



AEROSPACE STANDARD

AS5134™**REV. C**

Issued	2001-06
Reaffirmed	2007-09
Revised	2020-08

Superseding AS5134B

(R) Aviation Visual Distress Signals (AVDS)

RATIONALE

This Aerospace Standard is revised to harmonize significant signalling characteristics of the AVDS with the release of RTCM Standard 13200.0 "Electronic Visual Distress Signal Devices (EVDSD)." Harmonization of the visible and infrared signal pattern to the RTCM's recommended Morse Code "SOS" prosign ensures a common distress signal format for marine and aviation emergencies on the water.

1. SCOPE

This SAE Aerospace Standard (AS) provides minimum performance and design standards for a handheld, high-intensity, flashing Aviation Visual Distress Signal (AVDS) based on light-emitting-diode (LED) technology operating simultaneously in visible (white) and near infrared (NIR) spectra designed to facilitate location and rescue of aviation accident/ditching survivors in open sea conditions.

1.1 Purpose

The purpose of this document is to specify the performance requirements for an LED-based distress signal that can be used in lieu of pyrotechnic flares in transport category aircraft survival kits, meeting the following objectives: (a) provide an equivalent level of safety to pyrotechnic flares with respect to utility as an aid to search and rescue, and (b) eliminate the serious and potentially life-threatening hazards to life-saving equipment and ditching survivors posed by the use of pyrotechnics by untrained personnel in inflatable life rafts or slide/rafts.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. 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.

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Documents
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2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR5690	Rationale for Replacement of Pyrotechnic Signaling Devices in Survival Kits on Transport Category Aircraft Life Rafts and Slide-Rafts
ARP577	Emergency, Instruction and Information Placards - Internal and External
ARP1282	Survival Kit - Life Rafts and Slide/Rafts

2.1.2 United States Code of Federal Regulations

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

Title 14, § 25.853	Compartment interiors
Title 14, § 25.1415	Ditching equipment
Title 14, § 45.15	Marking requirements for PMA articles, TSO articles, and Critical parts
Title 14, § 91.509	Survival equipment for overwater operations
Title 14, § 121.339	Emergency equipment for extended over-water operations
Title 14, § 125.209	Emergency equipment: Extended overwater operations
Title 14, § 135.167	Emergency equipment: Extended overwater operations

2.1.3 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

FAA Technical Standard Order TSO-C69	Emergency Evacuation Slides, Ramps, Ramp/Slides, and Slide/Rafts
FAA Technical Standard Order TSO-C70	Life Rafts
FAA Technical Standard Order TSO-C85	Survivor Locator Lights
FAA Technical Standard Order TSO-C142	Non-Rechargeable Lithium Cells and Batteries
FAA Technical Standard Order TSO-C168	Aviation Visual Distress Signals
FAA Advisory Circular AC 91-58A	Use of Pyrotechnic Visual Distress Signaling Devices in Aviation
FAA Report DOT/FAA/AM-13/15	Experimental Effective Intensity of Steady and Flashing Light Emitting Diodes for Aircraft Anti-Collision Lighting

2.1.4 RTCM Publications

Available from Radio Technical Commission for Maritime Services, 1621 N. Kent Street, Suite 705, Arlington, Virginia 22209.

RTCM 13200.0	Electronic Visual Distress Signal Devices (eVDSD)
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2.1.5 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

RTCA/DO-160 Environmental Conditions & Test Procedures for Airborne Equipment

RTCA/DO-227 Minimum Operational Performance Standards for Lithium Batteries

2.1.6 United States Coast Guard Publications

Available from Department of Homeland Security, Acquisition Directorate, Research & Development Center, United States Coast Guard.

Report No: CG-D-06-12

"Suitability of Potential Alternatives to Pyrotechnic Distress Signals,
Interim Report," dated February 2012

Report No. CG-D-04-15

“Alternatives to Pyrotechnic Distress Signals; Laboratory and Field Studies,” dated March 2015

Report No. CG-D-17-15

“Alternatives to Pyrotechnic Distress Signals; Supplemental Report,”
dated August 2015

Report No. CG-D-06-17

“Alternatives to Pyrotechnic Distress Signals; Additional Signal Evaluation,” dated June 2017

2.1.7 International Association of Marine Aids to Navigation and Lighthouse Authorities Publications

Available from IALA-AISM Headquarters, 10 rue des Gaudines 78100, St Germain en Laye, France, www.iala-aism.org.

IALA Recommendation E-200-2 (Ed. 1: 2008) On Marine Signal Lights: Part 2 – Calculation, Definition and Notation of Luminous Range

IALA Recommendation E-200-3 (Ed. 1: 2008) On Marine Signal Lights: Part 3 – Measurement

IALA Recommendation E-200-4 (Ed. 1: 2008) On Marine Signal Lights: Part 4 – Determination and Calculation of Effective Intensity

2.1.8 IES Publications

Available from Illuminating Engineering Society, 120 Wall Street, Floor 17, New York, NY 10005-4001, Tel: 212-248-5000, www.ies.org.

IES LM-79-08 Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

2.1.9 NIST Publications

Available from NIST, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070, Tel: 301-975-6478, www.nist.gov.

Ohno, Y., and Dennison, A., Modified Allard Method for Effective Intensity of Flashing Lights.

Ohno, Y., Physical Measurement of Flashing Lights – Now and Then.

2.1.10 European Commission Publications

Available from the European Commission, <https://ec.europa.eu> or <http://eur-lex.europa.eu>.

Regulation (EC) No 1907/2006 of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency

Directive 2002/95/EC of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

2.1.11 European Union Safety Agency Publications

Available from European Aviation Safety Agency, Konrad-Adenauer-Ufer 3, D-50668 Cologne, Germany (for visitors and for mail over 1 kg) and Postfach 10 12 53, D-50452 Cologne, Germany (for mail 1 kg or less); Tel: +49 221 8999 000, www.easa.europa.eu.

ETSO-C142a

Non-Rechargeable Lithium Cells and Batteries

2.2 Definitions

2.2.1 BATTERY CRITICAL OUTPUT VOLTAGE

Battery critical output voltage is defined as the voltage under the load imposed by an operating AVDS device under the following conditions: (a) at the end of the battery's de-rated service life with degradation of voltage and capacity due to self-discharge and reasonable testing fully taken into account (as defined in 8.2), and (b) under the worst case high or low temperature environment operating condition. These conditions are simulated by calculations and/or testing defined herein. Certain performance tests are conducted at the critical output voltage.

2.2.2 DISCERNIBLE FLASH

A single flash of light or a very rapidly repeating series of flashes that would be discernable to the unaided human eye as a single flash as defined by the Talbot-Plateau Law (see 2.2.9).

2.2.3 EFFECTIVE INTENSITY

Effective intensity is defined as the luminous intensity of a fixed light, of the same relative spectral distribution as the flashing light, which would have the same luminous range as the flashing light under identical conditions of observation. In accordance with the analysis and recommendations of IALA Recommendation E-200-4, FAA Report DOT/FAA/AM-13/15, and the referenced NIST technical papers, the Modified Allard Method is to be used for determination of effective luminous intensity for the device specified herein.

2.2.4 NOMINAL LUMINOUS RANGE

Nominal luminous range (also known as "nominal range") is defined by IALA Recommendation E-200-2 as "...the distance in nautical miles at which (the) light produces an illuminance at the eye of the observer of 2×10^{-7} lx for night time...". Further, Table 1 of that reference indicates that a nominal luminous range of 6 nm will require a minimum effective luminous intensity of 108 Cd.

2.2.5 MODIFIED ALLARD METHOD

The Modified Allard Method is recommended for determining the effective intensity of signal lights of any flash profile or multiple flash profiles at any repetition rate. This method is fully described in IALA Recommendation E-200-4 and is recommended in FAA Report DOT/FAA/AM-13/15 and the referenced NIST publications.

2.2.6 NVIS

Night vision imaging systems (NVIS) of the third generation (Gen III) are, at the time of this writing, in use by United States Coast Guard and U.S. military search and rescue resources. These devices are sensitive to near infrared (NIR) emissions in the range of 650 to 900 nm with a nominal peak sensitivity of 800 nm.

2.2.7 PROSIGN

A prosign (short for procedural signal) is shorthand Morse Code signal used in radio telegraphy procedures, for the purpose of simplifying and standardizing communications related to radio operating issues among two or more radio operators. The SOS distress signal is a prosign.

2.2.8 REACH

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) is a European Union regulation dated 18 December 2006. REACH addresses the production and use of chemical substances and their potential impacts on both human health and the environment (see 2.1.9).

2.2.9 RoHS

Restriction of Hazardous Substances Directive (RoHS) is a set of EU regulations that implements EU Directive 2002/95 that restricts the use of hazardous substances in electrical and electronic equipment. This directive bans placing on the EU market any product having an electrical/electronic component containing more than the thresholds set for lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants (see 2.1.9).

2.2.10 TALBOT-PLATEAU LAW

The Talbot-Plateau Law states that if a light source is flashed or pulsed at a rate above the critical flicker frequency or flicker fusion frequency, such that it appears as a continuous light, the luminance of the source will be equal to that of a steady light that has the same time-average luminance. This law is fully described in IALA Recommendation E-200-3.

2.2.11 NAIVE SUBJECTS

Individuals who are unfamiliar with and have no experience within the last 12 months with civil or military survival equipment of the type typically carried on life rafts.

3. GENERAL REQUIREMENTS

- 3.1 The device shall be designed with the following objectives: (1) optimize ease and simplicity of use by survivors of aircraft ditching accidents, (2) optimize effectiveness as a distress signal to identify survivor location to air, sea, and ground borne search and rescue forces, (3) optimize durability and reliability in the range of anticipated usage environments, and (4) minimize collateral harm or damage to personnel and equipment during use and storage.
- 3.2 Where testing is required for verification of compliance to these standards, the words "...shall be tested..." or similar are included in the requirement.
- 3.3 In cases where a specific test methodology is not prescribed within this standard, determination and documentation of a suitable test methodology with rationale shall be the responsibility of the TSO applicant and shall be subject to acceptance by the approving authority.
- 3.4 In cases where testing is not required for verification of compliance to these standards, compliance shall be shown and/or demonstrated by a method that is acceptable to the approving authority.

4. PERFORMANCE STANDARDS

4.1 Operating Life

- 4.1.1 The AVDS with a single battery assembly installed shall be tested and shown compliant to the performance requirements of this section for a minimum of 12 hours after conditioning to simulate the battery critical, end-of-life conditions within an operating temperature range of 30 °F (-1 °C) to 120 °F (48 °C).
- 4.1.2 The AVDS shall be tested to confirm a minimum 200 hour operating service life under ambient, room temperature conditions, using multiple battery replacements.