UL 1106

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Marine Manually Operated Shutoff Valves for Flammable Liquids

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UL Standard for Safety for Marine Manually Operated Shutoff Valves for Flammable Liquids, UL 1106

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-16	November 18, 1998

UL 1106

Standard for Marine Manually Operated Shutoff Valves for Flammable Liquids

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November 18, 1998

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover marine manually operated shutoff valves intended for use with flammable liquids used to power internal combustion engines on boats.

1.2 The valves covered by these requirements are intended for installation and use in accordance with the applicable requirements of the U. S. Coast Guard (as specified in 33 CFR 183.510 – Fuel Tanks), the standards of the American Boat and Yacht Council, Inc., or the Fire Protection Standard for Pleasure and Commercial Motor Craft (National Fire Codes Vol. 6), NFPA 302.

1.3 These requirements cover valves that are intended to operate only in the ″open″ and ″closed″ modes.

1.4 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 Units of Measurement

2.1 If a value for measurement is followed by a value in other units in parentheses, the second value may be only approximate. The first stated value is the requirement.

3 Components

3.1 Except as indicated in 3.2, a component of a product covered by this standard shall comply with the requirements for that component.

3.2 A component need not 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 standard, or

b) Is superseded by a requirement in this standard.

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

3.4 Specific components are recognized as being 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 for which they have been recognized.

CONSTRUCTION

4 General

4.1 The installation and operating instructions that accompany each valve as produced are to be provided with, and used as a guide in the examination and testing of, the valve. For this purpose, a final, printed version of the instructions is not required.

5 Assembly

5.1 A valve shall be constructed to withstand the stresses likely to be encountered in use.

5.2 An edge of an exposed part of a valve shall not be sufficiently sharp to constitute a risk of injury to persons during installation or servicing.

5.3 The body, bonnet, packing nut, and other exposed metallic parts of a valve shall be cast or forged bronze, cast brass, or formed of other material having at least equivalent resistance to corrosion. A valve employing material, or having a form of construction, not known to provide acceptable resistance to corrosion, dezincification resistance, and galvanic compatibility between parts shall be subjected to the Salt Spray Corrosion Test, Section 17. Also, see 10-Day Moist Ammonia-Air Stress Cracking Test, Section 18.

Exception: An operating lever or wheel need not be formed of material having corrosion resistance equivalent to brass or bronze, but shall be sufficiently corrosion resistant to withstand the exposure specified in Salt Spray Corrosion Test, Section 17, without loss of structural integrity.

5.4 A cast valve body shall be at least 3/32 inch (2.4 mm) thick.

5.5 A casting shall be smooth and free from scale, lumps, cracks, blisters, sand holes and other defects of any nature that could impair the intended use. A casting shall not be plugged or filled.

5.6 The means of fastening for a packing nut, bonnet, plug, and the like shall reduce the likelihood of loosening and leakage.

5.7 Pipe threads and threaded openings shall be in accordance with the Standard for Pipe Threads, General Purpose (Inch), Revision and Redesignation of ANSI/ASME B2.1-1968(R1992).

5.8 The packing nut shall be adjustable by means of a standard wrench. Knurling or any other provision intended to accommodate adjustment by hand or with pliers is not acceptable.

5.9 The construction of the valve stem shall prevent the stem from being inadvertently backed out of the valve.

5.10 Threaded portions of the valve stem shall not contact nonmetallic seals.

5.11 A nonmetallic material used to form a gasket, seal, or other part of a valve shall be resistant to deterioration from exposure to the liquids with which it may come in contact, such as gasoline, diesel fuel, engine oil, alcohol, and kerosene. See Resistance to Liquids Tests, Section 19.

6 Installation, Operation, and Servicing

6.1 A valve shall include all of the components necessary for the intended function and installation, and shall be constructed for installation as a single unit.

6.2 The intended installation of a valve shall not require drilling, tapping, welding, or other alteration of the valve.

6.3 A valve shall have integral, independent mounting provisions when:

a) it is intended for connection to tubing in fuel-line systems or for direct attachment to a fuel tank (or accessories) by pipe thread, and

b) its operating torque exceeds 2.92 foot pounds (0.40 kg meter).

6.4 The construction of a valve shall permit disassembly and reassembly to the degree necessary for intended servicing by means of ordinary tools, such as crescent or spanner wrenches, or tools that are provided with the device.

