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Summary of Topics

This fourth issue of the Outline of Investigation for LP-Gas Cylinder Assemblies, UL 2003, includes editorial corrections, clarifications to construction requirements and clarifications to performance requirements.

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INTRODUCTION

1 Scope

1.1 These requirements cover refillable liquefied petroleum gas (LP-Gas) cylinder assemblies employing U.S. Department of Transportation (DOT) type cylinders made from steel, aluminum, or composite materials. Steel or aluminum cylinders will have a water capacity greater than 2.2 pounds (1 kg), equivalent to nominal 1-pound (0.5-kg) LP-Gas but not greater than 1000 pound (454.5 kg) water capacity, which is equivalent to 420 pound (191 kg) propane capacity. Seamless Composite Cylinders have a size limitation of 105 pounds (48 kg) water capacity, which is equivalent to 45 pounds (20 kg) propane capacity.

1.2 Cylinder assemblies covered by these requirements are intended for use, installation and storage in propane systems such as, but not limited to, applications covered by the following standards:

- a) Liquefied Petroleum Gas Code, NFPA 58, except as noted in 1.4.
- b) Outdoor Cooking Gas Appliances, ANSI Z21.58/CSA 1.6.
- c) Recreational Vehicles, NFPA 1192.
- d) Safety Standard for Low Lift and High Lift Trucks, ASME B56.1.

1.3 These cylinder assemblies are intended for use in consumer, commercial, and industrial applications to provide fuel for portable, stationary, or engine fuel equipment for such purposes as, but not limited to, camping, cooking, heating, lighting, soldering, brazing, industrial truck, or cleaning machine service, etc. They may be filled at a location other than the point of use and be connected to utilization equipment by the user.

1.4 These requirements do not cover ASME type container assemblies covered under the Standard for Container Assemblies for LP-Gas, UL 644, ASME containers for industrial truck LP-Gas fuel service and containers permanently mounted on vehicles.

1.5 Seamless Composite Cylinders with a CGA 793 outlet connection are intended only to be for emergency temporary indoor heating in attended use.

2 General

2.1 Components

2.1.1 Depending on the type of application, a LP-Gas Cylinder Assembly may be provided with several types of valve, fitting or adapter components such as, but not limited to, a shutoff valve, a double backflow check filler valve, a fixed maximum liquid level gauge, a variable liquid-level gauge, an overfilling prevention device or a high pressure gauge. When used, these components shall be provided as separate appurtenances or shall be combined into one or more appurtenances incorporating several components.

2.1.2 Except as indicated in 2.1.3, a component of product covered by this outline shall comply with the requirements for that component.

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

- a) Involves a feature or characteristic not needed in the application of the component in the product covered by this outline or
- b) Is superseded by a requirement in this outline.

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

2.1.5 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.

2.2 Units of measurement

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

2.3 Undated references

2.3.1 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.

3 Glossary

3.1 For the purpose of this outline, the following definitions apply.

3.2 ADAPTER – A fitting or coupling for direct connection to a cylinder or service shutoff valve that is used to convert one type of connection to another.

3.3 APPURTENANCE – A device such as a pressure relief device, valve, fitting, gauge, or plug, that is directly installed into a cylinder opening to make the cylinder a leak-tight assembly.

3.4 CYLINDER – A container that complies with the specification for cylinders constructed under Subpart C of Part 178 of the Federal DOT Regulations, 3.7 or built under a DOT exemption or special permit.

3.5 CYLINDER – SEAMLESS COMPOSITE – A cylinder with fully wrapped reinforced non-metallic material.

3.6 CYLINDER VALVE – A manual shutoff valve that is used for both filling and withdrawal applications that contains an integral pressure relief device, and may contain a fixed maximum liquid level gauge, and an overfilling prevention device.

3.7 DEPARTMENT OF TRANSPORTATION (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.

3.8 EMERGENCY USE* – The following conditions apply:

- a) The permanent heating system is temporarily out of service;
- b) Heat is necessary to prevent damage to the buildings or contents;
- c) The cylinders and heaters comply with, and are used and transported in accordance with NFPA 58, 6.20.2 through 6.20.4;
- d) The temporary heating equipment is not left unattended; and
- e) Air for combustion and ventilation is provided in accordance with NFPA 54, National Fuel Gas Code.

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3.9 INTERNAL EXCESS-FLOW VALVE – An excess-flow valve constructed and installed so that damage to valve parts exterior to the container does not prevent closing of the valve.

3.10 LIQUEFIED PETROLEUM GAS (LP-GAS or LPG) – Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of the following hydrocarbons, either by themselves (excluding propylene) or as mixtures: propane, propylene, butane (normal butane or iso-butane) and butylenes.

3.11 MOUNTING TYPE – A designation to show how a LP-Gas Cylinder Assembly for industrial truck service can be mounted on the vehicle. “Horizontal Only” type is one that is mounted with the cylinder’s longitudinal axis in the horizontal position. “Vertical Only” type is one with the cylinder’s longitudinal axis in the vertical position. “Universal Type” is one in which the Cylinder Assembly can be mounted in either the horizontal or vertical positions.

3.12 PRESSURE-RELIEF DEVICE – A pressure, temperature or temperature and pressure activated device used to prevent the pressure in a cylinder from rising above a predetermined maximum value. The term “pressure relief device” is synonymous with “safety relief device” as used by DOT Regulations, 3.7.

