UL 1113

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Electrically Operated Pumps for Nonflammable Liquids, Marine

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UL Standard for Safety for Electrically Operated Pumps for Nonflammable Liquids, Marine, UL 1113

Fourth Edition, Dated March 1, 2004

Summary of Topics

This new edition of UL 1113 is issued for the addition of performance requirements for non-bildge pump operation under abnormal conditions, addition of a marking requirement for bildge pumps, and miscellaneous editorial revisions.

The requirements are substantially in accordance with UL's Bulletin(s) on this subject dated December 12, 2003. The bulletin(s) is now obsolete and may be discarded.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

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
1-24	March 1, 2004

UL 1113

Standard for Electrically Operated Pumps for Nonflammable Liquids, Marine

First Edition – August, 1977
Second Edition – October, 1986
Third Edition – September, 1997

Fourth Edition

March 1, 2004

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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No Text on This Page

CONTENTS

No Text on This Page

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 electrically operated pumps rated less than 50 volts direct current (dc), and intended for use on vessels to pump nonflammable liquids, such as bilge water, potable water, and the like.

1.2 The pumps covered by these requirements are intended to be installed in accordance with the Fire Protection Standard for Pleasure and Commercial Motor Craft, ANSI/NFPA 302; the standards and recommended practices of the American Boat and Yacht Council, Inc.; and the applicable regulations of the United States Coast Guard.

1.3 These requirements do not cover pumps intended for use in hazardous locations aboard United States Coast Guard inspected vessels.

1.4 These requirements cover ignition-protected pumps that are be required on boats under 65 feet (19.8 m) in length.

1.5 These requirements cover pumps intended for continuous duty.

1.6 Combination pump/blowers are covered by these requirements and by the requirements in the Standard for Marine Blowers, UL 1128.

2 Glossary

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

2.2 AUTOMATIC PUMP – A pump that automatically begins pumping when the liquid level attains a predetermined depth and stops when the liquid reaches a predetermined low level.

2.3 CONTINUOUS OPERATION PUMP – A pump capable of continuous operation at a voltage of 120 percent of rated normal voltage.

2.4 DESIGN VOLTAGE – A voltage of 113.3 percent of the nominal voltage.

2.5 IGNITION-PROTECTED – A device or component constructed so that it will not ignite a mixture of propane and air surrounding the device under operating conditions. An ignition-protected device is not necessarily ″explosion proof,″ as that term is applied to commercial vessels. An ″ignition-protected″ device may have exposed input and output wiring as permitted by the Fire Protection Standard for Pleasure and Commercial Motor Craft, ANSI/NFPA 302, the standards of the American Boat and Yacht Council, and the applicable Regulations of the United States Coast Guard for uninspected vessels.

2.6 NOMINAL VOLTAGES – Commonly available storage battery voltages (6, 12, 24 and 32 volts dc).

2.7 NONSPARKING PUMP – A pump that will not, under operating conditions, produce sparks of sufficient energy to ignite a flammable hydrocarbon mixture.

2.8 NONSUBMERSIBLE PUMP – A pump intended to be operated with the pump motor not less than 18 inches (457 mm) above an anticipated water level.

2.9 NORMAL HAND TOOLS – Any standard American or metric wrench or screwdriver (straight or cross-point), and standard hexagonal wrenches.

2.10 SUBMERSIBLE PUMP – A pump intended to be operated while totally immersed in water.

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 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.

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

3.4 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.

4 Units of Measurement

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

5 Undated References

5.1 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

6 General

6.1 All external edges, projections, and corners shall be smooth, rounded, and not sufficiently sharp to result in a laceration injury in intended use and maintenance of the product.

6.2 The mounting brackets, or other means provided to secure the pump to the boat, shall be of a type and so located that proper installation is capable of being made with normal hand tools. The securing means shall be designed so that the pump maintains a fixed relationship to the boat when subjected to the vibration and shock loads of marine service. See Vibration Test, Section 19 and Shock Test, Section 20.

6.3 The materials used for the impeller and the housing of the pump shall be nonsparking.

6.4 Pumps having the following characteristics are determined to be nonsparking:

a) Impeller or housing formed of nonmetallic materials;

b) Impeller and housing formed of nonferrous metals;

c) Impeller and housing formed of noncorrosive stainless steel;

d) Ferrous impellers and housing with not less than 1/2 inch (12.7 mm) tip clearance; or

e) Blades formed of aluminum or magnesium alloy and a ferrous housing with a nonferrous insert ring at the periphery of the impeller.

