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English Version

## Inland navigation vessels and sea-going vessels - Navigation light

Bateaux de navigation intérieure et navires de haute mer -  
Eclairage de navigation

Fahrzeuge der Binnen- und Seeschifffahrt -  
Navigationsleuchte

This European Standard was approved by CEN on 8 July 2005.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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## **Foreword**

This European Standard (EN 14744:2005) has been prepared by Technical Committee CEN/TC 15 "Inland navigation vessels", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2006, and conflicting national standards shall be withdrawn at the latest by February 2006.

CEN/TC 300 "Sea-going vessels and marine technology" supports this project.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

## 1 Scope

This European Standard applies to requirements for navigation lights and their testing:

- a) for inland navigation and sea-going vessels;
- b) for recreational craft of 20 m and over;
- c) For recreational craft of less than 20 m that shall also meet the CEVNI rules.

This European Standard is not applicable to navigation lights on recreational craft less than 20 m in length that come within the scope just of COLREGs.

This standard specifies requirements for navigation lights cited in regulations, see Bibliography.

## 2 Normative references

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

EN 60529, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 60945, *Maritime navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required test results (IEC 60945:2002)*

CIE 15, *Colorimetry*

CIE 69, *Methods of characterizing illuminance meters and luminance meters — Performance, characteristics and specifications*

CIE 70:1987, *The measurement of absolute luminous intensity distributions*

ISO/CIE 10527, *CIE standard colorimetric observers*

IEC 60068-2-27, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock*

COLREGs, *International Regulations for Preventing Collisions at Sea, 1972*

Provisions on the colour and luminous intensity of the on-board lights and the approval of signal lights in navigation on the Rhine of the Central Commission for Navigation on The Rhine (CCNR)

CEVNI, *Code Européen des Voies de Navigation Intérieure*

## 3 Terms, definitions and abbreviations

For the purposes of this European Standard, the following terms, definitions and abbreviations apply

### 3.1

#### **navigation light**

signal light

navigation lamp

apparatus with light source on water-borne vessels, recreational craft or on inland navigation and sea-going vessels for the distribution of light of specific colours and angles for the purpose of signalling

**3.2  
navigation light**

signal light  
light  
light phenomena radiated by navigation lights

**3.3  
non-electrically powered navigation light**

light in which the light source is operated with propane or petroleum, for example

**3.4  
range**

distance from which the light of the navigation light may be seen

**3.5  
zero signal direction**

horizontal direction of radiation of a navigation light in the centre-line plane or parallel to it, designated in this standard either as 0° or “dead ahead”

**3.6  
light source**

system for generating light in a navigation light

**3.7  
double-deck navigation light**

two navigation lights arranged in an enclosure one above the other

**3.8  
partially-screened navigation light**

two navigation lights with horizontal beam sectors that combine to give an overall sector  $\geq 360^\circ$

**3.9  
flashing light**

sequence of regular light phenomena per unit of time

**3.10  
reference circle light**

navigation light with radiation range of  $< 360^\circ$

**3.11  
abbreviations**

CCNR	Central Commission for Navigation of the Rhine
CIE	International Commission on Illumination
CEVNI	Code européen des voies de navigation intérieure
COLREGs	International Regulations for Preventing Collisions at Sea, 1972
IMO	International Maritime Organization
LED	Light Emitting Diode
MED	Marine Equipment Directive

## 4 Minimum requirements

### 4.1 Luminous intensity and range

#### 4.1.1 General

$I_0$  is the photometric luminous intensity in candela (cd) that, in the case of navigation lights with an electrical light source, is measured in the laboratory at rated voltage.

Taking into account the ageing of the light source, contamination of the optical system and voltage fluctuations of the vessel power supply system, for example, the luminous intensity under operating conditions  $I_B$  in candela (cd), for the values listed in the COLREGs is assumed to be 20 % less than the photometric luminous intensity  $I_0$ .

