UL 565

STANDARD FOR SAFETY

Liquid-Level Gauges for Anhydrous Ammonia and LP-Gas

UL Standard for Safety for Liquid-Level Gauges for Anhydrous Ammonia and LP-Gas, UL 565

Sixth Edition, Dated September 13, 2013

Summary of Topics

This revision of ANSI/UL 565 dated April 25, 2023 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

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 requirements are substantially in accordance with Proposal(s) on this subject dated February 24, 2023.

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UL 565

Standard for Liquid-Level Gauges for Anhydrous Ammonia and LP-Gas

Prior to the sixth edition, the standard was titled Liquid-Level Gauges and Indicators for Anhydrous Ammonia and LP-Gas.

First Edition – November, 1958
Second Edition – January, 1973
Third Edition – November, 1986
Fourth Edition – December, 1993
Fifth Edition – September, 1998

Sixth Edition

September 13, 2013

This ANSI/UL Standard for Safety consists of the Sixth Edition including revisions through April 25, 2023.

The most recent designation of ANSI/UL 565 as a Reaffirmed American National Standard (ANS) occurred on April 25, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

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 ULSE's Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover liquid-level gauges for anhydrous ammonia and liquefied petroleum gas (LP-Gas) for use with pressure vessels in nonrefrigerated systems in installations covered by the following American National Standards and others:

a) Compressed Gas Association, CGA G-2.1.

b) Liquefied Petroleum Gas Code, NFPA 58.

c) Storage and Handling of Liquefied Petroleum Gases at Utility Plants, ANSI/NFPA 59.

1.2 These requirements cover designs of gauges that require the release of liquid or gas phases of the contained fluid in order to function and gauges that do not require the release of liquid or gas phases of the contained fluid to function.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

2.1.2 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.

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

2.1.4 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.

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.

2.4 Pressure and temperature rating

2.4.1 The rated service-pressure of a gauging device covered by these requirements shall not be less than 250 psig (1.7 MPa gauge).

2.4.2 Gauging devices covered by these requirements are intended for use at ambient temperatures within the range of minus 40°C – 55°C (minus 40°F – 55°F).

3 Glossary

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

3.2 FIXED LIQUID LEVEL GAUGE – A liquid level indicator that uses a positive shutoff vent valve to indicate that the liquid level in a container being filled has reached the point at which the indicator communicates with the liquid level in the container.

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

3.4 MAGNETIC-FLOAT GAUGE – A type of variable liquid level gauge that incorporates a float that rests on the liquid level, which is connected to a series of gears and linkages that move in relation to the liquid level. The dial is connected to the gears and linkages through magnets on either side of the enclosure so no leakage occurs if there is a failure of the linkage mechanism. This type of gauge does not release contained fluid to atmosphere in order to function.

3.5 ROTARY GAUGE – A type of variable liquid level gauge that indicates the liquid level on a dial gauge installed on an ASME container by manually rotating an open ended tube inside the container, which is connected to a positive shutoff vent valve.

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3.6 SLIP TUBE GAUGE – A variable liquid level gauge in which a small positive shutoff valve is located at the outside end of a straight tube that is installed vertically within a container.

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3.7 VARIABLE LIQUID LEVEL GAUGE – A device that indicates the liquid level in a container throughout a range of levels.

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3.8 VENT VALVE – A type of manual shutoff valve that has a controlled orifice. Gauges that employ a vent valve release contained fluid to atmosphere to function.

CONSTRUCTION

4 Assembly

4.1 A gauge, when not assembled by the manufacturer as a unit, shall be arranged in as few subassemblies as practical; and shall be capable of being installed as a final assembly without alteration, other than for adjustment in the length of a gauging tube.

4.2 When a design requires the use of tubing, tubing fittings, pipe fittings, gaskets, bolts, cap screws, and the like, for making a proper installation, such parts shall be furnished by the manufacturer with each gauge when shipped.

4.3 The construction shall be such that parts can be readily reassembled in their intended manner after being dismantled to the extent needed for installation and normal care.

4.4 Convenient means shall be provided for the purpose of making any necessary field adjustment.

4.5 A brazing material used for joining fluid confining parts of a gauge for LP-Gas shall have a melting point (solidus temperature) not less than 538°C (1000°F). Brazing shall not be used on assemblies for anhydrous ammonia.

4.6 A dial of a magnetic-float or of a rotary-tube type gauge intended to be installed on a container greater than 1200 gallons for use with LP-Gas, and which is intended to be used for filling in accordance with the Liquefied Petroleum Gas Code, NFPA 58, shall be marked so that the maximum liquid level for butane, for a 50-50 butane-propane mixture, and for propane is readily determinable at temperatures between minus 7 and 46°C (20 and 115°F). Markings shall be in increments of not more than 11°C (20°F).