6.5 Any combination of components formed when a ferrous component is used with either an aluminum alloy or a magnesium alloy is identified to be sparking regardless of the material used as the fixed or rotating components.

7 Enclosures and Guards

7.1 The enclosure shall be so formed and assembled that it has the strength and rigidity required to resist the abuses to which it is liable to be subjected without total or partial collapse, loosening or displacement of parts, or other serious defects that impair intended operation of the pump.

7.2 The impeller shall be so enclosed or guarded as to prevent accidental contact during intended operation.

7.3 The degree of protection required of an enclosure by 7.2 is based upon the general design and the intended use of the pump.

8 Materials

8.1 Nonmetallic materials and finished coatings exposed to bilge water shall be resistant to deterioration by gasoline, oil, kerosene, and salt water. See Exposure to Solvents Test, Section 23.

8.2 A synthetic rubber part shall comply with the requirements of the Exposure to Solvents Test, Section 23.

8.3 A synthetic rubber part which is able to be affected by aging, the deterioration of which impairs intended operation of the pump, shall not crack nor show visible evidence of deterioration such as discoloration, shrinking, swelling, melting, or warping following exposure in an air oven for 70 hours at 100 ±2°C (212 ±3.6°F).

8.4 All materials used shall withstand the temperature range of minus 30°C (-22°F) to plus 85°C (185°F). See also Temperature Tests, Section 21.

9 Corrosion Protection

9.1 Iron and steel parts, except motor laminations and minor parts which are totally enclosed within the pump or motor, shall be protected against corrosion by enameling, galvanizing, zinc or cadmium plating, or other equivalent means. See also 10.2.

Exception: Phosphate treatment with an oil or wax coating meets the intent of the requirement as corrosion protection for magnets and armatures; oil treatment is satisfactory as corrosion protection for steel springs; and stainless steel is satisfactory without additional protection, when properly polished or treated.

9.2 The composition of exposed metallic alloys, such as motor shafts, shall provide corrosion resistance at least equivalent to stainless steel alloy 410 and shall be galvanically compatible with other parts of the pump and of the system. A component not known to provide intended resistance to corrosion shall be subjected to the Salt Spray Corrosion Test, Section 26.

10 Current-Carrying Parts

10.1 A current-carrying part shall be of silver, copper, a copper alloy, or other metal capable of being used for the particular application in a marine environment.

10.2 Iron or steel are not prohibited from use as a current-carrying part within a motor or associated governor when provided with a corrosion-resistant coating, as defined in 9.1. The use of iron or steel for a current-carrying part elsewhere in the pump does not meet the intent of the requirements. The use of stainless steel for a current-carrying part is satisfactory.

11 Wiring

11.1 The wiring and connections between parts of a pump shall be mechanically protected or enclosed.

Exception: Flexible cord is not required to be enclosed.

11.2 All conductors, other than short internal jumpers and those in wound coils, shall be stranded copper.

11.3 Wires routed within an enclosure, compartment, or raceway shall be supported and routed to prevent damage to the conductor insulation resulting from contact with any rough or sharp edge or moving part.

11.4 A hole in a wall or partition through which insulated wires or cords pass, or on which has the potential to bear within the overall enclosure of the pump, shall be provided with a smooth rounded bushing, or the hole shall have a smooth rounded surface to prevent abrasion of the insulation.

11.5 Internal wiring shall have insulation rated for the potential and temperature to which it is subjected, and shall be a minimum of 18 AWG (1.0 mm^2). Thermoplastic-insulated wire employed for internal wiring shall be marine wire or appliance wiring material intended for use in moist or wet locations.

11.6 When stranded internal wiring is connected to a wire-binding screw, loose strands of wire shall be prevented from contacting other uninsulated live parts and dead-metal parts. This shall be accomplished by the use of pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or by other equivalent means.

12 Field Power Supply Connections

12.1 A nonsubmersible pump shall be provided with:

a) Field wiring terminals for connection of power supply conductors corresponding to the marked rating of the pump; or

b) Pigtail leads or flexible cord.

12.2 A submersible pump shall be provided with pigtail connections (leads or flexible cord) a minimum of 16 inches (406 mm) long.

12.3 When flexible cord is used, it shall be Type SJO, SJT, SJTO, SO, ST, or STO and shall be not less than 16 inches (406 mm) long.

