



**SLOVENSKI STANDARD**  
**oSIST prEN 4709-001:2021**  
**01-julij-2021**

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**Aeronavtika - Letalski sistemi brez posadke - 001. del: Zahteve za proizvod in preverjanje proizvodov**

Aerospace series - Unmanned Aircraft Systems - Part 001: Product requirements and verification

Luft- und Raumfahrt - Unbemannte Luftfahrzeugsysteme - Teil 001: Anforderungen und Prüfverfahren

Série aérospatiale - Aéronefs télépilotes - Partie 001 : Exigences produit et méthodes de vérification

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49.020	Letala in vesoljska vozila na splošno	Aircraft and space vehicles in general
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**prEN 4709-001**

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## Aerospace series - Unmanned Aircraft Systems - Part 001: Product requirements and verification

Série aéronautique - Aéronefs télépilotes - Partie 001 :  
Exigences produit et méthodes de vérification

Luft- und Raumfahrt - Unbemannte  
Luftfahrzeugsysteme - Teil 001: Anforderungen und  
Prüfverfahren

This draft European Standard is submitted to CEN members for second 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.

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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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COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

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## **European foreword**

This document (prEN 4709-001:2021) 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 second 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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## 1 Scope

This document provides technical specification and verification method to support compliance with Commission Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems.

This includes compliance with product requirements for all UAS authorized to operate in the 'open' category (class C0, C1, C2, C3 and C4 UAS).

This document does not cover "Specific" or "Certified" categories of UAS as well not UAS lighter than air (e.g. airships and balloons).

Compliance with this document assists in complying with CE marking technical requirements.

This document is only applicable for UA with energy sources based on electro-chemical technologies.

Additional hazards that occur from the characteristics of the payload are excluded and are under the responsibility of the manufacturer and operator.

## 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.

EN 71-1:2014+A1:2018, *Safety of toys - Part 1: Mechanical and physical properties*

prEN 4709-002:2020, *Aerospace series — Unmanned Aircraft Systems — Part 002: Direct Remote Identification*

prEN 4709-003:2020, *Aerospace series — Unmanned Aircraft Systems — Part 003: Geo-awareness requirements*

prEN 4709-004:2020, *Aerospace series — Unmanned Aircraft Systems — Part 004: Lighting requirements*

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

EN ISO 2307:2019, *Fibre ropes - Determination of certain physical and mechanical properties (ISO 2307:2019)*

EN ISO 3744:2010, *Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*

### 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:

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

#### 3.1

##### **automatic flight**

flight following pre-programmed instructions, loaded in the unmanned aircraft (UA) flight control system that the UA executes

#### 3.2

##### **open category**

category of UAS operation that, considering the risks involved, does not require a prior authorisation by the competent authority nor a declaration by the UAS operator before the operation takes place

#### 3.3

##### **specific category**

category of UAS operation that, considering the risks involved, requires an authorization by the competent authority before the operation takes place and takes into account the mitigation measures identified in an operational risk assessment, except for certain standard scenarios where a declaration by the operator is sufficient

#### 3.4

##### **certified category**

category of UAS operation that, considering the risks involved, requires the certification of the UA, a licensed remote pilot and an operator approved by the competent authority, in order to ensure an appropriate level of safety

#### 3.5

##### **competent authority**

authority responsible for the certification, authorization and oversight of UAS air operations in the Member State where the UAS operator has its principal place of business or place of residence

#### 3.6

##### **direct remote electronic identification**

function for broadcasting the identity of the UA so that it can be directly received by existing mobile devices within the broadcasting range

#### 3.7

##### **follow-me mode**

means a mode of operation of a UAS where the unmanned aircraft constantly follows the remote pilot within a predetermined radius

#### 3.8

##### **geo-awareness**

means a function that, based on the data provided by Member States, detects a potential breach of airspace limitations and alerts the remote pilots so that they can take immediate and effective action to prevent that breach

**3.9****hazard**

condition or an object with the potential to cause injuries, damage, loss of material or a reduction of the ability to perform a prescribed function

**3.10****Maximum Take-Off Mass****MTOM**

maximum take-off mass of the UA in the heaviest combination with accessories, payloads and batteries, as defined by the manufacturer when placing the product on the market, at which the UA can be safely operated

Note 1 to entry: As opposed to classical manned aircraft, small unmanned aircraft can have removable or adaptable items that are neither the payload nor the batteries, but are considered as part of the UA itself. When applying the MTOM definition to the UA, the term UA is to be understood as including all accessories that are neither payloads nor batteries but that relate directly to the UA and can be attached to it.

