UL 25

STANDARD FOR SAFETY

Meters for Flammable and Combustible Liquids and LP-Gas

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UL Standard for Safety for Meters for Flammable and Combustible Liquids and LP-Gas, UL 25

Ninth Edition, Dated April 19, 2016

SUMMARY OF TOPICS

This revision of ANSI/UL 25 is being issued to add torque requirements for larger size valve.

The revisions are substantially in accordance with Proposal(s) on this subject dated August 26, 2016.

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APRIL 19, 2016
(Title Page Reprinted: October 7, 2016)

ANSI/UL 25-2016

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Standard for Meters for Flammable and Combustible Liquids and LP-Gas

The first edition was titled Liquid-Phase Meters for LP-Gas.

The second through fourth editions were titled Meters for Flammable Liquids and LP-Gas.

First Edition – March, 1956
Second Edition – April, 1959
Third Edition – June, 1968
Fourth Edition – December, 1973
Fifth Edition – June, 1979
Sixth Edition – September, 1990
Seventh Edition – May, 1996
Eighth Edition – January, 2003

Ninth Edition

April 19, 2016

This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through October 7, 2016.

The most recent designation of ANSI/UL 25 as an American National Standard (ANSI) occurred on October 7, 2016. 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 UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 These requirements cover positive displacement liquid meters for:

a) Flammable and combustible liquids of the type and size commonly used in the assembly of motor fuel dispensing devices and

b) Liquefied petroleum gas (LP-Gas) of the type and size commonly used in the assembly of motor fuel dispensing devices and tank trucks.

1.2 ″Flammable and Combustible Liquids,″ as used herein, means gasoline, gasoline/alcohol blends up to 15% Ethanol or 15% Methanol, diesel fuel, fuel oil, lubricating oil, kerosene, and the vapors of these fuels. Other petroleum products are not prohibited from being used in the meter when the materials comply with the requirements in Materials, Section 5, and when the meter is evaluated using the additional liquids. Petroleum products shall be handled at pressures not exceeding 50 pounds per square inch gauge (psig) (345 kPa) and at temperatures within the range of minus 29°C (20°F) – 52°C (125°F).

1.3 Flammable and combustible liquid meters covered by this standard are for use in accordance with the National Fire Protection Association's Flammable and Combustible Liquids Code, NFPA 30, and the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA 30A.

1.4 LP-Gas meters covered by this standard are for use in nonrefrigerated systems in accordance with the National Fire Protection Association's Liquefied Petroleum Gas Code, NFPA 58.

1.5 These requirements do not cover:

a) Meters for use with liquefied petroleum gas in the gaseous phase;

b) Velocity meters, head meters, or area meters;

c) Meters for use in centralized fuel oil distribution systems; and

d) Meter components incorporating electrical circuits except those meeting intrinsically safe or explosion standards.

1.6 Determinations of the suitability of registers, counters, or computers used or provided with these meters, or the accuracy of measurement resulting from or required in actual application are not within the scope of these requirements.

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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 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.

CONSTRUCTION

3 General

3.1 A meter designed to handle flammable and combustible liquids shall be constructed for a minimum working pressure of 345 kPa (50 psig), and an ultimate rupture pressure of not less than five times the rated working pressure.

3.2 A meter designed to handle LP-Gas shall be constructed for a minimum working pressure of 2408 kPa (350 psig), and an ultimate rupture pressure of not less than five times the rated working pressure.

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4 Assembly

4.1 A meter shall be assembled as a unit and shall include all of the components necessary for its intended function.

4.2 If a meter requires the use of special pipe flanges, gaskets, bolts, or other special fittings or parts for making a proper installation, such parts shall be furnished by the manufacturer with each meter.

4.3 A brazing material used for joining fluid-confining parts of a meter shall have a melting point (solidus temperature) exceeding 538°C (1000°F).

5 Materials

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

5.2 Except as indicated in 4.3, fluid-confining parts, other than a seal ring or a gasket, shall have a minimum melting point (solidus temperature) of 510°C (950°F) and a minimum tensile strength of 68,950 kPa (10,000 psi) at 204°C (400°F).

5.3 Fluid confining metal parts of meters for LP-Gas shall be one of the following materials or the equivalent:

a) Steel.

b) Ductile (nodular) iron –

1) As specified in the Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures, ASTM A395/A395M.

