FINAL
DRAFT

INTERNATIONAL
STANDARD

**ISO/FDIS
17731
CIE S 021/E**

CIE

Voting begins on:
2011-10-21

Voting terminates on:
2012-03-21

Vehicle headlighting systems photometric performance — Method of assessment

Performances photométriques des systèmes de phares pour véhicules — Méthode d'évaluation

Please see the administrative notes on page iii

Reference number
ISO/FDIS 17731:2011(E)
CIE S 021/E:2011

This document is submitted to all ISO member bodies for voting within 5 months, as a standard prepared by an international standardizing body in accordance with Council Resolution 42/1999. The proposer, the International Commission on Illumination (CIE), has been recognized by the ISO Council as an international standardizing body for the purposes of Council Resolution 42/1999.

Votes are required to be explicit: positive, negative or abstention. Any request or proposal to change the text will be regarded as a negative vote.

In accordance with the provisions of Council Resolution 15/1993, this document is **circulated in the English language only**.

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

ISO 17731 was prepared as Standard CIE S 021/E by the International Commission on Illumination, which has been recognized by the ISO Council as an international standardizing body. It was adopted by ISO under a special procedure which requires approval by at least 75 % of the member bodies casting a vote, and is published as a joint ISO/CIE edition.

The International Commission on Illumination (abbreviated as CIE from its French title) is an organization devoted to international cooperation and exchange of information among its member countries on all matters relating to the science and art of lighting.

ISO 17731 was prepared by CIE Technical Committee 4-45, *Performance Assessment Method for Vehicle Headlamps*.

CIE S 021/E:2011

Standard

Vehicle Headlighting Systems Photometric Performance - Method of Assessment

Systèmes d'éclairage des véhicules routiers - efficacité photométric - méthode pour évaluer

Kraftfahrzeugscheinwerfer – Photometrische Leistungsmerkmale - Bewertungsmethode

CIE Central Bureau, Vienna
Kegelgasse 27, A-1030 Vienna, Austria

CIE S 021/E:2011

UDC: 628.971.85
628.971.85:629.113.06

Descriptor: Lighting by lamps attached to the vehicle
Lighting by motor vehicle lamps

CIE Central Bureau
Kegelgasse 27
A-1030 Vienna
Austria
Tel.: +43 1 714 3187 0
Fax: +43 1 714 3187 18
e-mail: ciecb@cie.co.at
www.cie.co.at

Foreword

Standards produced by the Commission Internationale de l'Eclairage are concise documents on aspects of light and lighting that require a unique definition. They are a primary source of internationally accepted and agreed data which can be taken, essentially unaltered, into universal standard systems.

This CIE Standard has been prepared by CIE Technical Committee 4-45[1] "Performance Assessment Method for Vehicle Headlamps" and is derived from CIE 188:2010, which was produced by the same committee.

[1] This TC was chaired by G. Draper (GB) (until 2009), K. Koeth (DE) (until 2010), and G. Langhammer (DE) (from 2011).
Members were: T. Adachi (JP), T. Bauckhage (DE), A. Bissieres (FR), T. Carter (GB), M. Cejnek (CZ), B. Delaunay (BE), L. Dellby (SE), G. Dorleans (FR), K. Fadel (FR), J. Hasegawa (JP), T. Izawa (BE), M. Kleinkes (DE), K. Koeth (DE), M. Kocian (CZ), K. Manz (DE), F. Müller (DE), R. Neumann (DE), H. Scheidegger (FR), O. Schmidt (DE), I. Schneider (DE), T. Spingler (DE), T. Targosinski (PL), S. Troccon (FR), W. van Laarhoven (NL), S. Völker (DE), S. Watson (GB), Y. Yamada (JP).