Exception: If the marked temperature range does not include minus 7 and 46°C (20 and 115°F), the gauge dial shall be marked in accordance with 16.4.

4.7 A dial of a gauge intended to be installed on a container greater than 1200 gallons that is not to be used for filling shall be marked in accordance with 16.5.

4.8 A dial of a magnetic-float or of a rotary-tube type gauge intended to be installed on ASME containers for use with anhydrous ammonia shall be marked so that the maximum liquid level for anhydrous ammonia is readily determinable at temperatures between minus 7 and 38°C (20 and 100°F). Markings shall be in increments of not more than 11°C (20°F).

Exception: If the marked temperature range does not include minus 7 and 38°C (20 and 100°F), the gauge dial shall be marked in accordance with 16.4.

4.9 A dial of a magnetic-float or of a rotary-tube type gauge for use with LP-Gas shall be marked to indicate whether it is for use with cylindrical or spherical containers and whether it is for use in aboveground or underground service.

4.10 A dial of a magnetic-float or of a rotary-tube type gauge for use only in LP-Gas aboveground containers of over 1200 gallons (4542 L) water capacity shall be so marked.

4.11 Dial markings shall be legible and shall not be readily discolored or obliterated by weathering.

4.12 A gauge, other than for farm use as mentioned in 4.13, that requires the release of the contained fluid to the atmosphere to function, such as those of the rotary-tube, slip-tube, fixed-tube, and vent-valve types, shall be constructed so that the controlling orifice is not larger than a No. 54 (0.055-inch diameter) drill size.

4.13 A fixed-tube or a vent-valve gauge that is intended for mounting on a container for anhydrous ammonia used solely on farm equipment for field application of ammonia, is permitted to be constructed with a controlling orifice larger than that indicated in 4.12, but not larger than 7/16-inch diameter. Such a device shall be marked with the size of the opening.

4.14 A gauging tube of a slip-tube type of liquid-level gauge shall be constructed with a substantially secured stop on its lower end to prevent the tube from being withdrawn completely from the body of the gauge or forced out by container pressure.

5 Materials

5.1 Fluid confining parts of a gauge, or its operating parts, the failure of which might result in leakage, shall have the strength and durability necessary to perform their intended function.

5.2 A part in contact with the fluid to be handled shall be resistant to the action of such fluid.

5.3 Only iron, steel, and certain nonferrous alloys that are suitable for ammonia service, are to be used in contact with anhydrous ammonia. Ammonia containing minute quantities of water will react rapidly with copper, zinc, and many alloys, especially those of copper base.

5.4 Nonductible cast iron (gray iron) shall not be used for bodies or closures in contact with anhydrous ammonia and LP-Gas.

5.5 A synthetic rubber part in contact with one of the fluids indicated in Table 5.1 shall not show excessive volume change or loss of weight, when considered on the basis of its intended function, following immersion for 70 hours in the specified test liquid.

Table 5.1
Test liquids for synthetic rubber materials

Fluid in contact with part	Test liquid
LP-Gas	n-Hexane
Anhydrous ammonia	Liquid anhydrous ammonia

5.6 A change in volume of not more than 25 percent swelling or 1 percent shrinkage, and a weight loss (extraction) of not more than 10 percent is considered as indicating compliance with 5.5.

5.7 A part made of synthetic rubber that is affected by aging shall not crack or show visible evidence of deterioration following exposure in an air oven for 70 hours at a temperature of 100 ±2°C (212 ±3.6°F).

5.8 When corrosion of a ferrous part interferes with the intended function of a gauge, the part shall be provided with a corrosion-resistant protective coating.

5.9 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings indicated in 5.10.

5.10 Cadmium plating shall be minimum 0.0003 inch (0.008 mm) thick and zinc plating shall be minimum 0.0005 inch (0.013 mm) thick.

Exception: In cases where threads constitute the major portion of the area, the thickness of the cadmium or the zinc plating shall be minimum 0.00015 inch (0.0038 mm) thick.

5.11 A part made of drawn brass or machined from brass rod shall withstand, without cracking, a 10-Day Moist Ammonia-Air Stress Cracking Test for copper and copper alloys. See 10-Day Moist Ammonia-Air Stress Cracking Test, Section 14.

5.12 A glass or a plastic part shall not be used in the construction of a gauge when breakage or destruction of the part will result in the escape of fluid from the tank to which it is attached.

5.13 A glass part, where permitted, shall be protected against breakage and shall withstand a sudden temperature reduction of 56°C (100°F) from not more than 100°C (212°F) without the development of cracks.

