SAE Aerospace
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AEROSPACE STANDARD

SAE AS4492

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Survivor Locator Lights

1. SCOPE:

This document covers steady type lights (Type I) and flashing-type lights (Type II).

1.1 Purpose:

This document provides minimum performance and design standards to be applied to battery-powered emergency lights intended to be fitted to individual and multiplace flotation devices to mark the location and aid in the marshalling of aviation accident survivors in bodies of water.

2. REFERENCES:

The following publications form a part of this specification to the extent specified herein. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 RTCA Publications:

Available from Radio Technical Commission for Aeronautics, One McPherson Square, 1425 K Street, NW Suite 500, Washington, DC 20005.

DO-160C

3. DEFINITIONS:

3.1 Survivor Locator Light:

A device consisting of parts and components which may include but is not limited to a light source (e.g., electrical, gas or chemically generated, self-luminous), a battery pack (primary or reserve type), interconnecting electrical wires, rigging/activation means, and integral attachment/security means.

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3.2 Host Equipment:

Individual life preservers, life rafts, and slide/rafts and other survival equipment to which a survivor locator light may be fitted.

3.3 Primary Batteries:

Nonrechargeable batteries with self-contained, stored potential electrochemical systems requiring only closing of an electrical circuit for operation.

3.4 Reserve Batteries:

Batteries that are chemically inert and unable to generate electrical energy until introduction of an external electrolyte (in this case, fresh or seawater).

4. MINIMUM PERFORMANCE AND DESIGN STANDARDS:

4.1 Configuration/Design:

The survivor locator light shall be designed and configured in such a way as to preclude harm to the survivor or adversely affect the operation, performance, or physical integrity of host equipment while packed or in active use; special care shall be taken to avoid sharp edges or protrusions. The design of the survivor locator light and its parts, including any electrical wires, shall be such to minimize snagging while the host equipment is donned or in use, including evacuation from the aircraft.

4.2 Materials:

Materials used in the survivor locator light shall be compatible with materials and processes used in the construction of host equipment and shall not contribute to the degradation of same.

4.3 Light Characteristics:

4.3.1 General: Survivor locator lights may be steady on (Type I) or flashing (Type II). Emitted light shall be white, in the spectral range of 380 to 780 nn, or yellow-green, in the spectral range of 530 to 560 nn. The device shall be capable of functioning at or above minimum light intensities while the integral battery is immersed in fresh or seawater at 2 °C, uninterrupted, for a period of 8 h at the end of the rated service life of the battery.

4.3.2 Steady-Type Lights (Type I): The steady-type survivor locator light shall be shown by test to provide a minimum effective luminous intensity of 1.0 candela over the operating regime established in 4.3.1. The minimum light output shall be provided within a minimum 1° beam width centered on the horizon (±10°) over a minimum of 300° of arc in the horizontal plane with gaps of no more than 30°, and within a minimum 1° beam width centered on the vertical (±10).

4.3.3 Flashing-Type Lights (Type II): The flashing-type survivor locator light shall be shown by test to provided a minimum effective luminous intensity of 1.0 candela over the operating regime established in 4.3.1, where the minimum effective luminous intensity is calculated according to Equation 1. The minimum light output shall be provided through 180 of arc centered on the vertical (±10°), over a minimum of 300° of horizontal arc with gaps of no more than 30°. The flash rate shall be 60 ± 10 flashes per minute.

$$Ie = \frac{\int_{t_1}^{t_2} I(t)dt}{0.2 + (t_2 - t_1)} \qquad \text{(Eq.1)}$$

where:

Ie = Effective luminous intensity
I(t) = Instantaneous intensity at time t
0.2 = Biondel-Rey constant
t_1 and t_2 = Flash time interval (seconds)

4.4 Power Source (Battery):

The power source for the survivor locator light shall be based on either a primary (nonrechargeable) chemical cell or a reserve battery activated and operated by the introduction of fresh or salt water. Due to the proximity of survivor locator lights to the head of survivor when fitted on individual life preservers, no battery technology may be used which will expose the survivor or the host equipment to injurious effects of explosion, flame, high exothermic heat radiation, or the discharge of toxic or incapacitating effluents under any reasonable set of operational eventualities including but not limited to one or a combination of the following:

a. Cell rupture
b. Puncture
c. Short circuit
d. Exposure to fresh or salt water

4.4.1 Primary Batteries: In the case of primary batteries, positive means to prevent short-circuits and to preclude damage that might be caused in such eventuality must be provided; a positive means to prevent inadvertent activation of the light must also be provided. Additional design consideration shall be given to venting of gases generated within the cell and protection of the user and the host equipment from outgassing or cell leakage.

4.4.2 Reserve Batteries: In the case of reserve batteries, a positive means of protecting the battery from the introduction of moisture and resultant deterioration must be provided while ensuring that the light activation requirements of 4.5.2 are met.

4.5 Light Activation - General:

Activation of the survivor locator light shall be automatic upon contact with or immersion in fresh or sea water, and the activation means shall be configured, rigged, and/or located on the host equipment in such a way as to provide for automatic activation upon entry of the survivor into the water with the host equipment properly donned or deployed. The survivor locator light must be armed and ready for automatic activation when the host equipment is removed from its primary container, donned, and/or deployed.