CONTENTS

Foreword vii

1 Scope 1

2 Normative References 1

3 Terms and Definitions 1

4 Headlight Performance 2
4.1 General 2
4.2 Assessment Requirements 2
4.3 Assessment of Simulated Headlights 2

5 Beam Assessment Parameters 2

6 Assessment Procedure 3
6.1 Basis of the Procedure 3
6.2 Passing Beam Illumination 3
6.2.1 Summary of Process 3
6.2.2 Passing Beam Range Assessment Procedure – Zones A and B 4
6.2.3 Passing Beam Range Assessment for Offside Pedestrian Visibility – Zone C 7
6.2.4 Total Luminous Flux 7
6.2.5 Passing Beam Width Assessment – Zones D and E 7
6.2.6 Passing Beam Glare 8
6.3 Driving Beam Illumination 11
6.3.1 Summary of Process 11
6.3.2 Assessment of Range 11
6.3.3 Assessment of Width 11
6.3.4 Total Luminous Flux 11

7 Measurement and Calculation 13
7.1 Photometric Measurement of Each Headlight 13
7.2 Data Relating to the Installation of the Headlighting System on the Vehicle 14
7.3 Software Algorithms for the Analysis of the Headlight Data 15

8 List of Results 17

9 Reporting and Presentation of Results 18

Bibliography 18

Vehicle Headlighting Systems
Photometric Performance - Method of Assessment

1 Scope

This Standard specifies a method to consistently assess the photometric performance of vehicle headlighting systems to enable the performance of different systems to be compared. The requirements are given in relation to road scene illumination and the limitation of glare, and the performance is assessed using parameters relevant to lane guidance and the detection of pedestrians and objects.

The Standard includes a measurement and calculation procedure. It does not specify the format of an assessment report.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including amendments) applies.

CIE 188:2010, *Performance Assessment Method for Vehicle Headlighting Systems,* 2010.

CIE DS 017.2/E:2009, *International Lighting Vocabulary*, 2009.

Federal Motor Vehicle Safety Standard (FMVSS) No. 108, *Lamps, reflective devices, and associated equipment*, US Department of Transportation, National Highway Traffic Safety Administration, 2007.

GTB Working Group Photometry, *Photometry Laboratory Accuracy Guidelines, Edition 3*, 2005.

SAE J1383, *Performance Requirements for Motor Vehicle Headlamps*, 2010.

UNECE Regulation 37, *Uniform Provisions Concerning the Approval of Filament Lamps for Use in Approved Lamp Units on Power-Driven Vehicles and of their Trailers*, available at <http://www.unece.org/trans/main/wp29/wp29regs21-40.html>.

UNECE Regulation 99, *Uniform Provisions Concerning the Approval of Gas-Discharge Light Sources for Use in Approved Gas-Discharge Lamp Units of Power-Driven Vehicles*, available at <http://www.unece.org/trans/main/wp29/wp29regs81-100.html>.

3 Terms and Definitions

For the purposes of this document the terms and definitions given in the International Lighting Vocabulary (CIE DS 017.2/E:2009) and the following apply:

3.1
headlighting system

a full set of headlights as installed to a vehicle

3.2
nearside

for traffic following the right-hand rule of the road, the right side of the vehicle

3.3
offside

for traffic following the right-hand rule of the road, the left side of the vehicle

NOTE With regard to the performance of the passing beam it is necessary to define whether the traffic flow is for right-hand or left-hand rule of the road. For the purposes of this Standard it is assumed that the traffic is following the right-hand rule of the road (as in mainland Europe and USA for example) and all reference to features of the beam pattern and photometric performance is related to this. In the case of traffic following the left-hand rule of the road (as in Japan and the UK for example) a reference to a feature on the right in this document should be transformed to refer to an identical feature translated to the left side.

4 Headlight Performance

4.1 General

The assessment method given in this Standard is a means of evaluating headlighting system performance, to enable the performance of different systems to be compared. It uses techniques that produce repeatable results, and has been developed to give correspondence with the subjective impressions of the driver.

When assessing the compliance of a headlighting system to safety regulations or standards with this method, it is solely the photometry of the passing beam and driving beam that is evaluated using calibrated equipment in the photometric laboratory.

NOTE 1 In service, the photometric performance of the headlight is influenced by a number of factors that will cause the actual performance to differ from that defined in regulations or standards. These include mounting height, supply voltage/operating current, beam alignment, variations in light source geometry and the headlight optical system, luminous flux, etc.

