be installed in the pressure supply piping. The pressure indicating device is to be installed in the piping between the valve being tested and the shutoff valve. Start-to-discharge and resealing pressures are to be observed through a water seal not more than 4 inches (102 mm) deep. The pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range of not less than 1-1/2 times nor more than two times the upper start-to-discharge limit of the valve;

b) A digital pressure transducer, or other digital gauge, that is calibrated over a range of pressure that includes the test pressure; or

c) Other device that is equivalent to the devices in (a) or (b).

15.3 The shutoff valve is to be opened so that the pressure to the valve being tested is increased to within 25 psig (172 kPa) of the lower start-to-discharge limit. The pressure to the valve being tested is then to be increased slowly, at a rate not greater than 2 psig (14 kPa) per second, until the first bubbles through the water seal are observed. The pressure at this instant, as indicated by the pressure gauge, is to be recorded as the start-to-discharge pressure of the safety-relief valve under test.

15.4 After recording the start-to-discharge pressure of the valve, the pressure is to be increased above the start-to-discharge pressure to unseat the valve. The shutoff valve then is to be closed tightly and the water seal, as well as the pressure gauge, is to be observed. The pressure at which bubbles through the water seal cease is to be recorded as the resealing pressure of the valve.

16 Fire Test

16.1 A nonrefillable cylinder assembly shall be subjected to the heat of a charcoal fire as specified in 16.2 – 16.4. The relief device provided in the cylinder assembly shall operate to prevent any part of the cylinder from being propelled or thrown from the assembly.

16.2 Nine sample fuel containers, fully charged by the manufacturer, are to be used. A charcoal fire, 24 by 18 by 6 inches (610 by 457 by 152 mm) high, is to be prepared within a 3-sided concrete-block, cinder block or brick enclosure. The top and one long side of the enclosure are to be open for observation.

16.3 A metal grate with minimum 1/2 inch spacings or wire screen with minimum 1/4 inch openings on which the samples are placed, is to be placed on top of the charcoals. The grate or metal wire screen shall

be even with the top of the enclosure (described in 16.2). The temperature shall be measured in the air space between the screen and the charcoals, below the sample. The temperature during the test shall be between 1000 and 1200°F (537 and 649°C). Thermocouples may be used to measure the temperature. Thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice.

16.4 The samples shall be individually tested in the charcoal fire. Three samples in each position of vertical up, vertical down, and horizontal shall be tested. The test shall be conducted until the entire contents of the container have been exhausted.

17 Accelerated Aging Test

17.1 A nonmetallic part is to be conditioned in accordance with 17.2. After conditioning there shall be no cracking or other visible evidence of deterioration.

17.2 Three samples of each nonmetallic part, other than that covered by the Exception to 10.4, are to be conditioned for 70 hours in an air oven maintained at a temperature of 212°F (100°C).

18 Fuel Gas Compatibility Test

18.1 General

18.1.1 A nonmetallic part in contact with the gases described in Table 18.1 shall be subjected to an immersion test in appropriate test fluid for 70 hours. Polymeric parts, other than those described in the Exception to 10.4, shall show no evidence of shrinkage, warpage, cracking, or other signs of deterioration following the immersion test(s). Elastomeric parts, when tested in accordance with 18.2.1 – 18.3.1, shall not show a change in volume of more than 25 percent swelling or 1 percent shrinkage, and a weight loss (extraction) of more than 10 percent.

Table 18.1
Test liquids for nonmetallic materials

Gas in contact with part	Test liquid
Propane	n-Hexane
Propylene	Propylene

18.1.2 With reference to the requirement in 18.1.1, when the limits for volume change or weight loss are exceeded, a complete valve assembly is to be filled with the appropriate test fluid(s) for 70 hours, following which the assembly shall comply with the requirements of the Leakage Test, Section 12.

18.2 Volume change

18.2.1 The volume change test is to be conducted as described in the Immersion Test in the Standard for Gaskets and Seals, UL 157.

18.3 Weight loss

18.3.1 The weight-loss test is to be conducted as described in the Immersion Test in the Standard for Gaskets and Seals, UL 157.