4.5.1 Light Activation - Primary Batteries: Activation of primary batteries may be accomplished with a reliable mechanical or electrical water-sensor. Primary batteries shall be designed to ensure that the light remains activated once automatic activation has occurred. This may be accomplished by an electrical latching circuit or other means. Switches which include delayed-action devices and/or moisture barriers shall be shown to provide for automatic activation of the device, with light output meeting the established minimums within the times provided in Table 1.

4.5.2 Light Activation - Reserve Batteries: Activation of reserve batteries is to be accomplished with immersion in fresh or sea water. Such batteries must be designed for and located on the host equipment such that they remain immersed. A suitable means to prevent degradation of the battery due to moisture or humidity exposure over long term storage is required. The battery, along with any passive, water-soluble moisture barriers, shall be shown to be capable of developing sufficient power to meet minimum required light output within the activation times specified in Table 1. If the battery is provided with a mechanic moisture protection device or means, such as plugs, and their removal is necessary to provide for activation of the survivor locator light, these devices and/or means must be designed and rigged in such a way as to be automatically removed from the battery upon removal of the host equipment from its primary packaging or upon inflation of the buoyancy chambers.

TABLE 1 - Maximum Light Activation Time to Minimum Required Effective Luminous Intensity

Sea Water	5 min at water temperature of 2 °C and higher
Fresh Water	10 min at water temperature of 2 °C and higher

4.6 Service Life Limitations:

Service life limitations for the power source (battery) shall be established for primary and reserve batteries in accordance with the following paragraphs. Service life limitations shall be prominently marked on the battery.

4.6.1 Primary Batteries: Primary batteries for survivor locator lights shall have a rated service life equal to no more than that recommended by the primary cell manufacturer, but in no case more than the average time since manufacture at which self-discharge rates or other cell degradation mechanisms reduce available cell energy to the point that the light intensity and duration requirements of document cannot be met. Tests for light intensity and duration, as may be required to show conformance to this document, should be conducted with cells discharged to calculated end-of-service life capacity levels.

4.6.2 Water-Activated Reserve Batteries: The service life for water-activated reserve batteries may be termed "indefinite" or "on condition" if:

a. They are chemically inert prior to the introduction of moisture through immersion or humidity
b. They are adequately protected against moisture degradation per 4.5.2 and 4.9.2
c. They are not susceptible for or are properly protected against other degradation mechanisms including but not limited to aging (e.g., embrittlement) and long term vibration
d. There is a stated means to test for and/or identify reserve batteries that are inoperable or compromised to the extent that they cannot meet the recommended operational requirements of this document.

In cases where reserve battery service life cannot be defined as "indefinite" or "on condition" as specified, the stated service life shall be no more than that recommended by the manufacturer, but in no case more than the average time since manufacture at which self-discharge rates or other degradation mechanisms reduce available cell energy to the point that the minimum requirements of this document cannot be met.

4.7 Attachment Provisions:

The design of the survivor locator light and any detached and/or connected components, such as battery packs, shall include provisions for secure attachment to host equipment such that when properly installed, the light and any remote parts cannot be removed except by deliberate action. Special consideration shall be given to attachment security under conditions related to evacuation from the aircraft, entry into the water, entry onto flotation platforms, and rescue.

4.8 Moisture Protection:

The survivor locator light (with exception of the battery section of water-activated reserve batteries) shall be waterproof and exhibit no evidence of moisture penetration when tested in accordance with 4.9.6.

4.9 Tests:

The following tests represent the minimum required for qualification of survivor locator lights to this document. These tests are applicable to both primary and reserve battery power units, except as noted. Each test is to be conducted on a minimum of three randomly selected test articles. Test articles are to be production units or representative of production units in all respects. The test articles must be shown to activate automatically and illuminate upon immersion in fresh water at 70 °C (±3 °C) after each test (except the waterproofness test of 4.9.6).

4.9.1 Luminous Intensity: The effective luminous intensity requirements of 4.3.1 and/or 4.3.2 shall be demonstrated using standard photometric measuring techniques.

4.9.2 Humidity: Perform the tests outlined in RTCA Document DO-160C, paragraph 6.3.1 (Category A - Standard Humidity Test).

4.9.3 Operation Shock and Crash Safety: Perform the tests outlined in RTCA Document DO-160C, Section 7.0 (impulse tests only).

4.9.4 Vibration: Perform the tests outlined in RTCA Document DO-160C, Section 8.0, corresponding to "standard" vibration (paragraph 8.5), per vibration test curve "B" on Table 8-1 and Figure 8-1 (fixed wing turbojet, instrument panel/console and equipment rack mounted, on vibration insulators).

4.9.5 Explosion Proofness: Perform the tests outlined in RTCA Document DO-160C, Section 9.0 for Environment I conditions, Category A equipment.

4.9.6 Operation and Waterproofness: Each test sample shall be submerged in fresh water maintained at 20 °C ± 3 °C to a depth of 1 m (39.3 in) for a period of at least 8 h. The tests articles shall exhibit proper activation function and illuminate for the entire test period. Inspection of the test articles after the test shall yield no evidence of water penetration (with the exception of the battery in configurations using water-activated reserve batteries).

4.9.7 Salt Spray: Perform the spray proof tests outlined in RTCA Document DO-160C, Section 14, for Category S equipment.

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