3.13 QUICK CLOSING COUPLING – A device that consists of two parts (male and female), which provides for a means of connecting and disconnecting an LP-Gas Cylinder Assembly from the fuel line without the use of tools. The two parts are threaded together. The coupling incorporates 1-1/4 inch ACME threads and each part contains a check valve that closes when the two parts are separated.

3.14 SERVICE VALVE – A manual shutoff valve that is used to control the flow of LP-Gas to and from a cylinder. It can be used for vapor or liquid withdrawal service and does not contain a relief device, fixed maximum liquid level gauge, or an overfilling prevention device.

4 Pressure and Temperature Rating

4.1 The pressure rating of a steel or aluminum LP-Gas Cylinder Assembly shall not be less than 240 psig (1.65 MPa). The pressure rating of a composite LP-Gas Cylinder Assembly shall not be less than 290 psig (2.0 MPa).

4.2 LP-Gas Cylinder Assemblies covered by these requirements are intended for use at ambient air temperatures within the range of minus 40 to plus 130°F (minus 40 to plus 55°C).

CONSTRUCTION

5 Pressure and Temperature Rating

5.1 A LP-Gas Cylinder Assembly shall be constructed using steel, aluminum or composite materials. A steel or aluminum LP-Gas Cylinder Assembly shall incorporate a cylinder constructed in accordance with the specifications DOT-4B, DOT-4BA, DOT-4BW, or DOT-4E of the DOT Regulations, 3.7, as appropriate, with a minimum service pressure in accordance with 4.1, having a water capacity greater than 2.2 pounds (1 kg), equivalent to nominal 1-pound (0.5-kg) LP-Gas but not greater than 1000 pound (454.5 kg) water capacity, which is equivalent to 420 pound (191 kg) propane capacity. A LP-Gas Seamless Composite Cylinder Assembly shall incorporate a cylinder, constructed under a valid DOT exemption or special permit, appropriate for the service, with a minimum service pressure in accordance with 4.1, shall be so marked, and shall not exceed 105 lbs (48 kg) water capacity, which is equivalent to 45 lb (20 kg) propane capacity.

5.2 A LP-Gas Cylinder Assembly shall include all of the components necessary for its intended function and installation, and shall be furnished as a single unit or assembly.

Exception: Quick-connect couplings for use on industrial truck service cylinders can be provided by the user as outlined in 6.7.

5.3 A LP-Gas Cylinder Assembly can be constructed in a manner that provides for vapor withdrawal only, liquid withdrawal only, or vapor and liquid withdrawal service. See Section 6 for the type of valve(s) that shall be provided in each case. When a LP-Gas Cylinder Assembly provides for both vapor and liquid withdrawal service, markings shall be provided to indicate the fluid type for each connection. See 24.4.

5.4 A LP-Gas Cylinder Assembly shall be provided with a ventilated cap or collar that encircles the appurtenances for a minimum of 240 degrees (4.2 radians) of the circumference. Ventilated caps or collars of steel and aluminum cylinders shall be capable of withstanding a blow of 120 foot-pounds (163 N·m) on the largest unreinforced area and thinnest wall section (not at an opening) of the collar. The construction shall be such that the force of the blow will not be transmitted to the valve(s), gauging devices, connections, or other appurtenances. See the Impact Test, Section 11. Collars of Seamless Composite Cylinders shall be capable of withstanding the Drop Test, Section 12, without damaging any of the appurtenances or creating a leak.

5.5 A LP-Gas Cylinder Assembly shall incorporate a foot ring or other means that will allow a cylinder to stand upright in a stable manner without allowing the cylinder bottom to contact the ground.

5.6 Steel cylinder shells, foot rings and collars of the assembly shall be provided with an exterior coating such as paint.

5.7 All NPT pipe threaded container appurtenances shall be installed using a pipe-joint sealant such as a sealing compound or Polytetrafluoroethylene (PTFE) tape for use with LP-Gas.

Exception: A pipe joint sealant is not required when the LP-Gas Cylinder Assembly incorporates "dry-seal" threads and complies with the requirements in the External Leakage Test, Section 14, with all appurtenances installed as intended in service without any such sealant.

5.8 A LP-Gas Cylinder Assembly shall incorporate one or more pressure relief devices that comply with the Standard for Pressure Relief Device Standards Part 1 - Cylinders for Compressed Gases, CGA S-1.1 for the pressure rating of the cylinder into which it is installed. Relief Valves for LP-Gas Seamless Composite Cylinder Assemblies shall be flow tested at the test pressure of the Seamless Composite Cylinder in accordance with the DOT special permit. The flow capacity shall have the capacity required for the size of the Seamless Composite Cylinder at this test pressure. For installation of relief devices, see Relief Device Installations, Section 7.

Exception: LP-Gas Seamless Composite Cylinder Assemblies shall not be equipped with fusible plugs.

5.9 Collars shall be constructed so that they do not interfere with the free operation of the cylinder or service shutoff valve and the relief valve. All valve(s), gauging devices, or other appurtenances shall not extend beyond the protective collar when the cylinder is not connected for use.

5.10 A LP-Gas Cylinder Assembly for industrial truck service shall be constructed to engage a substantial positioning pin or an equivalent means to provide for intended positioning of the container when reinstalled on the industrial truck.

5.11 A LP-Gas Cylinder Assembly for industrial truck service shall be constructed for one of the following LP-Gas capacities; 20 lb (9.1 kg), 31 lb (14 kg), 33-1/2 lb (15.2 kg), or 43-1/2 lb (19.8 kg).