2) Grade 60-40-18 or 65-45-12 as specified in the Standard Specification for Ductile Iron Castings, ASTM A536.

c) Malleable iron as specified in the Standard Specification for Ferritic Malleable Iron Castings, ASTM A47/A47M.

d) Class 40B or higher strength gray iron as specified in the Standard Specification for Gray Iron Castings, ASTM A48/A48M.

e) Brass.

f) Aluminum.

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5.4 If atmospheric corrosion of a part will interfere with the operation of a meter, or permit external leakage, such part shall be of a corrosion-resistant material or be provided with a corrosion-resistant protective coating.

Exception: A coating need not be provided for ferrous materials used for fluid-confining parts which have the thickness specified in the following:

a) Castings have a minimum wall thickness of 6.4 mm (1/4 inch),

b) Standard pipe and fittings conforming to the Standard for Welded and Seamless Wrought Steel Pipe, ANSI/ASME B36.10M, Schedule 40, and

c) Fabricated sheet steel parts having a minimum wall thickness of 2.36 mm (0.093 inch).

Also see Section 17 for additional test requirements.

5.5 A protective coating shall provide resistance against corrosion to a degree not less than that provided by the protective coatings specified in 5.6.

5.6 Cadmium plating shall have a minimum thickness of 0.0076 mm (0.0003 inch), and zinc plating shall have a minimum thickness of 0.0127 mm (0.0005 inch), except on parts where threads constitute the major portion of the area, in which case the minimum thickness of the cadmium or zinc plating shall be 0.0038 mm (0.00015 inch).

5.7 Sand castings used in the construction of fluid-confining parts, failure of which will allow external leakage, shall be free from porosity leakage and shall have a minimum design thickness as specified in Table 5.2. See the Leakage Test, Section 12, and General, Section 17, for additional test requirements.

Table 5.2
Minimum thickness of liquid-confining sand castings

Material	Flammable and combustible liquid meters,		LP-Gas meters,	
	mm	(inch)	mm	(inch)
Cast iron	4.8	3/16	6.4	1/4
Malleable iron, ductile iron, or cast steel	3.2	1/8	4.8	3/16
Brass or bronze	2.4	3/32	4.8	3/6
Aluminum	4.0	5/32	6.4	1/4
NOTE – Also see 5.3 concerning materials used.				

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5.8 If warping of a casting affects the tightness of fluid-confining joints, or the necessary fit of parts, the casting shall be stress-relieved to reduce the possibility of warping to a minimum.

5.9 A liquid-confining transparent part provided for purposes of observation shall be of glass. It shall be protected against damage by recessing or guarding. The glass part shall not be adversely affected by changes in temperature. See the Temperature Reduction Test, Section 15.

5.10 For flat flanges, a plant fiber gasket shall be not more than 0.8 mm (1/32 inch) thick. A cork-composition gasket shall be shellacked in place on one side and coated with graphite on the other. Synthetic rubber gaskets shall have a minimum thickness of 1.6 mm (1/16 inch) and a maximum thickness of 2.4 mm (3/32 inch).

5.11 An elastomeric part used in contact with liquid shall have the following properties when tested as specified in the Standard for Gasket and Seals, UL 157.

a) Those properties relating to minimum tensile strength and elongation after oven aging, as specified in UL 157. The maximum service temperature used to determine the conditioning time and temperature for oven aging is determined to be 60°C (140°F), unless the product is designated for use at higher temperature.

b) Low temperature rating of minus 29°C (minus 20°F).

c) Volume change and extraction as specified in the requirements for UL 157, for end use applications of gasoline, gasoline/alcohol blends up to 15% Ethanol or 15% Methanol, diesel fuel, fuel oil, lubricating oil and kerosene for meters handling flammable and combustible liquids and for end use applications of LP-Gas for meters handling LP-Gas. Other end use applications shall use the fluids intended for exposure.

5.12 The Standard for Gasket and Seals, UL 157, provides for the testing of either finished elastomeric parts, or sheet or slab material. Sheet or slab material is to be tested when the elastomeric parts are O-rings having a diameter less than 25.4 mm (1 inch). The material tested is to be the same as that used in the product, regardless of whether finished elastomeric parts, or sheet or slab material is tested.

5.13 When the limits for tensile strength and elongation, volume change, or extraction specified in 5.11 are exceeded, the gasket material may be retested in the complete meter after conditioning as outlined in 5.14 – 5.16.