Therefore,  $I_B = 0,8 \times I_0$  (cd)

Where

$I_B$  is the luminous intensity under operating conditions, in candela (cd)

$I_0$  is the photometric luminous intensity, in candela (cd)

The range given on the navigation light depends on the interval for  $I_0$  in Table 1 in which the luminous intensity  $I_0$  actually measured lies. It is not permitted to mark a navigation light with a higher or lower figure.

**Table 1 — Range, luminous intensities and range designations**

Nominal size is the range of the navigation lights	Minimum range value		Maximum range value		Operational luminous intensity ( $I_B$ )	Minimum photometric luminous intensity ( $I_0$ ) to be measured in the laboratory	Maximum photometric luminous intensity ( $I_0$ ) to be measured in the laboratory	Other range designation (CCNR, CEVNI)
	nm	km	nm	km				
1	1	1,85	2	3,70	0,9	1,1	5,4	Normal
2	2	3,70	5	9,26	4,3	5,4	65	Bright
3	3	5,56	5	9,26	12	15	65	Bright
5	5	9,26	7,5	13,9	52	65	257	Intense
6	6	11,11	7,5	13,9	94	118	257	Intense

If the luminous intensity of a navigation light is within the ranges specified in Table 1 for  $I_0$ , the COLREGs, CCNR and CEVNI requirements may be considered to have been met.

#### 4.1.2 COLREGs

If the range of the navigation light is intended to meet only the COLREGs, the luminous intensities in Table C.1 of normative Annex C apply instead of Table 1.

#### 4.1.3 CCNR and CEVNI

If the range of the navigation light is intended to meet only the CCNR and CEVNI regulations, the luminous intensities in Table D.1 of normative Annex D apply instead of Table 1.

**4.2 Luminous intensity distribution**

**4.2.1 Horizontal luminous intensity distribution**

The requirements of the COLREGs apply.

According to the COLREG "almost zero" means a value of not greater than 10% of the photometric luminous intensity  $I_0$  measured in the zero signal direction (3.5) (dead ahead direction).

In the case of two-colour or three-colour navigation lights, the luminous intensity distribution shall be uniform so that in the range of 3° on each side of the zero signal, the maximum permissible luminous intensity shall not be exceeded and the minimum required luminous intensity shall not be fallen short of.

The horizontal luminous intensity distribution of the navigation light shall be uniform over the whole radiation angle so that the maximum and minimum values of the photometric luminous intensity do not differ by more than a factor of 1,5. The luminous intensities of the starboard and port lights shall not differ by more than a factor of 1,5.

**4.2.2 Vertical luminous intensity distribution**

The requirements of the COLREGs apply.

The maximum vertical luminous intensity shall not exceed the horizontal luminous intensity at 0° by more than a factor of 1,5. Navigation lights with vertical luminous intensity distribution according to COLREGs, Annex I, 10 (a) specified for motor boats only shall be marked accordingly (three-bladed propeller).

**4.3 Colorimetric requirements**

**4.3.1 General**

The colour ranges given in Table 2 apply.

**Table 2 — Colour range vertices**

Signal light colour	Coordinates of the vertices						
	x	y	z	x	y	z	x
White	x	0,310	0,443	0,500	0,500	0,453	0,310
	y	0,283	0,382	0,382	0,440	0,440	0,348
Red	x	0,690	0,710	0,680	0,660		
	y	0,290	0,290	0,320	0,320		
Green	x	0,009	0,284	0,207	0,013		
	y	0,720	0,520	0,397	0,494		
Yellow	x	0,612	0,618	0,575	0,575		
	y	0,382	0,382	0,425	0,406		
Blue	x	0,136	0,218	0,185	0,102		
	y	0,040	0,142	0,175	0,105		

If the colour locus of a navigation light is within the coordinates specified in Table 2, the COLREGs, CCNR and CEVNI requirements relating to colour loci are satisfied.

