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Road vehicles — Ergonomic aspects of transport information and control systems — Specifications and test procedures for in-vehicle visual presentation

Véhicules routiers — Aspects ergonomiques des systèmes de commande et d'information des transports — Spécifications et modes opératoires pour la présentation visuelle à bord du véhicule

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 39, *Ergonomics*.

This third edition cancels and replaces the second edition (ISO 15008:2009), which has been technically revised with the following changes:

— Introduction was modified;

— Scope was modified (heavy vehicles partly excluded);

— test conditions for direct sunlight have been changed;

— character height was modified;

— character proportion was modified;

— character weight criterion was modified;

— intercharacter spacing was modified;

— word spacing was modified;

— a new subclause on text case was added;

— the subclause on character outlines was modified;

— a new subclause on character shadows was added;

— the subclause on Non-Roman text was modified and renamed Non-Latin.

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Introduction

Driving is a complex task requiring continuous allocation of attentional resources to both driving and non-driving tasks. Because of this, driving is an interactive balance between cognitive, physical, somatosensory, visual and psychomotor skills.

Driver and vehicle form an integrated system that includes the environment, vehicle controls, and displays collectively defined as the transport information and control systems (TICS). Since driving is an interactive systems activity, vehicle characteristics in combination with human capabilities constitute important factors in the performance of this TIC system.

In order to achieve optimal driver performance, the purpose of TICS is to support drivers in their primary task such that performance, comfort and safety are increased and overall driver workload is not negatively influenced by the use of TICS. One set of factors influencing this process involves the characteristics of visual displays. Specifically, those aspects of displays designed to accommodate human capabilities, the range of illumination conditions and location of the display with respect to the driver. This is especially important since visual specifications must include a wide range of environmental conditions and constitute only one necessary condition for adequate performance, comfort and workload. The purpose of this document is to standardize visual presentation.

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Road vehicles — Ergonomic aspects of transport information and control systems — Specifications and test procedures for in-vehicle visual presentation

1 Scope

This document specifies minimum requirements for the image quality and legibility of displays containing dynamic (changeable) visual information presented to the driver of a passenger car by on-board transport information and control systems (TICS) used while the vehicle is in motion. Heavy vehicles are excluded for the requirements of contrast and font size since these chapters reference ISO 4513 which is only applicable for passenger vehicles. These requirements are intended to be independent of display technologies. Reference to test methods and measurements for assessing compliance with them have been included where necessary.

This document is applicable mainly to perceptual, and some basic cognitive, components of the visual information, including character legibility and colour recognition. It is not applicable to other factors affecting performance and comfort, such as coding, format and dialogue characteristics, or to displays using:

— characters presented as a part of a symbol or pictorial information (e.g.CD symbol);

— superimposed information on the external field (e.g. head-up displays);

— pictorial images (e.g. rear view camera);

— maps and topographic representations (e.g. those for setting navigation systems); or

— quasi-static information (e.g. AM/PM, km/miles, kPa/PSI, On/Off information).

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.

ISO 4513, *Road vehicles — Visibility — Method for establishment of eyellipses for driver's eye location*

CIE 85:1989, *Solar spectral irradiance*

SAE J1757/1:2015, *Standard Metrology for Vehicular Displays*

CIE S 017/E:2011 ILV, *International lighting vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in CIE S 017/E:2011 ILV 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

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3.1
adaptation
adjustment of the eye's sensitivity to the *brightness* (3.2) of the observed visual field by chemical and physical processes within the eye

Note 1 to entry: Dark adaptation occurs at a slower rate than does light adaptation.

3.2
brightness
subjective attribute of light sensation by which a stimulus appears to be more or less intense or to emit more or less light

3.3
chromatic
having hue or being coloured, appearing different in quality from a neutral grey having the same *brightness* (3.2)

Note 1 to entry: It is related to the colour properties of a visual stimulus.

3.4
contrast ratio
R_C
ratio between the luminance L_{high} and the luminance L_{low}

Note 1 to entry: $R_C = \frac{L_{high}}{L_{low}}$.

Note 2 to entry: Terms and definitions related to photometric quantities (e.g. illuminance, luminance, luminance contrast and saturation) are given in CIE S 017/E:2011 ILV. In CIE S 017/E:2011 ILV, it is referred as luminance contrast ratio.