5.14 When the limits for tensile strength, elongation, volume change, or extraction are exceeded, the complete assembly constructed with the gasket installed as intended shall be filled with the appropriate test fluid for 70 hours at room temperature, and then shall comply with the Leakage Test, Section 12, and the Hydrostatic Strength Test, Section 14, while at the test temperature.

5.15 When the oven aging results are not in accordance with 5.11, the complete assembly with the gasket installed as intended, shall be placed in an air oven for the same duration and at the same temperature used when testing the gasket material, and then shall comply with the Leakage Test, Section 12, and the Hydrostatic Strength Test, Section 14, while at the test temperature.

5.16 When the low temperature results are not in accordance with 5.11, the complete assembly with the gasket material installed as intended, shall be placed in a cold chamber for 24 hours at the same temperature used when testing the gasket material and then shall comply with the Leakage Test, Section 12, and the Hydrostatic Strength Test, Section 14, while at the test temperature.

6 Bodies and Covers

6.1 Plugs and other parts, other than cap screws and bolts, threaded into noncorrosion-resistant ferrous parts of a meter shall be of corrosion-resistant metal or provided with a protective coating when their function is such that they are required to be removed for adjustment, repair, or other care of the meter.

6.2 A plug, cap, or other part threaded into or on the meter body shall engage with at least four full threads.

6.3 Tapped openings for ordinary studs or cap screws used for assembly shall not extend into a fluid-confining section of a meter.

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7 Register-Shaft Seals

7.1 A shaft seal provided to prevent external leakage shall not require field adjustment to maintain it tight against leakage.

8 Springs

8.1 An operating spring shall be guided and arranged to prevent binding, buckling, or other interference with its free movement. If necessary, both ends of a spring shall be closed and squared.

9 Piping and Fittings

9.1 Joints in wrought iron, steel, brass, or copper pipe shall be threaded, welded, or brazed. Pipe threads shall be in accordance with the Standard for General Purpose (Inch) Pipe Threads, ANSI/ASME B1.20.1.

Exception: Meters 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 18.5.

9.2 An opening threaded for attachment to a pipe shall be constructed so that a pipe threaded two threads beyond the standard number (for the size in question) shall run into the opening and shall not result in distortion of any part of the fitting.

9.3 A threaded pipe connection shall be made with litharge and glycerine cement, shellac and inert powder filler, or a pipe-joint sealing compound resistant to:

a) LP-Gas for LP-Gas meters and

b) Gasoline for flammable and combustible liquid meters.

9.4 Pipe shall be wrought iron or steel (black or galvanized), brass or copper, and shall comply with the following requirements, as applicable:

a) For wrought iron pipe, the Standard for Welded and Seamless Wrought-Steel Pipe, ANSI/ASME B36.10M.

b) For steel pipe:

1) The Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, ANSI/ASTM A53/A53M.

2) The Standard Specification for Seamless Carbon Steel Pipe for High Temperature Service, ASTM A106/A106M.

c) For brass pipe, the Standard Specification for Seamless Red Brass Pipe, Standard Sizes, ASTM B43.

d) For copper pipe, the Standard Specification for Seamless Copper Pipe, Standard Sizes, ASTM B42.

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9.5 A pipe fitting shall be steel, brass, copper, malleable iron, or ductile (nodular) iron. A cast-iron pipe fitting shall not be used.

9.6 Tubing shall be steel, brass, or copper for LP-Gas meters and shall be steel, or seamless drawn aluminum or copper for flammable liquid meters. The tubing shall have a wall thickness of not less than that specified in Table 9.1. Tubing shall also comply with the following requirements, as applicable:

a) For steel tubing, the applicable requirements for Grade A steel in the Standard Specification for Electric-Resistance Welded Carbon Steel and Carbon-Manganese Steel Boiler and Superheater Tubes, ASTM A178/A178M.

b) For brass tubing, the Standard Specification for Seamless Brass Tube, ASTM B135.

c) For copper tubing:

1) Type K or L, the Standard Specification for Seamless Copper Water Tube, ASTM B88.

2) The Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service, ASTM B280.

3) The Standard Specification for Seamless Copper Tube, ASTM B75.

9.7 Steel tubing of the wall thickness specified in Table 9.1 shall be protected with a corrosion-resistant coating that has been determined to be equivalent to that provided by hot-dip galvanizing.