NOTE The table corresponds to that in CIE No. 2.2 (TC – 1.6) – 1975; CIE S 004/E – 2001 "Colours of light signals" published by the CIE in 2001 was not regarded as being suitable.



#### 4.3.2 COLREGs

If the colour locus is intended to meet the requirements of the COLREGs only, the colour ranges in Table C.2 in normative Annex C apply instead of Table 2.

#### 4.4 Flashing light

The ruling dimension for the range is the visually effective luminous intensity ( $I_{EFF}$ ).  $I_{EFF}$  is a measure for the conspicuity and efficiency of the flashing light emitted.

$I_{EFF}$  shall attain at least the minimum horizontal photometric luminous intensity values  $I_0$  in Table 1.

$I_{EFF}$  is calculated as follows from the maximum instantaneous luminous intensity in the observation direction ( $I_{MAX}$ ) according to the Blondel-Rey equation:

$$I_{EFF} = \frac{\int_{t_1}^{t_2} I_{MAX} dt}{0,2 + (t_2 - t_1)}$$

Where

$I_{EFF}$  is the effective luminous intensity in candela;

$I_{MAX}$  is the instantaneous value in candela;

0,2 is the Blondel-Rey constant for night observation in seconds;

$t_1$  and  $t_2$  are the integration time limits in seconds.

If the duration of the light phenomenon less the rise time and decay time, i.e. the time in which the instantaneous luminous intensity attains or exceeds the required minimum luminous intensity, is greater than 0,3 s, the light may be regarded as a steady light. The effective luminous intensity shall not then be determined.

**Table 3 — Number of regular light phenomena of flashing lights**

Designation	Area	Number of regular light phenomena per minute	
		min.	max.
Flashing light	CCNR, CEVNI	40	60
Quick flashing light	CCNR, CEVNI	100	120
Flashing light	COLREGs	120	—

The luminous intensity ranges and colour ranges in 4.1 and 4.3 apply, but without the upper limit for the luminous intensity.

The vertical radiation shall be at least 4°.

With an inclination of the flashing light to the horizontal of up to ± 2°, the luminous intensities shall still be at least 80 % of the luminous intensity at 0°.

#### 4.5 Structural requirements

**4.5.1** Prehoistable navigation lights shall be fitted with an adequate strain-relief device for the supply cable that shall withstand a tensile load of at least 50 N.

**4.5.2** In the case of prehoistable navigation lights, the tensile loading shall be tested as described in 5.4.3.

##### 4.5.3 Electrical safety

The electrical safety shall be ensured as described in EN 60945

#### 4.5.4 Reflectors

Reflectors are permitted only in hermetically-sealed systems.

#### 4.6 Fastening

The navigation lights shall be capable of being fastened on board in the specified manner.

#### 4.7 Power supply

4.7.1 The requirements of EN 60945 apply except for those on:

- a) extreme power supply;
- b) excessive conditions;
- c) power supply failure.

#### 4.7.2 Rated voltage

The possible rated voltages for navigation lights are 6 V, 12 V, 24 V, 32 V, 42 V, 115 V and 230 V.

#### 4.8 General requirements

##### 4.8.1 General

Unless otherwise indicated in this standard, the requirements of EN 60945 apply.

##### 4.8.2 Equipment category

Navigation lights belong to the equipment category "exposed to the weather" as specified in EN 60945.

##### 4.8.3 Vibration

When tested as described in 5.3.5, the deviations listed there shall be taken into account.

##### 4.8.4 Rain and spray

The requirements of EN 60945 apply with the addition that a navigation light in continuous duty shall withstand a shock from a flood of water without any change.

The test shall be as described in 5.3.6.

##### 4.8.5 Solar radiation

The test shall be as described in 5.3.7.

##### 4.8.6 Corrosion (salt mist)

The test shall be as described in 5.3.1.

##### 4.8.7 Electromagnetic compatibility

The test shall be as described in 5.3.8.