12.4 Conductors of a pigtail connection shall be 16 AWG (1.3 mm^2) or larger when single and 18 AWG (1.0 mm^2) or larger when in a multiconductor sheath and shall be one of the following types:

a) A stranded conductor that has insulation complying with the moisture-resistance and flame-retardance requirements in the Standard for Thermoset-Insulated Wires and Cables, UL 44, or the Standard for Thermoplastic-Insulated Wires and Cables, UL 83 (Type RHW, THW, and similar materials).

b) Type BC (boat cable).

c) A stranded conductor that complies with the requirements of the Recommended Practice for Marine Engine Wiring, ANSI/SAE J378; Standard for Battery Cable, SAE J1127; or Standard Practice for (R) Low Tension Primary Cable, SAE J1128.

12.5 Terminals shall be located or enclosed to reduce the risk of water accumulating between terminals of opposite polarity and between the terminals and ground.

12.6 An exposed metallic part of a pump shall have provision for connection of a bonding conductor unless the part is isolated from all current-carrying parts by independent insulation provided in addition to the basic insulation. See Stray Current Leakage Test, Section 22.

13 Strain Relief

13.1 A pigtail connection of flexible cord employed for field wiring shall be provided with strain relief so that a stress on the lead or cord will not be transmitted to terminals, splices, or internal wiring, as determined in the Strain Relief Test, Section 28.

13.2 A metal strain-relief clamp or band (without auxiliary protection) is capable of being used with a Type SJO, SJT, SJTO, SO, ST, or STO cord.

13.3 The pigtail connections of a nonsubmersible pump shall be prevented from being pushed into the pump through the cord-entry hole when such displacement subjects the leads to mechanical damage or exposure to a temperature higher than that for which the leads are intended.

13.4 When a knot in a flexible cord serves as strain relief, a surface with which the knot comes in contact shall be free from projections, sharp edges, burrs, fins, or similar, that is able to abrade the insulation on the conductors.

14 Motor Protection

14.1 A pump shall be protected against stalled rotor conditions by any of the following means:

a) The motor incorporates a protector that complies with the stalled rotor requirements of the Standard for Overheating Protection for Motors, UL 2111.

b) An impedance-protected motor complying with the Standard for Motor-Operated Appliances, UL 73.

c) The pump is marked that it is to be protected by an overcurrent means. The means to be used shall:

1) Be specified by the manufacturer [see 35.1(g)];

2) Be acceptably rated for the application; and

3) Function within 2 minutes after development of a stalled-rotor condition.

d) The pump complies with the Locked Rotor Test, Section 29.

15 Insulating Material

15.1 Material for mounting uninsulated current-carrying parts shall be porcelain, phenolic composition, or other material intended for a marine environment.

15.2 Vulcanized fiber is not prohibited from use for insulating bushings, washers, separators, and barriers, and not as the sole support for uninsulated current-carrying parts.

15.3 Thermoplastic materials are able to employed for the sole support of uninsulated current-carrying parts, provided the material is of a type previously investigated and found usable for the application, or complies with the requirements of 15.4.

15.4 Thermoplastic material not previously investigated and found capable of being used for the application is able to be employed for the sole support of uninsulated current-carrying parts when:

a) An examination of the pump following the Performance Tests of Sections 18 – 31 reveals no cracking, distortion, or other degradation to the extent that the operation of the pump is impaired;

b) The pump satisfactorily complies with the requirements of the Stray Current Leakage Test, Section 22 following the 500 hour aging test described in Section 30; and

c) The flammability characteristic of the material is determined to be at least equivalent to Type V-2 in accordance with the requirements for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

15.5 Small molded parts, such as brush caps, shall have the mechanical strength and rigidity required to withstand the stresses of intended service, without cracking, distortion, or other degradation to the extent that the operation of the pump is impaired. Brush caps shall be secured or located so as to be protected from mechanical damage.

16 Switches and Controllers

16.1 A switch or other control device provided with the pump shall be rated for controlling the loads involved. See Overload Test, Section 31.

PERFORMANCE

17 General

17.1 A representative sample pump shall be subjected to all tests, and in the order listed.

Exception: The Exposure To Solvents Test, Section 23, shall be conducted on sample materials.

18 Input Test

18.1 The current or wattage input to a pump shall be not more than 110 percent of the rated value when the pump is operated under maximum operating load for 5 minutes while connected to its nominal supply voltage.

19 Vibration Test

19.1 A pump shall withstand 12 hours of vibration without development of any condition that impairs the intended operation of the pump or its mounting provisions.

19.2 The pump is to be secured to the vibration machine test fixture in its intended operating position in accordance with the manufacturer's installation instructions, and an unsupported one foot (0.3 m) length of hose or pipe is to be attached to each inlet and discharge connection. When the inlet or discharge connection is threaded for standard pipe, iron pipe is to be used. When the connection is intended for hose, SAE Type 30R1 or equivalent hose is to be clamped to the connection.