Table 9.1
Wall thickness for aluminum, brass, copper, and steel tubing

Outside diameter,		Minimum wall thickness			
		Aluminum, brass, or copper,		Steel,	
mm	(inches)	mm	(inch)	mm	(inch)
3.17	1/8	0.67	0.0265	0.71	0.028
6.35	1/4	0.67	0.0265	0.71	0.028
7.94	5/16	0.67	0.0265	0.71	0.028
9.53	3/8	0.67	0.0265	0.71	0.028
12.70	1/2	0.80	0.0315	0.71	0.028
15.88	5/8	0.93	0.0365	0.89	0.035
19.05	3/4	0.98	0.0385	0.89	0.035
22.23	7/8	1.04	0.0410	1.24	0.049
25.40	1	1.17	0.0460	1.24	0.049
28.58	1-1/8	1.17	0.0460	1.24	0.049
31.75	1-1/4	1.28	0.0505	1.24	0.049
34.93	1-3/8	1.28	0.0505	–	–
38.10	1-1/2	–	–	1.65	0.065

9.8 Fittings intended for the tubing employed shall be used. Brass or copper in combination with aluminum shall not be used unless coated with chromium or a metallic coating that has been determined to be equivalent to preclude electrolytic action. A coating shall have a thickness of not less than 0.005 mm (0.0002 inch).

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9.9 Flared or compression type fittings furnished with the assembly shall comprise the complete assembly for this purpose. Such fitting, whether partially furnished as a machined portion of the body or assembled into a pipe threaded connection, shall comply with the appropriate American National Standard for such purpose.

PERFORMANCE

10 General

10.1 A representative sample of each size and specific design of meter is to be subjected to the tests described in these requirements. Additional samples of parts constructed of nonmetallic materials, such as gaskets and other seal materials, are generally required for physical and chemical tests.

10.2 Endurance and leakage tests on flammable and combustible liquid meters are to use kerosene or the equivalent as the test medium.

10.3 Endurance tests on LP-Gas meters are to use normal hexane or LP-Gas as the test medium.

10.4 Leakage tests on LP-Gas meters are to use a source of aerostatic pressure, such as air, nitrogen, or carbon dioxide gas.

10.5 Liquids, such as water or hydraulic oil, are to be used for developing the required pressure in a hydrostatic pressure strength test.

10.6 All leakage and hydrostatic-pressure strength tests are to be maintained for at least 1 minute.

11 Deformation Test

11.1 A meter shall not leak, nor shall there be evidence of damage resulting from the turning effort exerted on pipe-threaded sections when tested as described below.

11.2 The sample meter used in this test is to be rigidly anchored or otherwise supported. A 150 mm (6-inch) length of Schedule 80 pipe is to be connected to a female pipe-threaded section of the meter, the male threads having first been lubricated with No. 10 SAE machine oil. Each pipe is then to be tightened to the torque specified in Table 11.1.

11.3 After the torque has been applied to each connected pipe, the meter is to be subjected to the applicable leakage test specified in the Leakage Test, Section 12.

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Table 11.1
Torque requirements for pipe connections

Pipe size, nominal inches	Outside diameter,		Torque,	
	mm	(inch)	N·m	(pound-inches)
1/8	10.29	0.405	17.0	150
1/4	13.72	0.540	28.0	250
3/8	17.15	0.675	51.0	450
1/2	21.34	0.840	90.0	800
3/4	26.67	1.050	113.0	1000
1	33.40	1.315	137.0	1200
1-1/4	42.16	1.660	164.0	1450
1-1/2	48.26	1.900	175.0	1550
2	60.33	2.375	186.0	1650
2-1/2	73.03	2.875	198.0	1750
3	88.90	3.500	203.0	1800
4	114.3	4.5	215	1900

12 Leakage Test

12.1 A flammable and combustible liquid meter, before being subjected to the Endurance Test, Section 13, shall withstand, without leakage, a minimum internal liquid pressure of 1-1/2 times the maximum working pressure.

12.2 An LP-Gas meter, before being subjected to the Endurance Test, Section 13, shall be capable of withstanding, without leakage, a minimum internal aerostatic pressure of 1-1/2 times the maximum working pressure.

12.3 The meter is to be connected to a source of liquid or aerostatic pressure. A positive shutoff valve and a calibrated pressure gauge having a minimum pressure range of 1-1/2 times nor more than 2 times the test pressure are to be installed in the pressure-supply piping. The pressure gauge is to be installed in the piping between the shutoff valve and the meter.