Vehicle headlights illuminate the road scene ahead of the vehicle in order to provide guidance for the driver to retain control of the vehicle through adequate illumination of road markings, the edges of the road and features such as verges, trees and road signs, and to provide early warning of the presence of obstacles including pedestrians and other road users.

It is also necessary that headlighting system performance is such that glare to vehicles travelling in the opposite direction is controlled.

NOTE 2 Reflected glare in rear view mirrors caused by the headlights of following vehicles is not taken into account, as technologies exist to reduce the reflectivity of the mirrors.

4.2 Assessment Requirements

The vertical illuminance[2] provided by the headlighting system shall be determined both at the road surface and at a horizontal plane located 250 mm above the road surface, using the assessment procedure and measurement and calculation procedure described in Clauses 6 and 7 respectively. To ensure repeatability of results and to avoid interpolation errors when transforming data between matrices, the measurements and calculations shall exactly follow the procedures set out in these clauses.

NOTE The height of 250 mm corresponds to the mid-point of the leg of an average pedestrian.

4.3 Assessment of Simulated Headlights

During the development of headlights it may be necessary to produce a performance assessment of a new model at the design stage before tooling has been manufactured. Software packages can be used to provide simulations of photometric data for the design, produced from CAD data. This simulated photometric data can be used as an input into the measurement and calculation procedure described in Clause 7, replacing the photometric measurement described in 7.1 a) to d). The output from the simulation software shall comply with the requirements given in 7.1 e).

5 Beam Assessment Parameters

The assessment of the passing beam takes account of the following requirements:

- range for guidance,
- range for pedestrian detection,
- width for lane guidance,
- visibility on curves,
- width for pedestrian detection at intersections,
- opposing glare.

[2] In the following, if not indicated elsewise, vertical illuminances are meant when speaking of illuminances.

The assessment of the driving beam takes account of the following requirements:

- range for pedestrian detection, lane guidance and visibility,
- width for pedestrian detection at intersections.

The assessment for both beams includes the calculation of the total projected luminous flux, as an indication of the optical efficiency of the system.

6 Assessment Procedure

6.1 Basis of the Procedure

The procedure is based upon laboratory measurements of headlights under controlled conditions (calibrated light source, vehicle operating voltage as defined in 7.2 d, initial aim according to 7.2 c) using a defined format for the data including the angular increments of the measurement points. Using these data, aspects of the headlight performance are evaluated as detailed in 6.2 to 6.3. In all cases, the illuminance and luminous intensity values being assessed are derived from a combination of the individual photometric data measured for each component of the headlighting system. These values are combined taking account of the mounting height, separation and aim specified for the particular vehicle to which the system is installed. The method of combining the data is described in Clause 7.

6.2 Passing Beam Illumination

6.2.1 Summary of Process

Illumination of the road scene by the passing beam shall be assessed by evaluating the performance of the headlighting system as summarised in Table 1.

NOTE The zones are for traffic following the right-hand rule of the road.

Table 1 – Aspects of passing beam road scene illumination to be assessed

Zone (see Figures 1 to 6)	**Purpose**	**Assessment Method**
A, B	Range for lane guidance	See explanation in 6.2.2 and Figures 1, 2, 3 and 4
C	Range along the offside verge for pedestrian detection	See explanation in 6.2.3 and Figure 5
D	Width for lane guidance and visibility on curves	See 6.2.5 and Figure 6 Evaluate arithmetic mean value of the width of the 3,0 lx line at 30 m, 40 m and 50 m in front of the vehicle at the road surface. Individual width values are calculated from the lane centre line to the offside and nearside of the vehicle.
E	Width for pedestrian detection at intersections	See 6.2.5 and Figure 6 Evaluate arithmetic mean value of the width of the 3,0 lx line at 10 m and 20 m from the car on a plane located at 250 mm above the road surface. Individual width values are calculated from the lane centre line to the offside and nearside of the vehicle
Whole beam	Luminous flux	See 6.2.4 Total luminous flux (lumen) within a vertical zone 5° up to 15° down, 45° left to 45° right