5.14 A plastic part, where permitted, shall be resistant to deterioration and distortion under conditions of intended service.

6 Bodies

6.1 A body or a part designed to be threaded into an opening in a container or designed for connection of piping shall have the required strength to withstand the normal stresses of installation and shall be constructed with a section to serve as a wrench grip.

6.2 A flange or other part of a body designed to be clamped in place when the gauge is installed shall have the required strength to withstand the stresses imposed by tightening the clamping screws or bolts.

6.3 Pipe threads shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch), ANSI/ASME B1.20.1.

Exception: Gauges intended for use in installations where pipe fittings incorporate other than NPT type threads shall be permitted to be provided with pipe threads complying with a national pipe thread standard compatible with those fittings. The pipe thread type shall be identified in accordance with 16.8.

7 Springs

7.1 A spring shall be guided and arranged to reduce binding, buckling, or other interference with its free movement. When necessary, both ends of a spring shall be closed and squared.

8 Floats

8.1 A float designed to actuate a gauging mechanism shall have a buoyancy not less than 50 percent greater than that required to operate the mechanism, unless a counterbalanced arrangement is used.

8.2 A hollow float shall withstand an external crushing pressure of not less than 750 psig (5.2 MPa).

8.3 A float shall be secured to its corresponding lever, rod, or other part of the mechanism by a method that prevents the float from becoming detached under service conditions.

PERFORMANCE

9 General

9.1 Representative samples of each size and specific design of a gauge are to be subjected to the tests described in these requirements. Additional samples of internal parts, such as parts made of nonmetallic materials, may be required for separate tests.

9.2 A leakage test on a gauge is to use a source of aerostatic pressure such as air, nitrogen, or carbon-dioxide gas. A hydrostatic strength test is not prohibited from using water for developing the required pressure. All pressures are to be maintained 1 minute.

9.3 For the External Leakage and Hydrostatic Strength Tests in Sections 10 and 11, a positive shutoff valve and a pressure measuring device shall be installed in the pressure supply piping between the shutoff valve and the product under test.

9.4 Pressure measuring devices shall be calibrated over the range that it is used. The test pressure measured shall be not less than 20 percent nor more than 80 percent of the full-scale reading of the device.

Exception: The test pressure is allowed to be less than 20 percent or more than 80 percent of the full-scale reading of the measuring device, when calibration indicates that there is no loss of accuracy in the measured value.

10 External Leakage Test

10.1 A liquid-level gauge shall withstand, without leakage, an internal aerostatic pressure of 375 psig (2.6 MPa), or 1-1/2 times the rated service pressure, whichever is higher. The pressure is applied with the vent valve, if provided, in the closed position.

11 Hydrostatic Strength Test

11.1 A liquid-level gauge, exclusive of any float used therein, shall withstand, without rupture or permanent distortion, an internal hydrostatic pressure of 1250 psig (8.6 MPa), or 5 times the rated service pressure, whichever is greater.

11.2 Samples of gauges previously subjected to the External Leakage Test, Section 10, are to be connected to a source of hydrostatic pressure.

12 Endurance Test

12.1 A variable liquid-level gauge that will permit the escape of vapor or liquid, in the event of failure of the gauging gears, linkage, or other mechanism, shall withstand 25,000 complete cycles of operation without failure or excessive wear of parts. Following the Endurance Test, the test gauge shall comply with the test requirement in External Leakage Test, Section 10.

12.2 A gauge that incorporates a vent valve shall withstand 1500 cycles of opening and closing of the vent valve seat disc with the main knob, handwheel, or stem assembly initially in the closed position and 100 psig aerostatic pressure applied to the valve inlet. The test is to be conducted manually and with a closing torque sufficient to stop air flow.

13 Float Crush Test

13.1 A hollow float shall withstand, without distortion, an external pressure of 750 psig (5.2 MPa).

13.2 Two samples of a hollow float are to be subjected to this test. Each float is to be inserted into a vessel of appropriate size and strength, that may be constructed of pipe and pipe fittings. The vessel is to be connected to a source of hydrostatic pressure. A pressure gauge having a range as described in 9.3, is to be installed in the pressure supply piping. The vessel is to be completely filled with liquid to expel all air. The pressure is then to be slowly increased to 750 psig (5.2 MPa).

13.3 Subsequent to the test, the floats are to be removed from the vessel and examined for evidence of distortion.

14 Moist Ammonia-Air Stress Cracking Test

14.1 After being subjected to the conditions described in 14.2 – 14.3, a pressure confining brass part containing more than 15 percent zinc shall: