



SLOVENSKI STANDARD
oSIST prEN 4709-004:2021
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Aeronavtika - Letalski sistemi brez posadke - 004. del: Zahteve za razsvetljavo

Aerospace series - Unmanned Aircraft Systems - Part 004: Lighting requirements

Luft- und Raumfahrt - Unbemannte Luftfahrzeugsysteme - Teil 004: Anforderungen an die zu führenden Lichter

Série aérospatiale - Aéronefs télépilotés - Partie 004 : Exigences de signalément lumineux

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ICS:

49.020	Letala in vesoljska vozila na splošno	Aircraft and space vehicles in general
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EUROPEAN STANDARD
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ICS

English Version

Aerospace series - Unmanned Aircraft Systems - Part 004: Lighting requirements

Série aérospatiale - Aéronefs télépilotes - Partie 004 :
Exigences de signalement lumineux

Luft- und Raumfahrt - Unbemannte
Luftfahrzeugsysteme - Teil 004: Anforderungen an die
zu führenden Lichter

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee ASD-STAN.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 4709-004:2020) has been prepared by the Aerospace and Defence Industries Association of Europe — Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this document has received the approval of the National Associations and the Official Services of the member countries of ASD-STAN, prior to its presentation to CEN.

This document is currently submitted to the ASD-STAN National Domain Ballot in parallel to the CEN Enquiry.

This document was originally reviewed by the Domain Technical Coordinator of ASD-STAN's Autonomous flying Domain.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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prEN 4709-004:2020 (E)**1 Scope**

This document will provide means of compliance to cover lighting related requirements for Part 2 to 4 of the Annex to the Commission Delegated Regulation on unmanned aircraft and on third country UAS operators.

The purpose is to be able to verify that an UA is equipped with lights which:

- ensure controllability of the UA.
- ensure conspicuity of the aircraft at night, the design of the light shall allow a person on the ground to distinguish a UA from a manned aircraft.

This document addresses:

- definition of types, technical requirements, and technical parameters of UA lights (e.g. position of lights for different UA categories, intensity for different operation modes).
- definition of purpose, test procedures, requirements, and compliance rules to evaluate UA lights.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

prEN 4709-001:2019¹⁾, *Aerospace series — Unmanned Aircraft Systems — Part 001: Product requirements and verification*

EN IEC 62368-1:2020, *Audio/video, information and communication technology equipment - Part 1: Safety requirements (IEC 62368-1:2018)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1**control operational modes**

safety control categories for which the UA can be operated: automatic, semi-automatic, manual direct piloting

Note 1 to entry Several flight control modes can be used for each category.

¹⁾ At draft stage.

3.2

automatic control operational mode

control operational mode where the UA attitude, speed and flight path are fully controlled by the flight control system

Note 1 to entry No pilot input is needed to address flight control and vehicle steering, other than to load or modify the required flight plan or waypoint parameters. C2 link performance and latency are not an issue for control stability and guidance, besides situation awareness and collision avoidance issues. Examples of automatic modes are waypoint path navigation, waypoint holding (hovering/loitering), automatic take-off, automatic landing, follow-me mode, return to home, etc

3.3

semi-automatic control operational mode

control operational mode where the remote pilot commands outer loop parameters such as altitude, heading and UA speed in given values specified by the UA manufacturer

Note 1 to entry The flight control system operates the UA controls to achieve the commanded outer loop parameter value. Envelope flight protection and/or control decoupling functions should be in place in this control operational mode. The flight manual shall clearly specify, for any possible/available control mode that is classified as semi-automatic, for each degree of freedom, the level of involvement of the pilot to address control stability. For assisted modes a higher latency on C2 link may be adequate (e.g. < 5 s) but vehicle steering is always pilot direct responsibility. A wide range of flight control modes are semi-automatic, from low level attitude/rate control, autopilot heading/speed/altitude control, velocity control; position control may be considered semi-automatic if pilot input is transformed into position commands continuously (or an automatic mode if pilot inputs only modify waypoint coordinates in on-board autopilot)

3.4

manual direct piloting control operational mode

control operational mode where the remote pilot directly commands UA controls (e.g. aerodynamic surfaces through servo-actuators and engine through electronic speed control)

Note 1 to entry This control mode does not benefit (as a general rule) of autopilot aiding action (e.g. stability/control augmentation systems SAS/CAS, flight envelope protection FEP) and the pilot is also directly responsible for vehicle stability (no hand-off control is allowed). Link performance and latency is critical (e.g. << 1 s).

Note 2 to entry derived from STANAG 4703 UL47.1 definition.

3.5

effective frequency

frequency at which the UA complete light for conspicuity system is observed from a distance and applies to each sector of light including any overlaps that exist when the system consists of more than one light source

prEN 4709-004:2020 (E)**4 Technical specifications****4.1 General**

Used Lights for controllability, conspicuity or other purposes shall be either fixed by the UAS manufacturer or attached by the UA operator as add-on lights.

All lights described in the following Clause 5 and Clause 6 shall comply with requirements of EN IEC 62368-1 to reduce the likelihood of painful effects and injury due to optical energy to eyes or skin.

If the UAS manufacturer implements a solution to automatically switch off the UA light system partly or completely at night, the off time of the affected lights for controllability and conspicuity shall not exceed 10 seconds.

4.2 Add-on lights

Add-on lights shall be equipped on the UA with either

- a) a connection to an accessible interface for electrical power or
- b) without affecting the controllability of the UA (prEN 4709-001:2019) using independent power equipment.

Add-on lights are considered as equipment in accordance to definition prEN 4709-001:2019. Therefore, equipping an UA with Add-on lights should lead to not exceed the allowed maximum take-off mass (MTOM) for the required class in accordance to prEN 4709-001:2019.

If Add-on lights are used, the manufacturer of the Add-on lights shall place instructions on how to install and operate the Add-on light.

4.3 Colours

[oSIST prEN 4709-004:2021](https://standards.iteh.ai/catalog/standards/sist/ba9a248f-7f2b-4265-8379-)

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Every light colour proposed for lights for controllability and for conspicuity should follow the aviation colour system for orientation indication in the colours aviation green, red and white [CS-23 Amendment 4 - CS 23.1397 Colour specifications].

Each light colour should have the applicable International Commission on Illumination chromaticity coordinates as follows:

- a) Aviation Red:

\dot{y}' is not greater than 0.335; and

\dot{z}' is not greater than 0.002.

- b) Aviation Green:

\dot{x}' is not greater than $0.440 - 0.320 y$;

\dot{x}' is not greater than $y - 0.170$; and

\dot{y}' is not less than $0.390 - 0.170 x$.

- c) Aviation White:

\dot{x}' is not less than 0,300 and not greater than 0,540;

\dot{y}' is not less than " $x - 0,040$ " or " $y_0 - 0,010$," whichever is the smaller; and

y' is not greater than " $x + 0,020$ " nor " $0,636 - 0,400x$ ";

where y_0 is the y coordinate of the Planckian radiator for the value of ' x ' considered.

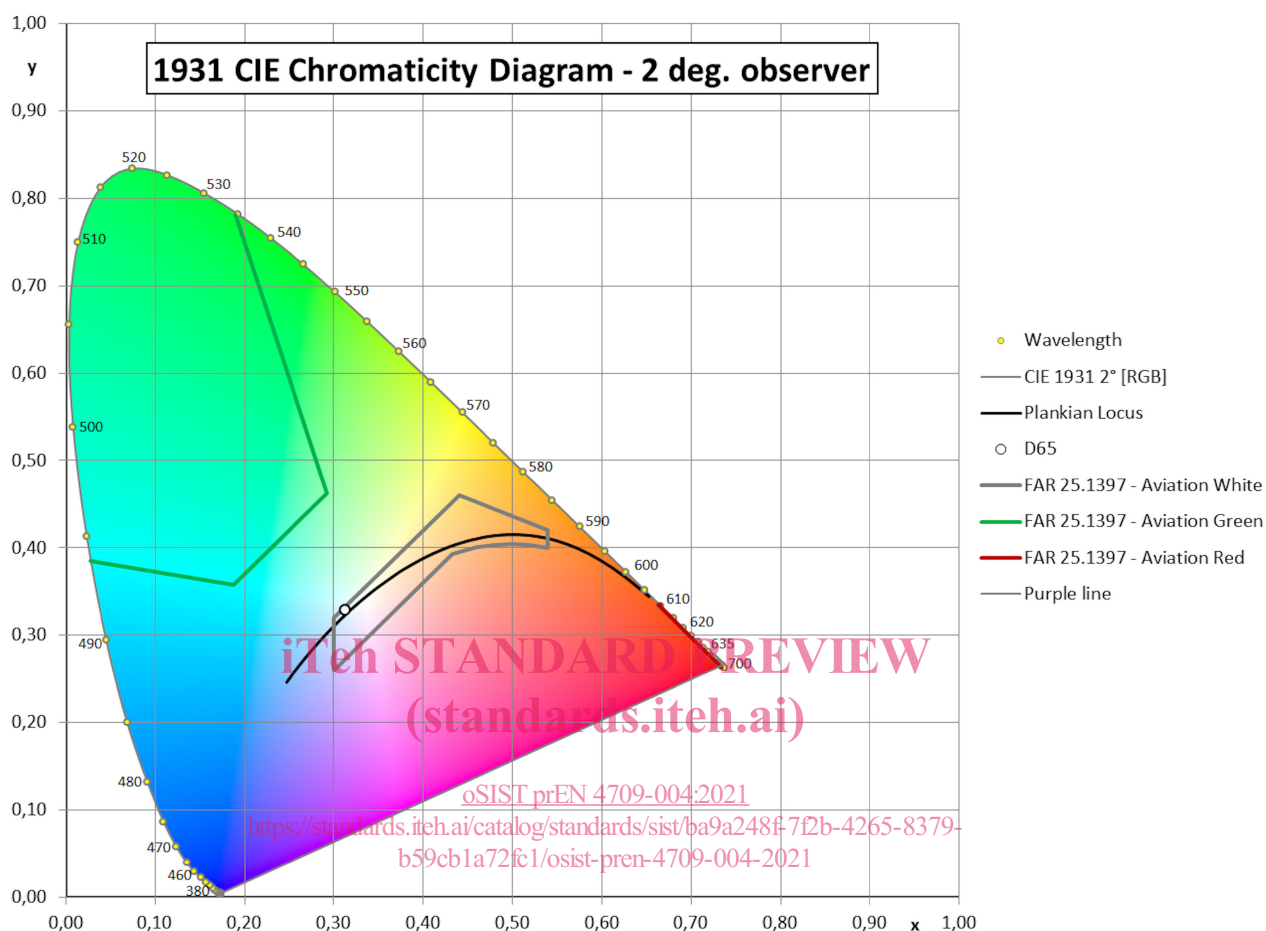


Figure 1 — Colour representation of aviation colours in CIE1931 format

5 Lights for controllability

5.1 General

The purpose of lights for controllability is to provide the remote pilot with sufficient information about the position, attitude and heading of the UA and regarding the control mode [see 3.1].

Annex A provides additional guidance of acceptable light positions according to types and size of UA.

5.2 Performance Specification

5.2.1 General

If the UA is operated during night ²⁾, the UA shall be equipped with lights for controllability according to their control mode [3.1].

²⁾ Night means the hours between the end of evening civil twilight and the beginning of morning civil twilight as defined in Implementing Regulation (EU) N° 923/2012.

prEN 4709-004:2020 (E)

NOTE If the UA manufacturer decides to equip and operate the UA with lights for controllability for daytime operations as well, the same specifications in Clause 5 apply.

The UA shall be equipped with one or more lights for controllability using one of the following colour schemes:

- red, green, and white permanent light.
- red or white alternating light alternating with green light for conspicuity.

Every UA with automatic control mode should have the possibility to either switch to semi-automatic or manual control mode.

If the UA switches to manual mode in case of emergencies or abnormal function, lighting requirements for manual mode are required even when the UA is operated in semi-automatic or automatic mode.

Annex A provides additional guidance of acceptable light positions according to types and size of UA.

5.2.2 Manual direct piloting control mode

If the UA is controlled in manual mode at any time of the flight, the UA shall be equipped with lights for controllability to indicate:

- attitude,
- heading, and
- position

of the UA.

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<https://standards.iteh.ai/catalog/standards/sist/ba9a248f-7f2b-4265-8379-639cb1a721c1/osist-pr-en-4709-004-2021>
Control Mode: Conventional Control

