UL 1110

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Marine Combustible Gas Indicators

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety
for
Marine Combustible Gas Indicators, UL 1110

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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.

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UL 1110

Standard for

Marine Combustible Gas Indicators

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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 differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, 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 electrically operated marine combustible gas indicating equipment for use in boats.

1.2 Marine combustible gas indicators are intended for permanent installation and for installation, maintenance, and use in accordance with the applicable requirements of the Standard for Fire Protection of Pleasure and Commercial Motor-Craft, NFPA 302, or the American Boat and Yacht Council, Inc.

1.3 These requirements cover ignition-protected equipment that may be used on boats under 65 feet (19.8 m) in length, but do not cover marine combustible gas detectors intended for use in hazardous locations aboard vessels subject to the U. S. Coast Guard electrical engineering regulations.

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 required to maintain the 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 is not judged to comply with this Standard. Where appropriate, revision of requirements are proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

2 Glossary

2.1 For the purpose of this standard, the following definitions apply.

2.2 LOWER EXPLOSIVE LIMIT – The lowest concentration of a flammable gas or vapor in air that will burn or explode.

2.3 MARINE COMBUSTIBLE GAS INDICATOR – One or more unit assemblies of electrical components that are constructed to detect and indicate the presence of a combustible gas or vapor aboard boats.

3 General

3.1 Components

3.1.1 Except as indicated in 3.1.2, 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.

3.1.2 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.

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

3.1.4 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.

3.2 Units of measurement

3.2.1 Unless otherwise indicated, all voltage and current values mentioned in this standard are rms.

3.2.2 If a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

CONSTRUCTION

4 Materials

4.1 A material used in an indicator shall be acceptable for use in a marine environment.

4.2 A metallic component of an indicator that is necessary for the indicator to perform its intended function and that may be exposed to corrosive conditions, such as a bilge combustible gas indicator, shall be fabricated of metals or metal alloys that are inherently resistant to corrosion in salt atmospheres (see Salt-Spray Corrosion Test, Section 13). Other metallic components shall be provided with a corrosion-resistant coating or equivalently protected against corrosion. Metal combinations shall be galvanically compatible.

5 Operation

5.1 An indicator shall be constructed to detect and indicate the presence of combustible vapors or gases for which it is intended. See Operational Tests, Section 12.

5.2 An indicator shall be provided with an indicating device. The indicating device may include either an audible or visual signal to show the presence of a combustible gas or vapor. Examples of audible signal devices are bells, horns, sirens, electronic horns, or buzzers. Visual indicators include lamps, light-emitting diodes, and meters.

5.3 An indicator that is marked for gasoline shall be provided with means to give visual and audible warning of the presence of a 20 percent or greater concentration (by volume) of the lower explosive limit of 87 – 93 octane gasoline vapor in air.

5.4 An indicator that requires a warm-up period to attain intended operation shall not indicate a satisfactory operating condition during the required warm-up period.

5.5 An indicator shall be provided with means that indicates the malfunction of a component due to immersion, burn-out of the filament, or other cause that affects the intended function of the indicator.

5.6 An indicator lamp shall be provided to indicate energized equipment.

5.7 A Wheatstone bridge or other circuit that may require balancing or adjustment shall be provided with an adjustment for the purpose. Such adjustments shall be recessed or so located that the adjustments cannot be unintentionally changed.

5.8 Provision shall be made for periodic testing (by the user) of the response of an indicator. A bilge or remotely-located component shall be removable for testing and recalibration. Also, see 16.2.

6 Assembly

6.1 General

6.1.1 An indicator shall be constructed to withstand the stresses to which it may be subjected during intended use.

6.1.2 An enclosure, a frame, a guard, a handle, or the like shall not be sufficiently sharp to constitute a risk of injury to persons in normal maintenance or use.

6.1.3 A means shall be provided to securely mount all components of the indicator to appropriate members of the vessel's structure. Only common hand tools (such as standard American or metric wrenches, straight or cross-recessed screwdrivers, or hexagonal wrenches) shall be required for the installation and, if necessary, for the calibration of the indicator.

6.1.4 A replaceable part, such as an indicating component or lamp, shall be accessible for maintenance.

6.1.5 An ignition source, such as a hot wire component, shall have flame arresting provisions, so that ignition of an explosive mixture will be contained and not propagate external to the component.

6.2 Wiring

6.2.1 The equipment frame shall not be used as a current-carrying part.

Exception: An instrument frame or electronically equipped frame intended to be mounted above the cockpit deck near the engine instruments may be internally grounded.

6.2.2 Barrier-type terminals or equivalent protection shall be provided to reduce the likelihood of ungrounded terminals, located outside a junction box or enclosure, short-circuiting with other terminals or ground.

6.2.3 A conductor shall not carry a current greater than the applicable value specified in Table 6.1. The current through a conductor connected between the control box and sensors located in machinery spaces shall not be greater than the derated value obtained by multiplying the applicable amperage value specified in Table 6.1 by the applicable correction factor specified in Table 6.2. The current through two or more current-carrying conductors that share the same duct or bundle and operate at potentials of 50 volts or more shall not be greater than the derated value obtained by multiplying the appropriate amperage values specified in Table 6.1 by the correction factor corresponding to the number of bundled conductors specified in Table 6.3.