Exception: If the manufacturer's instructions specifically require pipes or hose to be supported within 12 inches (305 mm) of the pump or less, the pipe or hose shall be supported in accordance with the instructions.

19.3 The test sample is to be subjected to vibration in each of three axes (horizontal, lateral, and vertical), for 4 hours in each axis (total 12 hours), at a peak-to-peak amplitude of 0.030 ±0.001 inches (0.76 ±0.015 mm). The frequency of vibration is to be continuously varied, at a uniform rate, from 10 to 60 to 10 hertz every four minutes.

19.4 For this test, peak-to-peak amplitude is defined as the maximum displacement of sinusoidal motion (total table displacement).

19.5 To establish compliance with 19.1, the pump shall operate in its intended manner before and after the test. While the pump is operating, water shall be provided as required at the impeller so that bearings are not operated dry.

20 Shock Test

20.1 A pump shall withstand 5000 shock impacts without development of any condition that impairs the intended operation of the pump or its mounting provisions.

20.2 The pump, with pipe or hose attached in accordance with 19.2, is to be mounted on a test table and the assembly subjected to 5000 shock impacts, each having an acceleration of 10 g [322 feet per second per second (98 m/s^2)] and a duration of 20 – 25 milliseconds as measured at the base of the half-sine shock envelope.

20.3 The machine used for this test is to be of the automatic cycling type capable of producing a half-sine shock pulse at the acceleration level and duration specified. The acceleration and shock pulse duration are to be measured by a piezo-electric accelerometer mounted on the test machine platform on an axis parallel to the axis of motion.

20.4 The test sample is to be mounted so that the center of gravity of the sample is as close as possible to the geometric center of the machine platform.

20.5 To establish compliance with 20.1, the pump shall operate in its intended manner before and after the test.

21 Temperature Tests

21.1 Cold temperature

21.1.1 There shall be no evidence of cracking or development of any condition that impairs its operation when a pump is subjected to the test described in 21.1.2 and 21.1.3.

21.1.2 The pump is to be placed in a cold chamber maintained at minus 30 ±3°C (minus 22 ±5°F) for 24 hours. At the end of the 24 hours, wiring subject to flexing in normal use is to be wrapped 360 degrees around a mandrel of the appropriate size specified in Table 21.1, first in one direction and then the other, prior to removal from the cold chamber.

Table 21.1
Mandrel diameters

Wire size		Mandrel diameter	
AWG	(mm^2)	Inches	(mm)
16	1.3	0.313	7.95
14	2.1	0.313	7.95
12	3.3	0.375	9.53
10	5.3	0.563	14.3
8	8.4	0.688	17.5
6	13.3	1.250	31.8
4	21.2	1.375	34.9
2	33.6	1.563	39.7
1	42.4	2.688	68.3

21.1.3 Immediately following the Cold Temperature Test, the pump shall be clamped to the shock test table, see Shock Test, Section 20, and subjected to 25 shock impacts, each having an acceleration of 10 g (98 m/s^2) and a duration of 20 – 25 milliseconds. The shock impacts shall be started within 30 seconds

after removal from the cold chamber. When the transfer is unable to be made in the time specified, the pump shall be wrapped in insulating material to prevent a temperature rise in excess of 5°C (9°F) before the initial impact.

21.2 High temperature

21.2.1 No external temperature on the pump shall exceed 150°C (302°F) during this test. There shall be no softening, swelling, or development of any condition that impairs the operation of the pump, nor shall there be any evidence of water in any part of the pump intended to be sealed against the entry of water.

21.2.2 A pump shall be so placed in an oven that it is operated in its intended manner against a zero head. The oven temperature and the pumping liquid temperature shall be 60 ±5°C (140 ±9°F).

21.2.3 The pump shall be operated continuously at 120 percent of nominal voltage for a period of 24 hours.

21.2.4 Thermocouples shall be attached to the pump motor stator windings or, in the case of a permanent magnet motor, to the magnet, to the external pump housing, and to other parts as deemed advisable for the purpose of recording operating temperatures.

21.2.5 It is common practice to employ thermocouples consisting of 30 AWG (0.05 mm^2) iron and constantan wires and a potentiometer-type instrument. Such equipment is utilized whenever referee temperature measurements by thermocouples are specified.

21.2.6 Submersible pumps shall be operated at a minimum liquid level sufficient to maintain full volume circulation.

22 Stray Current Leakage Test

22.1 The test shall be conducted while the pump is still in a heated condition following the high temperature test specified in 21.2.1 – 21.2.6.