#### **4.8.8 Compass safe distance**

The requirements of EN 60945 do not apply to navigation lights that consist mainly of non-magnetic materials.

#### **4.8.9 Housing temperature**

Housing parts of electrically powered navigation lights that may be accessed by hand during normal operation shall meet the requirements of the test described in 5.4.2

#### **4.8.10 Mechanical shock**

The test shall be as described in 5.4.1.

### **4.9 Electrical light sources**

The manufacturer of the navigation light shall describe clearly the light source or light sources that are used.

The light source shall be unmistakably identifiable and documented.

Replaceable light sources shall be marked at least with the rated voltage, nominal wattage and the manufacturer's mark.

The rated service life of the light sources shall be at least 1000 h at rated voltage and nominal wattage.

Light sources that correspond to the examples in Annex A meet the requirements of this standard.

### **4.10 Other light sources, e.g. light emitting diodes (LED) and their particularities**

#### **4.10.1 Deviations caused by service life conditions**

If a light source other than an incandescent lamp is used, the navigation light shall clearly indicate (e.g. by failure, similar to the burn out of an incandescent lamp) if the required range can no longer be attained (e.g. as a result of degradation - ageing - or failure of parts of the light source).

#### **4.10.2 Influence of temperature**

##### **4.10.2.1 Influence of temperature on colour locus and luminous intensity**

If something different to an incandescent lamp is used as the light source, it shall be ensured and tested that at ambient temperatures of  $-25\text{ °C}$  to  $+30\text{ °C}$  the luminous intensity and colour locus meet the requirements of this standard both one minute after switching on and after 120 min operation or after thermal equilibrium has been reached.

The test shall be as described in 5.2.4.

##### **4.10.2.2 Dry heat and low temperature**

The light source in the energized state shall withstand ambient temperatures of  $-25\text{ °C}$  to  $+55\text{ °C}$  without damage.

##### **4.10.3 Pulse frequency**

If the light of a light source is timed electrically, this shall be done at a frequency of at least 100 Hz for steady lights so that the human eye does not notice the pulsing.

#### 4.11 Holders for electrical light sources

Holders for electrically powered light sources (also for those with pin caps), shall ensure permanent fixing and perfect electrical contact.

#### 4.12 Partially-screened navigation lights

Navigation lights that are to be used in pairs as all-round lights shall be fitted with partial screens so that the horizontal radiation sectors of the two lights add up to  $\geq 360^\circ$ .

Each of the two navigation lights shall have a mark indicating the "zero signal" direction of the vessel after assembly.

NOTE In order to prevent occlusion of all-round lights by masts and other components, these navigation lights should also be used and operated in pairs. These pairs of navigation lights are called partially-screened navigation lights.

### 5 Testing

#### 5.1 General

##### 5.1.1 Validity of EN 60945

Unless otherwise specified in this standard, the test conditions in EN 60945 apply.

##### 5.1.2 Performance test and performance check

A performance test (PT) within the meaning of EN 60945 is a complete photometric and colorimetric test as described in this standard

A performance check (PC) within the meaning of EN 60945 only requires the navigation light to function after being switched on.

Only a performance check (PC) shall be carried out after or during all the tests specified in EN 60945. A performance test (PT) shall only be carried out after the sequence described in the "Order of the tests" and after the corrosion test.

##### 5.1.3 Pretreatment

The navigation lights are not pretreated before the test.

##### 5.1.4 Order of the tests

The vibration, shock, dry heat, low temperature, solar radiation, rain and spray tests shall be carried out one after another in this order on the same navigation lights.

Then, these navigation lights shall be subjected to a performance test (PT) without any intervention.

All other tests may be carried out in any order.

##### 5.1.5 Documentation

All tests shall be documented.

## **5.2 Photometric and colorimetric tests**

### **5.2.1 Test voltage**

During the photometric and colorimetric tests, the navigation lights shall be supplied with their rated voltage with a tolerance of  $\pm 0,1$  %.