7 Operating Controls

7.1 A 1/4 turn valve employing a lever type operating handle shall be constructed so that the axis of the handle is:

a) Parallel to the direction of fluid flow in the open position; and

b) At an angle of 90 degrees relative to the direction of fluid flow in the closed position.

7.2 For a valve of the type described in 7.1, positive stops shall be provided for both the open and closed positions.

7.3 For a valve of the type described in 7.1, the construction of the valve stem shall positively index the operating handle to the stem.

7.4 A valve employing a wheel type operating handle shall be constructed so that clockwise rotation closes the valve.

Exception: A counterclockwise rotation may be used to close the valve if the valve is clearly and permanently marked to indicate this direction. Also, see 23.3.

7.5 An operating handle shall be of sufficient length or diameter that not more than 4.2 foot pounds (0.58 kg meter), applied at the end or periphery, is required to operate the valve. See Operating Force Test, Section 10.

PERFORMANCE

8 General

8.1 Representative samples of a valve are to be subjected to the applicable tests described in Sections 9 – 18. Component samples are to be used for the tests described in Resistance to Liquids Tests, Section 19.

8.2 For a valve having threaded inlet or outlet openings, the tests described in Sections 9 – 13 are to be conducted on samples fitted (in accordance with the manufacturer's instructions) with 1 foot (0.3 m) lengths of steel or brass pipe of the intended size and type, supported as intended in service.

8.3 For the tests specified in Operation Tests, Section 9, Vibration Test, Section 11, and Shock Test, Section 12, the liquid used to pressurize the samples is to be Stoddard solvent or an equivalent liquid.

8.4 For a valve having more than one open position, such as a three way (selector) valve, the valve is to be subjected to the tests described in Vibration Test, Section 11 and Shock Test, Section 12 in each open position. A different sample may be used for each position.

9 Operation Tests

9.1 General

9.1.1 When tested as described in 9.2 – 9.4, a valve shall show no evidence of:

a) External leakage;

b) A change in setting to the extent that there is a change in the amount of fluid flow;

c) Internal leakage when closed;

d) Introduction of air into the system while under suction; or

e) Any other mechanical malfunction.