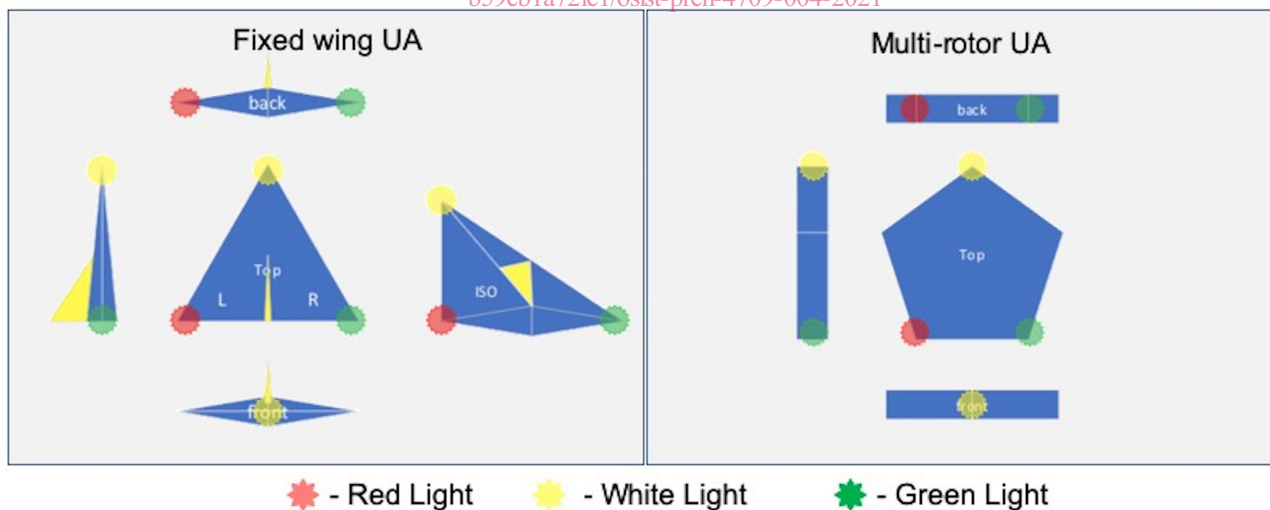


Figure 2 — Example of light setup for a UA with manual direct piloting control mode

5.2.3 Semi-automatic control Mode

If the UA is controlled in semi-automatic mode at any time of the flight, the UA shall be equipped with lights for controllability to indicate at least:

- heading, and
- position

of the UA while hovering/loitering.

NOTE It is technically possible to indicate heading and position with one single alternating light on the UA, using different colours. More guidance on technical implementations are given in Annex A.

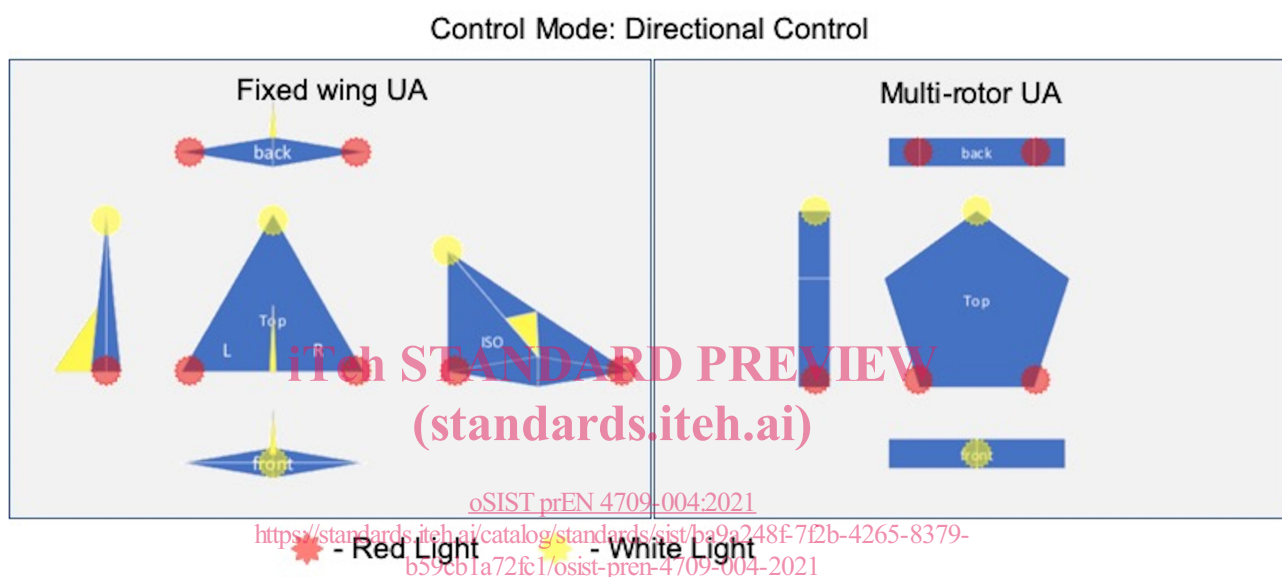


Figure 3 — Example of light setup for a UA with semi-automatic control mode

5.3 Test Methods

To demonstrate that the UA is safely controllable during night, test methods from prEN 4709-001:2019 shall apply.

6 Lights for conspicuity

6.1 General

The purpose of these type of lights is to ensure the conspicuity of the aircraft at night. The design of the lights shall allow a person on the ground to distinguish an UA from a manned aircraft.

Annex A provides additional guidance of acceptable light positions according to types and size of UA.

6.2 Performance Specification

6.2.1 General

The UA shall be equipped with one light or more lights for conspicuity using one of the following colour schemes:

- green flashing, blinking, or