SLOVENSKI STANDARD

SIST-TS CLC/TS 50509:2008

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Uporaba signalnih glav LED v sistemu cestne signalizacije

Use of LED signal heads in road traffic signal systems

LED-Signalgeber in Straßenverkehrs-Signalanlagen

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Use of LED signal heads in road traffic signal systems

This Technical Specification was approved by CENELEC on 2007-06-01.

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CENELEC

European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

This Technical Specification was prepared by Working Group 1 ‘Use of LED signal heads in road traffic signal systems’ of CENELEC BTTF 69-3 ‘Road traffic signal system’.

The text of the draft was submitted to vote in accordance with the Internal Regulations, Part 2, Subclause 11.3.3.3 and was approved by CENELEC as CLC/TS 50509 on 2007-06-01.

The following date was fixed:

– latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2007-12-01

This document contains specifications for the use of LED signal heads in road traffic signal systems in the form of information with regard to the interpretation of existing standards and additional specifications, dealing with specific technical properties of LED signal heads, not previously described in the existing standards.

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Contents

Introduction

This document gives a specification for the mutual behaviour of traffic signal controllers and *light-emitting diode* (LED) based signal heads in road traffic signal systems. The specification was written to contribute to safe and reliable operation, while at the same time allowing the compatible operation of various types and brands of signals and controllers.

Whilst the performance requirements for LED signals heads, as specified in the standards, remain unchanged, various properties of composite LED signals that were implicit for incandescent lamps now need to be described.

The market for LED signals has developed rapidly; products show considerable national or even regional technical differences. This document intends to give guidance to the market for future development and harmonisation.

It is the aim of this document to establish a minimum set of requirements that would allow both controllers and signal heads to be tested separately. Where a controller or signal has been verified as compatible with a class specified in this document, it would be deemed to function safely and securely in cooperation with a signal or controller verified as compatible with the same class.

1 Scope

This Technical Specification considers only newly manufactured and installed signal controllers and signal heads for road traffic applications, using appropriate cabling.

This Technical Specification considers only LED optical units with 200 mm and 300 mm roundels as standardised in EN 12368. It does not consider configurations such as an arrow or a pedestrian symbol, created by specifically positioned patterns of LEDs.

This Technical Specification does not consider railway signalling applications.

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 any amendments) applies.

EN 12368, *Traffic control equipment – Signal heads*

EN 12675, *Traffic Signal Controllers – Functional safety requirements*

EN 50293, *Electromagnetic compatibility – Road traffic signal systems – Product standard*

EN 55015, *Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment (CISPR 15)*

EN 60825 series, Safety of laser products (IEC 60825 series)

EN 60950 series, *Information technology equipment – Safety (IEC 60950* series)

EN 61000-2-2, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems (IEC 61000-2-2)*

EN 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits for harmonic current emissions (equipment input current up to and including 16 A per phase) (IEC 61000-3-2)*

EN 61508 series, *Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508 series)*

HD 638 S1, *Road Traffic Signal Systems*

3 Definitions and abbreviations

3.1 General definitions

3.1.1
road traffic signal system
see HD 638 S1

3.1.2
traffic signal controller
see EN 12675

3.1.3
signal head
see EN 12368

3.1.4
optical unit
see EN 12368

3.1.5
LED signal head
signal head, containing one or more optical units with light-emitting diodes as light source

3.2 Optical definitions

3.2.1
luminous intensity
see EN 12368

3.2.2
luminance uniformity
see EN 12368

3.2.3
dimmed operation
operating mode of the road traffic signal system in which the luminous intensity of the signal heads is reduced, generally during the hours of darkness

3.3 Electrical definitions and abbreviations

3.3.1 Operating Conditions (Steady State) definitions and abbreviations

3.3.1.1
operating voltage U_{IN}
voltage value at the input terminals of the optical unit, whereby the luminous intensity corresponds to the Class indicated in accordance with EN 12368. The voltage is a *root-mean-square* (r.m.s) value

3.3.1.2
relationship between luminous intensity and operating voltage
permissible change of the luminous intensity of the optical unit over the operating voltage range $U_{ON} - U_{IN,max}$

3.3.1.3
operating current I_{IN}
effective (r.m.s) values of the operating current over the operating voltage range $U_{ON} - U_{IN,max}$ with the signal switched on and in the steady state

3.3.1.4
operating current window of measurement
period of time in each half-wave of the operating voltage in which the traffic signal controller can carry out the current measurement for reliable signal monitoring

3.3.1.5
operating current trace inside the window of measurement
allowed deviation for the current profile compared to that that would be taken by a purely resistive load, within the operating current window of measurement (see 3.3.1.4)

3.3.1.6
operating current trace outside the window of measurement
allowed deviation for the current profile compared to that that would be taken by a purely resistive load, outside the operating current window of measurement (see 3.3.1.4)

3.3.1.7
power consumption at nominal value of the operating voltage $P_{IN,nom}$
power consumption of the optical unit at the voltage value $U_{IN,nom}$

3.3.1.8
power factor
see EN 61000-3-2

3.3.2
switching-on (illumination) related definitions and abbreviations

NOTE Differences may exist in specifications depending on the meaning of a signal to road users. For the purpose of this Technical Specification:

- “stop” indicates any signal and/or colour blocking traffic (generally: red);

- “go” indicates any signal and/or colour, permissive to traffic (generally: green and yellow).