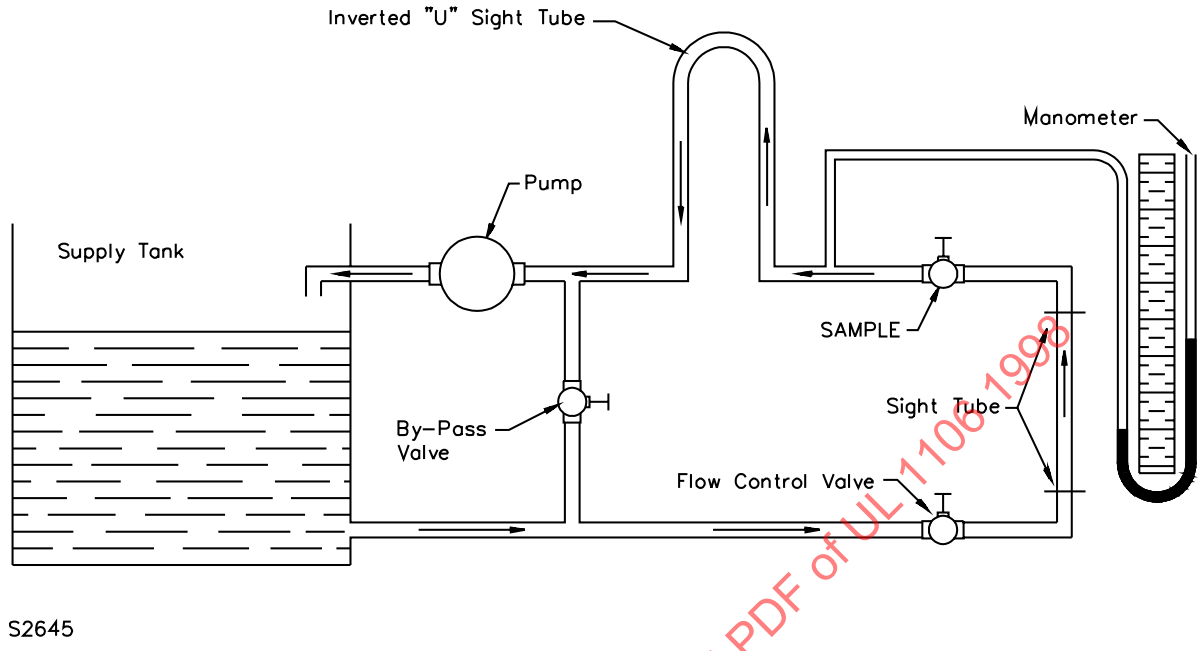
9.2 Leakage Test

9.2.1 The inlet end of a sample is to be connected to a pressure source and pressurized to rated maximum working pressure or 5 psig (34.5 kPa), whichever is greater, at rated flow. The valve then is to be subjected to 500 cycles of operation (each cycle consisting of turning the sample from the fully open to the fully closed position and then back to the fully open position), at a rate not exceeding 1 cycle every 15 seconds.

9.3 Static Suction Test

9.3.1 After completion of the test described in 9.2.1, the sample is to be assembled into a test rig as illustrated in Figure 9.1 so that the outlet end of the sample is connected to the suction end of a pump. The system is to be purged of all air and the bypass and flow control valves are to be closed. While the pump is providing a static suction of 3 psig (20.7 kPa or 0.207 bars), the sample is to be subjected to 500 cycles of operation at a rate not exceeding 1 cycle every 15 seconds.

Figure 9.1
Setup for Suction Tests



9.4 Surge Suction Test

9.4.1 While the sample is still in the rig as illustrated in Figure 9.1, the flow control valve is to be adjusted to provide rated flow through the sample. The sample then is to be subjected to an additional 10 cycles of operation during which the sample is to be in the fully closed position for 1 minute and then in the fully open position for 2 minutes in each cycle.

10 Operating Force Test

10.1 The maximum force required to turn the operating handle of a valve from the fully open position to the fully closed position, and from the fully closed position to the fully open position, shall not exceed 4.2 foot pounds (0.58 kg meter) under any condition of intended operation. In addition, for a valve intended for connection to tubing in fuel line systems or for direct attachment to a fuel tank (or accessories) by pipe thread, or the like (see 6.3), the maximum operating torque value, without providing independent integral mounting means, shall not exceed 2.92 foot pounds (0.40 kg meter).

10.2 This test may be conducted in conjunction with the Operation Tests, Section 9. The maximum operating force is to be determined in the plane of rotation of the operating handle by means of a scale attached to the end of a lever type handle or the periphery of a wheel type handle. The body of the valve is to be fixed in position during the determination. The maximum operating torque may be determined by means of a torque meter or by calculation using the maximum operating force.

11 Vibration Test

11.1 A valve shall withstand vibration as specified in 11.3 without development of mechanical malfunction or damage to the mounting means. The valve shall not change in setting during the test.

11.2 Two samples are to be tested; one in the fully closed position and at a static pressure of 5 psig (34.5 kPa), and the other in the fully open position and at a flowing pressure of 5 psig. For the test, the samples are to be mounted on test fixtures in the intended service position. The pressure is to be applied through flexible tubing connected to the inlet and outlet ports of the sample or the connected piping, as applicable.

11.3 Each assembly (sample and fixture) is to be subjected to a variable frequency vibration in each of three rectilinear axes (horizontal, lateral, and vertical) for 4 hours in each orientation, and at a peak-to-peak amplitude of 0.060 ±0.001 inch (1.52 ±0.025 mm). The frequency of vibration is to be continuously varied, at a uniform rate, from 10 to 60 to 10 hertz every 4 minutes.

11.4 After completion of the test described in 11.3, the samples are to be examined for movement of the operating control from the initial setting and damage to the mounting means. Each sample then is to be subjected to 10 cycles of operation as described in 9.2.1, following which it shall comply with the requirements in 9.1.1.

12 Shock Test

12.1 A valve shall withstand 5000 shock impacts as described in 12.4 without:

a) Mechanical malfunction; or

b) Damage to the mounting means.

12.2 The setting of the valve described in 12.1shall not change during the test.

12.3 Two samples, assembled as described in 11.2, are to be tested.

12.4 Each assembly (sample and fixture) is to be mounted on a shock machine and subjected to 5000 shock impacts, each having a 10 g [322 feet per second per second (98 m/s^2)] acceleration and a 20 – 25 millisecond duration as measured at the base of the half sine shock envelope.