22.2 A continuously energized pump shall be capable of withstanding a voltage of 500 volts dc for 1 minute without leakage in excess of 1 milliampere.

22.3 The test voltage shall be applied between the current-carrying parts of the pump and dead-metal parts. When the test is applied to internally grounded pumps, the ground connection shall be disconnected prior to the test.

22.4 The test voltage shall be applied at a rate of 50 volts per second until the test potential is reached. After the voltage has been maintained for 1 minute, it is to be reduced to zero at the same rate used to apply it.

23 Exposure to Solvents Test

23.1 Exposed nonmetallic materials:

a) Which form part of the enclosure of an ignition-protected product or component; or

b) Whose deterioration impairs intended operation of the pump,

shall sustain a loss in tensile strength of not more than 40 percent or a swelling of not more than 50 percent when immersed for 48 hours in each of the test fuels specified in Table 23.1.

Table 23.1
Test fuels

Fuel	ASTM Designation
Reference Fuel C	D471
IRM 903	D471

24 Humidity Exposure Test

24.1 Following exposure for 96 hours to air at a relative humidity of 90 ±5 percent and a temperature of 32 ±2°C (90 ±4°F), a nonsubmersible pump shall operate as intended under maximum operating load and at nominal input voltage for 5 minutes, during which time the electrical input shall be not more that 110 percent of the value recorded during the Input Test, Section 18. The pump is not to be energized during exposure to the moist air.

25 Operation Tests

25.1 Cycling

25.1.1 A pump shall operate as intended for 5000 ″on-off″ cycles while connected to 110 percent of nominal voltage and operating at zero head. Manual pumps are to be cycled by any acceptable means. Automatic pumps are to be automatically cycled.

25.2 Pump characteristics

25.2.1 The operational characteristics of a pump shall be determined with respect to:

a) Capacity versus head or pressure;

b) The suction lift capability of self-priming pumps; and

c) Operation of all submersible pumps while submerged 5 feet (1.52 m) below the water surface, or at the maximum permissible depth specified by the manufacturer, for 1 hour without failure of the seals.

25.2.2 For purposes of determining pump capacity, the following operating conditions are to be applied:

a) The pump is to be operated at nominal voltage, except that when both nominal and design voltages are marked on the pump, pump characteristics are to be determined at both voltages.

b) The pump intake and discharge hoses are to have the same internal diameter as the fittings provided on the pump and are to have a smooth interior surface. All bends are to have as large a radius as possible and the hose length is to be as short as possible to minimize resistance.

c) At zero static head, the discharge hose is to be positioned 1 inch (25.4 mm) above the liquid level at the pump, and the pump is to be positioned so that there is no air at the impeller.

25.3 Abnormal conditions

25.3.1 A pump shall show no evidence of swelling, softening, or other deterioration that impairs intended operation, nor shall there be evidence of water in any part of the pump intended to be sealed against the entry of water, when the pump is tested in accordance with 25.3.3.

25.3.2 A non-bilge pump shall be permitted to cease normal operation during or after the pump is tested in accordance with 25.3.3 but shall show no evidence of water in any part of the pump intended to be sealed against the entry of water. In addition, non-bilge-use pumps shall meet the requirements outlined in 25.3.4

25.3.3 The pump is to be intermittently operated for 5 days while pumping a mixture with the proportions of 5 gallons (18.9 liters) of sea water, 1 gallon (3.8 liters) of crankcase oil, and 2 quarts (1.9 liters) of gasoline (Reference Fuel C). To compensate for evaporation, 1 quart (0.95 liter) of gasoline is to be added to the mixture each day, 15 minutes prior to the pump operating period. A submersible pump is to be operated at nominal voltage for a continuous period of 4 hours each day under a 3 foot (0.9 m) head at 23 ±2°C (73 ±4°F). A nonsubmersible pump is to be operated at nominal voltage and in a manner simulating intended operation at 23 ±2°C. The pump intake and discharge are to be arranged to keep the mixture agitated while the pump is operating, and the pump is to be monitored periodically to verify that it functions continuously and in the intended manner.

25.3.4 A pump, together with its mounting brackets and impeller, is to be securely mounted on a pine wood board and completely covered with a double layer of cheesecloth. While connected to its nominal voltage source, the pump is to be operated dry for a period of 7 hours or until ultimate conditions occur, whichever is first. During the test, the ambient temperature is to be 25 ±3°C (77 ±5°F). At the conclusion of the test period the pump is not required to be operable and the cheesecloth covering shall not have ignited.