3.3.2.1
switch-on interval – current $T_{SET,current}$
interval following the application of the operating voltage until the input current is above the minimum operating current $I_{IN,min}$

3.3.2.2
switch-on interval – light $T_{ON,light}$
interval following the application of the operating voltage until the optical unit reaches the luminous intensity in accordance with EN 12368, 6.3

3.3.2.3
switch-on voltage U_{ON}

operating voltage at which the optical unit reaches a luminous intensity of 10 cd (signal considered “on”). The voltage is a root-mean-square (r.m.s) value

3.3.2.4
transient switch-on overcurrent interval $T_{ON,current}$
interval following the application of the operating voltage until the current is within specified limits of the operating current

3.3.2.5
switch-on overcurrent I_{ON} / $I_{IN,max}$
maximum permissible value (surge) over the operating current $I_{IN,max}$ during the interval $T_{ON,current}$

3.3.3 Switching-off (extinction) related definitions and abbreviations

3.3.3.1
switch-off interval - light $T_{OFF,light}$
interval following the removal of the operating voltage until the optical unit reaches a luminous intensity less than 0,05 cd in the reference axis (signal considered “off”)

3.3.3.2
switch-off voltage U_{OFF}
operating voltage below which the luminous intensity is less than 0,05 cd in the reference axis (signal considered “off”)

3.3.3.3
quiescent current – off I_{OFF}
input current for input voltages below the switch-on voltage U_{ON}

3.3.3.4
feedback voltage ratio U_{REV} / $U_{IN,nom}$
residual voltage ratio measured over the optical unit, a specified interval after the removal of the operating voltage, starting from the nominal value

3.3.3.5
optical unit resistance R_{OFF}
impedance of the unit measured on its terminals when no power is applied

NOTE R_{off} is one method of ensuring that any induced voltage pickup on long signal cable runs is eliminated / dissipate before it reaches any level that may cause controller conflict voltage monitoring where used to activate. However this may be an optional feature that can be dropped to reduce overall power consumption if an alternative method is available within the control equipment.

3.3.4 Fault response forced switch-off

3.3.4.1
residual current - FSO I_{FSO}
remaining residual current after a completed forced switch-off, for the entire operating voltage range

3.3.4.2
reaction interval - FSO $T_{OFF,FSO}$
interval from the triggering of the Forced switch-off procedure to the moment the input current reaches the permissible value for the residual current I_{FSO}

3.3.4.3
switch-off current ratio $I_{OFF,FSO}$ / $I_{IN,max}$
current during the interval $T_{OFF,FSO}$ in relation to the maximum operating current $I_{IN,max}$

3.3.4.4
load current during force off $I_{TRIGGER}$
maximum current drawn during activation of an operation termination circuit (“end of life fuse”) in the optical unit

3.3.4.5
interval to signal “off” – luminous intensity threshold T_{FAIL}
interval from the moment the luminous intensity drops below 80 % of the nominal value during operating conditions (steady state), to the moment the luminous intensity becomes less than 0,05 cd in the reference axis (signal considered “off”)

NOTE The luminous intensity of an optical unit may be measured directly, but may also be determined indirectly by measuring current and/or other electrical properties. The appropriate current values may be declared by the manufacturer of the optical unit.

3.3.4.6
optical unit resistance R_{OFF}
see 3.3.3.5

4 Specification

4.1 Existing standards

LED signal heads have to conform to EN 12368, HD 638 S1, EN 12675 and EN 50293 without restriction or limitation. When LV (Low Voltage) power supply is present, signal heads also have to comply with EN 60950.

Note that, within the scope of this Technical Specification, EN 12368 prescribes the luminous intensity values I_{OFF} and I_{ON}. The values for $I_{IN,min}$ and $I_{IN,max}$ are only tested for the voltage value $U_{IN,nom}$.

An informative, non exhaustive list of requirements that are not influenced by the technology of the light source, and consequently are outside the scope of this Technical Specification, are:

– constructional requirements (e.g. optical unit dimensions);

– environmental requirements (e.g. ambient temperature);

– optical requirements (e.g. luminous intensity, luminance uniformity, colour, phantom effect);

– constructional and environmental test methods.

4.2 Additional technical specifications

4.2.1 Introduction

The properties of traditional incandescent lamps in signal heads (such as a relatively high power consumption, the impossibility of a partial failure and the absence of complicated electronic components near the lamp), have produced standards that implicitly assume a certain behaviour of the light source.

The LED optical units for signal heads have different properties so that some of these assumptions are no longer valid, and explanatory or expanded technical specifications are necessary.

4.2.2 Explanatory specifications

This paragraph details the ***interpretation*** of some existing requirements with regard to specific properties of LED signal heads, such as the introduction of multiple light source LED optical units.

4.2.2.1 Partial failure

Failure of some of the light sources in an LED optical unit is permissible. However, an aspect of an LED signal head is considered to have failed when:

– the luminous intensity of the aspect is below the limit of the standard;

– the luminance uniformity of the aspect no longer satisfies the standard;

– a desired configuration/symbol becomes ambiguous.

The LED optical unit must either be designed in such a way that a failure cannot occur or be monitored in such a way that a failure is detected and dealt with according to the requirements of the standards, within the time interval required.

4.2.2.2 Failure mode analysis

When a failure mode analysis for road traffic signal systems, as defined in HD 638 S1, 5.2.4, is necessary, it must take into account the degree of reliability of any monitoring and control components in the LED signal head.