**3.11****unmanned aircraft system operator**

legal or natural person who operates or intends to operate one or more UAS

**3.12****remote pilot**

natural person responsible for safely conducting the flight of a UA by operating its flight controls, either manually or, when the UA flies automatically, by monitoring its course and remaining able to intervene and change its course at any time

**3.13****return home**

fail safe function that upon loss of data link will direct the UA back to predefined home position

**3.14****standard scenario**

description of a type of operation included in a certification specification issued by EASA, for which a specific operations risk assessment (SORA) has been conducted

**3.15****Unmanned Aircraft****UA**

aircraft operating or designed to operate autonomously or to be piloted remotely without a pilot on board

**3.16****Unmanned Aircraft System****UAS**

unmanned aircraft and its associated elements which are operated with no pilot on board

Note 1 to entry: ISO/CD 21384-2.

**prEN 4709-001:2021 (E)****3.17****Visual Line Of Sight****VLOS**

type of operation in which the remote pilot maintains continuous unobstructed and unaided visual contact with the UA, allowing the remote pilot to monitor the flight path of the UA in relation to other aircraft, persons, and obstacles, for the purpose of maintaining separation from them and avoiding collisions

**3.18****equipment to control unmanned aircraft remotely**

instrument, equipment, mechanism, apparatus, appurtenance, software or accessory that is necessary for the safe operation of a UA, other than a part, and which is not carried on board that UA

**3.19****payload**

means instrument, mechanism, equipment, part, apparatus, appurtenance, or accessory, including communications equipment, that is installed in or attached to the aircraft and is not used or intended to be used in operating or controlling an aircraft in flight, and is not part of an airframe, engine, or propeller

**3.20****configuration**

basic design arrangement of the UA: fixed-wing, rotary wing or multicopter

**3.21****list of items**

list provided with the description of the UA in the technical documentation that identifies the UA and all removable and adaptable items that can be attached to the main structure of the UA and are provided in any packaging configurations in which the UAS is placed on the market

Note 1 to entry: The list includes all payloads and batteries but not spare parts. The list identifies the items by part number and mass.

**3.22****non-configurable UA**

UA with a single combination that cannot be combined with other *payloads* (if any) or removable batteries (if removable)

Note 1 to entry: A non-configurable UA is the UA itself and its list of items contains only the UA.

**3.23****primary structural elements**

primary structural elements are those parts of the structure of the UA the failure of which would lead to a hazardous or more serious failure condition, e.g. primary UA structure bearing aerodynamic, inertial and propulsion forces; control surface and control system structural elements, control surface hinges; structural elements of systems used in launching and recovery phases ([8])

### 3.24 tether

a tether in the sense of this standard is a mechanical device for the purpose of effectively restraining the UA within the range permitted by the length of the tether as its primary function

Note 1 to entry: A tether in the sense of this standard is not any cable linking the UA to the ground e.g. an electric cable powering the UA, even if it was the only source of power and a loss of connection would inevitably lead to a loss of flight. However, the tether may be used to transmit electrical power to the UA as a secondary function.

### 3.25 mode of control

mode of control is used to distinguish between different methods of exercising control over the direction of flight of the UA

Note 1 to entry: This includes but is not limited to attitude, heading, track, speed, altitude, rate of climb. All flight modes are clearly defined in the flight manual explaining how pilot input (e.g. sticks) are associated to air vehicle degrees of freedom. Necessary conditions for each flight mode is also defined (e.g. GPS coverage is necessary for ground velocity or position control mode)

### 3.26 control operational modes

the UA can be operated in the following operational modes, according to STANAG4703 UL47.1 definition here rephrased. The expression “control operational modes” is used to address safety relevant control categories

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

### 3.27 automatic mode

control operational mode where 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 controls and vehicle steering, other than to change the operational mode, load or modify the required flight plan or waypoint parameters. Examples of automatic modes are waypoint path navigation, waypoint holding (hovering/loitering), automatic take-off, automatic landing, follow-me mode, return to home, etc.

### 3.28 semi-automatic mode

control operational mode where the remote pilot commands outer loop parameters such as altitude, heading and air speed

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 clearly specifies, 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.