3.5
critical specular line
CSL
line from the centre of the display to the centre of the *eyellipse* (3.10)

3.6
cyclopean eyellipse
elliptical volume combining the left and the right *eyellipse* (3.10) of the driver into one single volume located in the centre between them

3.7
day condition
condition with diffuse ambient light

3.8
direct sunlight condition
condition under which the viewing conditions are mainly influenced by direct light from the sun on the display surface

3.9
dynamic information
information that has more than two stages of change

3.10
eyellipse
elliptical shape of the driver eye range

Note 1 to entry: As defined in ISO 4513.

Note 2 to entry: See definition of 95th percentile eyellipse in ISO 4513.

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Note 3 to entry: It is the contraction of the words “eye” and “ellipse”.

3.11
flash
intended periodic variation of the luminance of a light or visual information, normally from “OFF” to a given value, typically used for attracting attention

Note 1 to entry: Terms and definitions related to photometric quantities (e.g. illuminance, luminance, luminance *contrast ratio* (3.4), saturation) are given in CIE S 017/E:2011 ILV.

3.12
flicker
unintended perceived temporal variation of the *brightness* (3.2) of a visual stimulus, usually generated by refresh process of the display content or by variation of the luminance of the backlight

Note 1 to entry: Terms and definitions related to photometric quantities (e.g. illuminance, luminance, luminance *contrast ratio* (3.4), saturation) are given in CIE S 017/E:2011 ILV.

3.13
disability glare
dazzling or disabling effect produced by a bright light

Note 1 to entry: This is a retinal effect, primarily caused by light scatter in the eye, which produces a luminous veil over the retinal image and thus reduces contrast.

3.14
discomfort glare
distracting or disrupting effect of bright point sources in the field of view

Note 1 to entry: This is a perceptual effect, interfering with visual attention and selection.

3.15
jitter
unintended periodic movement of an image or parts of it

3.16
legibility
visual properties of a character or graphics representation that determine the ease with which it can be recognized

Note 1 to entry: See also *readability* (3.21).

3.17
map
representation on plane surface of the features of a connected part of the earth surface (especially of the road and traffic environment), shown in their representative forms, sizes and relationship in accordance with some convention of representation

3.18
night condition
condition of low ambient illumination under which the *adaptation* (3.1) level of the driver is mainly influenced by the portion of the road ahead covered by the vehicle’s own headlights and surrounding street lights, and display and instrument *brightness* (3.2)

Note 1 to entry: Low ambient illumination is less than 50 lx.

3.19
pixel
smallest selectively addressable element of the display surface capable of reproducing the full range of luminance and colours

Note 1 to entry: “Pixel” is an abbreviated term for “picture element”.

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Note 2 to entry: Terms and definitions related to photometric quantities (e.g. illuminance, luminance, luminance *contrast ratio* (3.4), saturation) are given in CIE S 017/E:2011 ILV.

3.20
quasi-static information
<reconfigurable displays> information that has a limited number of states, where one or another state is always displayed and does not change frequently

EXAMPLE AM/PM, km/miles, kPa/PSI, on/off information.

3.21
readability
visual properties of a series of characters or words that determine the ease with which they can be read

Note 1 to entry: See also *legibility* (3.16).

3.22
redundantly presented information
information which is presented in parallel by different means or at different positions

EXAMPLE 1 Speed can be displayed in both analogue and digital format.

EXAMPLE 2 Turn-by-turn navigation can be displayed on a central display and in parallel in the instrument cluster.

3.23
segment
pre-defined geometric form that can be used to create a character or symbol in whole or in part

EXAMPLE Stroke.

3.24
static information
<reconfigurable displays> information that does not change, especially physical units

EXAMPLE km, miles, kPa, PSI, mph, kph.

3.25
twilight condition
condition between *night condition* (3.18) and *day condition* (3.7)

Note 1 to entry: In twilight condition, the setting of the display illumination might be in day or night setting.

4 Requirements and measurement methods

4.1 General

The following requirements shall be complied with to ensure that images on the visual displays used in on-board TICS equipment are legible.

Conformity of the presented images to the requirements specified in this document shall be tested at an ambient temperature within the range of 18 °C to 28 °C. The test shall not start until the illumination has reached a stable state. The requirements are accompanied by standard measurement conditions in terms of ambient illuminance and observer positions. Methods for measurement of contrast shall be in accordance with SAE J1757/1.

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