Table 6.1
Maximum amperage of conductors

Conductor size		Temperature rating of conductor insulation						
AWG	(mm^2)	60EC (140EF)	75EC (167EF)	80EC (176EF)	90EC (194EF)	105EC (221EF)	125EC (257EF)	200EC (392EF)
18	(0.82)	10	10	15	20	20	25	25
16	(1.3)	15	15	20	25	25	30	35
14	(2.1)	20	20	25	30	35	40	45
12	(3.3)	25	25	35	40	45	50	55

Table 6.2
Derating of conductors in 60EC (140EF) engine space

Temperature Rating of Conductor Insulation	60EC (140EF)	75EC (167EF)	80EC (176EF)	90EC (194EF)	105EC (221EF)	125EC (257EF)	200EC (392EF)
Correction Factor for Current Derating	0.58	0.75	0.78	0.82	0.85	0.89	1.00

Table 6.3
Derating of bundled conductors operating at potential differences of 50 volts or more

Number of current-carrying conductors	Correction factor
3	0.70
4 to 6	0.60
7 to 24	0.50
25 and above	0.40

6.2.4 The insulation of internal wiring shall be:

a) Rated for the voltage and temperature to which it may be exposed;

b) Moisture resistant; and

c) Acceptable for use in a marine environment.

6.2.5 External conductors shall be of stranded copper or stranded tinned copper having one of the following insulation types:

a) A wire or cable insulation that complies with the requirements for electric boat cable;

b) A wire insulation that complies with the water absorption and flame retardance requirements in the Standard for Thermoplastic-Insulated Wires, UL 83; or

c) A thermoplastic insulation rated at 600 volts, acceptable for dry applications up to a temperature of 105EC (221EF) and acceptable for applications up to 60EC (140EF) where moisture resistance is required, as described in the Standard for Flexible Cord and Fixture Wire, UL 62, and the Standard for Thermoplastic-Insulated Wires, UL 83.

Exception: A flexible cord of the type mentioned in 6.1.2 need not comply with this requirement.

6.2.6 Each external single conductor shall be No. 16 AWG (1.3 mm^2) or larger and each conductor in a multiconductor sheath shall be No. 18 AWG (1.0 mm^2) or larger.

Exception: A resistance conductor required to be of a specific size for circuit calibration or conductors carrying less than 1 A that would not involve a risk of fire, electric shock, or injury to persons need not comply with this requirement.

6.2.7 Flexible cord shall be Type SJO, SJT, SJTO, SO, STO, or ST and shall comply with the requirements in the Standard for Flexible Cord and Fixture Wire, UL 62.

PERFORMANCE

7 General

7.1 An indicator shall be connected in accordance with the manufacturer's instructions and operated to determine that it operates as intended, prior to subjecting it to any tests. The same sample of the indicator shall be used for the tests specified in Sections 9, 10, 11, and 12.

8 Chemical Resistance Test

8.1 A nonmetallic component intended to be located in a bilge space shall show no evidence of deterioration or swelling that would cause a malfunction of the indicator or create a risk of fire or injury to persons and shall function as intended after being conditioned as specified in 8.3.

8.2 Individual components are to be used for this test.

8.3 The component is to be partially submerged in each of the following liquids for 100 hours at 23 ±3EC (73 ±5EF). Tests may be conducted in any sequence:

a) Salt water made of 5 percent by weight of sodium chloride in distilled water.

b) IRM immersion oil 903.

c) ASTM Reference Fuel C.

9 Temperature Tests

9.1 When tested in accordance with 9.2 – 9.5, an indicator shall not malfunction in a manner that would cause it to give an incorrect reading or to ignite the vapor to be measured.

9.2 One complete sample of the indicator, including any wiring supplied by the manufacturer, is to be subjected to these tests.

9.3 The sample is to be placed in a cold chamber and maintained at a temperature of minus 30EC (minus 22EF) for 24 hours. While in the cold chamber, any external wiring is to be bent around a 1 inch (25.4 mm) rod first in one direction, then the other.

9.4 Immediately following the cold temperature exposure, the device is to be clamped to a shock machine test surface and subjected to 25 impacts, each having a 10 g [322 feet per second per second (98 m/s^2)] acceleration and a 20 – 25 millisecond duration. See Shock Test, Section 11. The shock impacts are to be started within 30 seconds of removal from the cold chamber. The indicator is then to be operated and examined for damage.

9.5 The sample is to be placed in a heat chamber and maintained at a temperature of 60 ±3EC (140 ±5EF) for 24 hours. The sample is then to be removed from the heat chamber, set up, and operated for 7 hours at an ambient room temperature of 23 ±3EC (73 ±5EF).

10 Vibration Test

10.1 An indicator shall withstand 12 hours of vibration without development of a malfunction that may impair its intended operation.

10.2 The sample used in the Temperature Tests, Section 9, is to be used for this test.

10.3 The sample is to be mounted on a vibration table so as to simulate, as closely as possible, installation on a boat in accordance with the manufacturer's installation instructions. The means used for such mounting is to be sufficiently rigid to avoid resonant frequencies of the mounting means. The vibration table is to produce the vibration frequencies and amplitudes specified in 10.4.

10.4 The sample is to be subjected to variable frequency vibration in each of three rectilinear axes for 4 hours in each plane (total 12 hours) at a peak-to-peak amplitude of 0.015 ±0.001 inch (0.38 ±0.03 mm) for those parts of the system intended to be installed at or near the helm position and of 0.030 ±0.001 inch (0.76 ±0.03 mm) for components located in bilge spaces. The frequency of vibration is to be continuously varied, at a uniform rate, from 10 to 60 to 10 hertz every 4 minutes. The sample is to be operated for the last 5 minutes, and for 5 minutes after the conclusion, of the vibration in each plane, and examined for damage.

10.5 For these tests, peak-to-peak amplitude is defined as the maximum displacement of sinusoidal motion (total table displacement).

11 Shock Test

11.1 An indicator shall withstand 5000 shock impacts without malfunction or development of a condition that involves a risk of fire, electric shock, or injury to persons.

11.2 The sample used in the Vibration Test, Section 10, is to be used for this test. The sample is to be operated after completion of the test and examined for compliance with 11.1.