Note 2 to entry: 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)

**prEN 4709-001:2021 (E)****3.29****manual direct piloting 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 operational mode does not benefit from autopilot aiding action (e.g. flight envelope protection FEP) in excess of stability augmentation.

**3.30****manual mode**

refers to all Control operational modes where the pilot is using manipulators or similar inceptors to change the trajectory of flight in real-time, such as in manual direct piloting mode and semi-automatic mode, as opposed to automatic mode where high level commands (such as setting waypoints or actuating an RTH button) are used to change the trajectory

**3.31****automated mode**

refers to Automatic mode and Semi-automatic mode (as opposed to Manual direct piloting mode) which depend on automation in excess of stability augmentation to control the trajectory of flight

**3.32****holding**

hovering for hovering capable aircraft, i.e., maintaining altitude and position; for fixed wing aircraft holding corresponds to loitering, i.e., flying a minimum distance orbit around current position, at low speed and holding altitude

Note 1 to entry: holding is used to address a flight condition where aircraft minimizes risks of flight path deviation (to reduce the risk of collisions) and loss of control.

Note 2 to entry: Besides the general minimum speed and minimum displacement requirement, radius/turn rate/bank angle/load factor and speed are specifically selected for each aircraft in order to provide a safe and stable flight condition (e.g. proper margins with respect to stall speed and load factors)

**3.33****link loss control mode**

control mode that the UA reverts to in the event of a C2 link loss. Typical link loss control modes are:

- holding
- return to home (RTH)
- automatic landing

**3.34****return to home**

automatic mode intended for returning to a pre-defined, safe landing position ("home") such as the take-off position; does not necessarily entail commence to land; typically includes climb or descent to a safe height, following a predefined route, approaching the landing position

**3.35****automatic landing,**

automatic mode where the UA attempts an automatic landing or an emergency landing at the current position

**3.36****safely controllable**

general ability of the remote pilot to exercise control over the UA at any time to change the position of the UA as far as required to avoid hazards to other persons using the airspace and persons on the ground

Note 1 to entry: As long as the UA is controlled manually (see manual mode) this includes manoeuvrability and handling qualities, unless functions are automated (see automated mode)

**3.37****nominal mode**

nominal mode is the basic modes of operation encountered in normal operation in the absence of any loss of features, functions or capabilities, or degradation of performance

**3.38****degraded mode**

degraded mode is any temporary, persistent, or permanent reduction in features, functions, and capabilities, including the ability to cope with adverse environmental conditions outside of the limitations of the service envelope defined by the manufacturer likely to occur when operating close to or at those limitations

Note 1 to entry: such limitations are (but not limited to): GNSS reception due to satellite constellation, ionospheric disturbances, jamming, etc.; magnetic deviation and disturbance affecting the compass (magnetometer); data link quality, in terms of latency, bandwidth, availability and integrity.

Note 2 to entry: Failures of one or, if applicable, more systems relevant for stability, controllability and pilot workload, such as (if required) accelerometers, gyroscopes, airspeed sensors, engine speed sensors, electrical power supply systems (batteries), power distribution systems (harnesses, connectors, voltage converters, fuses, etc.), and systems relevant for health monitoring such as internal temperatures and battery status, that are likely to occur during the life of the product are taken into account.

Note 3 to entry: If the number of possible combinations of failure condition can be represented by a smaller number of failure effects, then the manufacturer provides an FMEA showing that the failure effects subject to test are representing the failure conditions likely to occur during the life of the product. Failure of systems relevant for health monitoring without impact on stability and controllability, or pilot workload, may not be considered.

**3.39****level flight**

quasi-stationary flight condition with straight path, no bank angle nor turn rate

Note 1 to entry: Remark that straight path is also applicable in steady wind condition (constant speed and direction) because wind drift only affects a difference between airspeed and groundspeed with course over ground being different about vehicle heading

**3.40****low-level battery warning**

alert that indicates a critical status of the battery of the UA or its equipment to control the UA remotely that requires immediate landing of the UA

Note 1 to entry: Under the precondition of ensuring flight safety, UA manufacturer normally will define a minimum safety energy threshold e.g. 10 % on top of the critical status of the battery and may initiate pre-warnings of the low-level battery warning to the remote pilot. Such kind of pre-warnings are optional and not part of the defined low-level battery warning required by EN 4709-001.