12.4 While a flammable and combustible liquid meter is under the applied test pressure, all joints, in addition to body casting surfaces, are to be examined for evidence of liquid leakage.

12.5 An LP-Gas meter is to be submerged in water to detect leakage, or all joints and body casting surfaces are to be brushed with a soap-and-water or other leak-detection solution.

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13 Endurance Test

13.1 A flammable and combustible liquid meter and an LP-Gas meter shall not show evidence of leakage through a register shaft stuffing box or seal, or evidence of leakage through any joint at a pressure of 1-1/2 times its maximum working pressure, after the meter has been subjected to 300 hours of continuous operation under the conditions described below.

13.2 An endurance test on a meter is to be conducted on a sample previously subjected to the Leakage Test, Section 12. The meter is to be operated continuously for a total of 300 hours, 50 hours at the maximum working pressure and 250 hours at a pressure of 20 percent of the maximum working pressure. Throughout the 300 hour test, the speed of rotation of the register shaft is to be not less than that obtained with the meter operating at the maximum rated liquid flow capacity. Other conditions of the test are to simulate, insofar as practicable, those of actual service.

13.3 Following completion of the endurance test, the meter is to be subjected to the appropriate leakage test specified in Section 12. While the meter is under the test pressure, the register shaft stuffing box or seal and all body joints in the assembly are to be examined for evidence of leakage.

14 Hydrostatic Strength Test

14.1 A flammable and combustible liquid meter and an LP-Gas meter shall withstand, without rupture, a minimum hydrostatic pressure of five times their maximum working pressure.

14.2 A sample meter previously subjected to the Deformation, Leakage, and the Endurance Tests, Sections 11 – 13, is to be used, and is to be connected to a source of hydrostatic pressure. A positive 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 pressure-supply piping between the shutoff valve and the meter. The pressure indicating device shall comply with one of the following:

a) An analog gauge having a pressure range such that the test pressure is between 30 and 70 percent of the maximum scale reading of the gauge;

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).

Care is to be taken to completely fill the test sample with liquid and expel all air.

14.3 External leakage observed during this test does not constitute a failure, if, following the hydrostatic test, the meter is in compliance with the requirements for leakage specified in the Leakage Test, Section 12.

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15 Temperature Reduction Test

15.1 A liquid confining transparent part shall withstand without evidence of cracking a sudden temperature reduction of 55.5°C (100°F) from an initial temperature of not more than 100°C (212°F). The part shall be subject to rated pressure using a liquid during the temperature conditioning and reduction.

16 Moist Ammonia-Air Stress Cracking Test

16.1 After being subjected to the conditions described in 16.2 – 16.4, a pressure-confining brass part containing more than 15 percent zinc shall:

a) Show no evidence of cracking, delamination, or degradation, or

b) Perform as intended when tested as described in 16.4.

16.2 One test sample of each size is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Samples with female threads, intended to be used for installing the product in the field, are to have the threads engaged and tightened as specified in Table 11.1. Samples with female threads other than tapered pipe threads shall be torqued as specified by the manufacturer. Polytetrafluoethylene (PTFE) tape or pipe compound are not to be used on any threads. Samples with male threads are evaluated as received.

16.3 The samples are then to be tested in accordance with Apparatus, Section 6, Reagents and Materials, Section 7, Test Media, Section 8, Test Sample Preparation (9.3 - 9.4), Test Procedure (10.1 - 10.4) of the Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys, ASTM B858-06, except the pH level of the test solution shall be High 10.5 ±0.1 and the exposure temperature shall be 25 ±1°C.

16.4 After the exposure period, the samples are to be examined for cracks or other signs of stress corrosion using a microscope having a magnification of 25X. Pressure-confining parts exhibiting degradation as indicated in 16.1 as a result of the test exposure described in 16.2 and 16.3 shall withstand, without rupture, a hydrostatic test pressure of five times the rated pressure of the valve, for 1 minute.

MANUFACTURING AND PRODUCTION TESTS

17 General

17.1 To determine conformance with these requirements in production, the manufacturer shall provide the necessary production control, inspection, and tests. The program shall include at least the following tests.

17.2 Each assembled flammable and combustible liquid meter shall be tested for external leakage test at a liquid or an aerostatic pressure of not less than rated working pressure, but not less than 345 kPa (50 psig).

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