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Safety of laser products –
Part 19: Moving platform laser products

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SAFETY OF LASER PRODUCTS –

Part 19: Moving platform laser products

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IEC TS 60825-19 has been prepared by IEC technical committee 76: Optical radiation safety and laser equipment. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
76/746/DTS	76/749/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- withdrawn, or
- revised.

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INTRODUCTION

Laser products are sometimes used on moving platforms. Currently the standard IEC 60825-1:2014 considers only a stationary aperture; it does not address the situations where the emitting aperture is mounted on a platform, such as a vehicle, that can be in motion. Failure to consider the effects of the motion of the platform can result in overly restrictive assessment of the hazard.

Although accounting for a platform's movement during the assessment of a laser product's classification can lead to less restrictive measurement conditions, it is important not to overlook that there can be apertures, even on other moving platforms, moving at a relative speed of zero or close to zero with respect to the moving platform laser product being classified.

SAFETY OF LASER PRODUCTS –

Part 19: Moving platform laser products

1 Scope

This part of IEC 60825 specifies the velocity-dependent closest points of human access (VCPHA) for the classification of moving platform laser products when considering the movement of the platform with respect to a stationary frame of reference. This presupposes that the inherent kinetic hazard of the moving platform creates a zone in which persons would not be reasonably expected to be located. Additionally, it takes neighbouring moving platforms into account by defining stationary and moving apertures.

This document is applicable to all laser products whose laser apertures are on a moving platform.

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.

IEC 60825-1:2014, *Safety of laser products – Part 1: Equipment classification and requirements*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in IEC 60825-1:2014 and the following 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
moving platform laser product
product which is designed to move and incorporates an aperture that can emit laser radiation

Note 1 to entry: This definition is different from the definition of a *scanning laser product* (3.3) where the aperture stop is stationary for the determination of the accessible emission.

Note 2 to entry: A moving platform laser product can use scanning laser radiation.

Note 3 to entry: A moving platform can be so small that there is no place for a person to be in or on the moving platform. Alternately, a moving platform can be sufficiently large to allow one or more persons to be in or on the moving platform.

Note 4 to entry: Examples of moving platforms are vehicles, aircrafts, boats and trains.

3.2
moving platform laser product velocity
$\vec{v}$
velocity vector, composed of speed and direction, averaged over the time period t_{move}

Note 1 to entry: $|\vec{v}|$ is expressed in metres per second.

3.3
scanning laser product
laser product where the accessible emission has a time-varying direction or pattern of propagation with respect to a stationary frame of reference

Note 1 to entry: This definition is changed compared to the definition of scanning laser radiation in IEC 60825-1:2014, 3.78 because a time-varying origin is a characteristic of a moving platform laser product (see 3.2) and not of a scanning laser product.

Note 2 to entry: For the determination of the accessible emission of scanning laser radiation, a stationary aperture stop is used.

3.4
closest point of human access
CPHA
closest position where a human body can be exposed to laser radiation emitted from the laser product that is ensured by mechanical design

Note 1 to entry: The minimum measurement distances as given in IEC 60825-1:2014, Table 10 are determined from the measurement reference point (IEC 60825-1:2014, Table 11), but IEC 60825-1:2014 does not permit measurements closer than the CPHA.

3.5
velocity-dependent closest point of human access
VCPHA
closest position of human access to a moving platform laser product's laser emission that is defined by the motion of the moving platform laser product

Note 1 to entry: The term closest point of human access is also used in IEC 60825-1. This document defines a velocity-dependent CPHA due to the movement of a laser device. In the case of a velocity $\vec{v}$ = 0, this VCPHA corresponds to the closest point of human access in IEC 60825-1.

3.6
t_{move}
time for VCPHA
time used to calculate the distance δ

Note 1 to entry: t_{move} is expressed in seconds.

3.7
δ
distance for VCPHA
distance used to determine the VCPHA for a moving platform laser product, where $\delta = t_{move} \cdot |\vec{v}|$

Note 1 to entry: δ is expressed in metres.

3.8
δ_{max}
maximum distance for VCPHA
maximum value of δ above which the VCPHA for a moving platform laser product is independent of velocity

Note 1 to entry: δ_{max} is expressed in metres.

4 Classification principles

All classification principles of IEC 60825-1:2014 apply.

5 Determination of the accessible emission level and product classification

5.1 General

All subclauses of IEC 60825-1:2014 for the determination of the accessible emission and product classification apply and are supplemented by 5.2.

5.2 Evaluation of moving platform laser products

For the evaluation of the moving platform laser product, both measurement apertures which are moving with the platform and which are stationary shall be considered. It is important to include neighbouring platforms (e.g. persons on vehicles with the same velocity as a moving platform laser product) and stationary observers (e.g. pedestrians) in the evaluation. All reasonably foreseeable use cases and scenarios shall be considered during the assessment of the moving platform laser product's classification. An example for stationary and moving apertures is given in Annex A.

For a moving platform laser product, a velocity-dependent closest point of human access (VCPHA) can be applied as follows.

Considering a moving platform laser product with a velocity $|\vec{v}|$ at a certain point in time t_0, the volume swept by this moving platform within the time duration $t_0 - t_{move}$ to $t_0 + t_{move}$ (see blue area in Figure 1) can be excluded as location for reasonably expecting presence of persons. Therefore, the boundary of this volume can be used as a VCPHA for the moving platform laser product (see red dashed line in Figure 1). The extent of the swept volume parallel to the direction of motion, defined by δ, depends on the moving platform laser product velocity, $\vec{v}$, and is calculated as $\delta = t_{move} \cdot |\vec{v}|$. The maximum of this extent is limited to $\pm\delta_{max}$. If the actual extent of intended movement of a moving platform laser product is smaller (see NOTE 3) than the calculated δ based on the moving platform laser product velocity, the smaller one shall be used to calculate the VCPHA. The VCPHA can then be used for the evaluation. The values for t_{move} and δ_{max} shall be taken from Table 1.

Table 1 – Values for the parameters t_{move} and δ_{max}

t_{move}	δ_{max}
0,04 s	1 m

This document specifies a VCPHA due to the movement. All other measurement distances and conditions from IEC 60825-1:2014, Table 10 and IEC 60825-1:2014, Table 11 shall be applied. The classification principle for moving platform laser products is summarized in the flowcharts in Annex A. Annex A also provides exemplary moving platform laser products and the determination of their minimum evaluation distances.

NOTE 1 The value of δ = 1 m is reached in t_{move} of 0,04 s if the moving platform has a velocity of 25 m·s^{-1}, equal to 90 km·h^{-1} and 55,9 mile·h^{-1}. These values are conservative values applicable for all moving platforms. The minimum human reaction time is in the range of about 100 ms to 250 ms (see bibliography) and a factor 2,5 to 6,25 higher than the value of t_{move} in Table 1.

NOTE 2 All reasonably foreseeable use cases and scenarios include realistic kinematic estimates, such as size, inertia, direction and range of motion.