12.5 After completion of the test specified in 12.4, the samples are to be examined for movement of the operating control from the initial setting and damage to the mounting means. Each sample then is to be subjected to 10 cycles of operation as described in 9.2.1, following which it shall comply with the requirements in 9.1.1.

13 Temperature Tests

13.1 General

13.1.1 Following the conditioning specified in 13.2.1 and 13.3.1, a valve shall comply with the requirements in 9.1.1 when subjected to 25 cycles of operation as described in 9.2.1.

13.1.2 The samples are to be allowed to return to room temperature before being subjected to the 25 cycles of operation.

13.2 High Ambient Temperature Test

13.2.1 An empty sample is to be conditioned in an air oven at 95°C (203°F) for 50 hours.

13.3 Low Ambient Temperature Test

13.3.1 A sample is to be filled with liquid, capped, and then placed in a cold chamber at minus 30°C (minus 22°F) for not less than 16 hours. The liquid is to be equal proportions of water and either ethyl alcohol or ethylene glycol. For a valve intended for use with diesel fuel, an additional sample is to be tested with No. 2 diesel fuel.

14 Hydrostatic Tests

14.1 Leakage Test

14.1.1 A valve shall not leak when subjected to a hydrostatic pressure of two times the rated maximum working pressure of the valve or 50 psig (345 kPa), whichever is greater.

14.2 Strength Test

14.2.1 A valve shall not rupture or deform when subjected to a hydrostatic pressure of four times the rated maximum working pressure or 500 psig (3450 kPa), whichever is greater.

15 Mechanical Strength Test

15.1 A valve shall withstand, without breakage or malfunction, a force equal to twice the maximum operating force determined in accordance with 10.2 applied to the end or periphery of the handle in the direction that:

a) Opens the valve, with the valve in the fully open position; and

b) Closes the valve, with the valve in the fully closed position.

16 Fire Test

16.1 A valve shall withstand a 2-1/2 minute fire exposure as described in 16.2 – 16.8 and then shall not leak under a hydrostatic head of 3 feet (0.9 m) of fuel.

16.2 Three samples, each in turn, are to be connected into a supply system, as illustrated in Figure 16.1, and maintained at a distance of 9 inches (229 mm) above a pan filled with fuel, within a test chamber as illustrated in Figure 16.2.

16.3 A valve intended for use with gasoline, or with both gasoline and diesel fuel, is to be tested with n-heptane. A valve intended for use only with diesel fuel is to be tested with No. 2 diesel fuel. The fuel pan is to be approximately 8-1/2 by 14 by 1-1/2 inches (216 by 356 by 38 mm) deep. The fuel used in the pan is to be the same as that used in the test sample.

16.4 Thermocouples are to be positioned in the same horizontal plane as the sample, 1/2 inch (12.7 mm) from and parallel with the sample. The tips of the thermocouples are to be 1 inch (25 mm) from the ends of the sample as shown in Figure 16.1.

16.5 The flow control valve is to be opened and the system bled of all air by allowing fuel to run through the system from the tank to the discharge valve. With the system full of fuel, the fuel level in the tank is to be adjusted to provide a 3 foot (0.9 m) head of fuel, the discharge valve is to be closed, and the flow control valve is to be left open. The fuel in the pan is to be ignited and allowed to burn for 2-1/2 minutes. During the burning period, the temperatures are to be recorded at 15 second intervals. At the end of the 2-1/2 minute period, the fire is to be extinguished with CO_2. The sample is not to be disturbed.

16.6 For tests using No. 2 diesel fuel, the method of igniting the fuel is to be as follows:

a) The fuel and test chamber, including the walls and contained air, are to be preheated to a temperature of 100 ±5°F (38 ±3°C).

b) A sheet metal deflector is to be placed between the fuel pan and the sample under test.

c) Two 4-inch (100 mm) diameter rings of cotton stove wicking are to be placed in the fuel pan on expanded metal supports, so that the plane of the rings is parallel with and 1/8 inch (3.2 mm) above, the surface of the fuel. See Figure 16.3.

d) The rings are to be ignited. When the flames begin to spread across the surface of the fuel, the deflector is to be removed to begin the fire exposure period.

Figure 16.1
Fire Test Setup