If the manufacturer gives the navigation light a rated voltage range for the operation of his product, the photometric and colorimetric tests shall be carried out at the lowest and highest rated voltages in 4.7.2 that lie within the rated voltage range specified by the manufacturer.

Only in the case of light sources according to 4.10 is the test to be carried out with rated voltage  $\pm 10$  %; the required photometric and colorimetric values shall be attained.

### **5.2.2 Photometric test**

#### **5.2.2.1 Purpose and application**

This test is to determine the luminous intensity, the horizontal and the vertical luminous intensity distribution and the uniformity of the light output over the whole required radiation sector.

The base documents used for the test and assessment are:

- the COLREGs or the CCNR/CEVNI requirements ;
- this standard and
- CIE 70.

#### **5.2.2.2 Procedure**

##### **5.2.2.2.1 Number of test pieces**

The photometric test shall be carried out on at least one navigation light of each type, of each signal colour and of each rated voltage. The test shall be carried out with each light source specified by the manufacturer.

##### **5.2.2.2.2 Goniophotometer**

The photometric test shall be carried out with a goniophotometer with an accuracy of at least 0,2 degrees in the horizontal and vertical directions (see CIE 70:1987, Clauses 1, 2, 3 and 5). The navigation light shall be mounted on the goniophotometer by means of a suitable clamping device in the same way as it is intended to be attached on board, and be turned and inclined horizontally and vertically around the mid-point of the light source as the centre of rotation in accordance with the specified requirements.

##### **5.2.2.2.3 Photometer**

The luminous intensity shall be measured with a photometer with a measuring range of at least  $10^{-3}$  lux to  $10^4$  lux.

The  $V(\lambda)$  adjustment error of the photometer  $f_1$  according to CIE 69 shall not exceed 1,5%. The photometer shall have a tube of neutral colour reducing the internal reflections but not covering parts of the detector surface.

The photometer head detector shall be temperature-stabilized so that, as far as possible, it is not affected by the ambient temperature.

The photometer shall be adjusted to the national standard by calibration.

#### **5.2.2.2.4 Measuring distance**

The measuring distance between the centre point of the navigation light or of the light source and the measuring surface of the photoelectric detector shall lie in a range in which the product of the illuminance measured and the square of the distance in metres remains constant when the distance changes, i.e. the distance shall be greater than the photometric limit distance.

When the photometric limit distance is determined experimentally, it shall be taken into account that when the navigation light is inclined to the optical axis of the photometer, the limit distance may be greater than when the navigation light is standing vertical to the optical axis of the photometer.

#### **5.2.2.2.5 Calibration of the measuring section**

The calibration of the whole measuring set-up shall be checked with the aid of a suitable calibration lamp that has also been calibrated to the national standard at the measuring distance selected for the test to be carried out. The check shall be documented.

#### **5.2.2.2.6 Scattered light**

The photometric test shall be carried out in a darkened room in which the limiting surfaces shall be designed to have low reflectivity to ensure that only the light emitted directly by the navigation light to be tested is measured by the photoelectric detector.

The effect of scattered light on the measured result shall be tested, e.g. by cutting off the light falling directly onto the measuring detector directly from the test piece (see 15.4 of CIE 70:1987.).

#### **5.2.2.2.7 Power supply**

During the test, the electrically powered navigation light shall be operated with the test voltage, principally d.c. voltage, via a quickly and finely adjusting power supply unit that keeps the current and voltage constant. The voltage shall be measured as close to the test piece as possible.

The equipment used for setting and controlling the current and voltage shall be calibrated to the national standard.

#### **5.2.2.2.8 Ageing and stabilizing**

Electrical light sources shall be aged before the test and burned in directly before the test; for the required periods, see Table 4.

**Table 4 — Minimum values for ageing and burning-in period of different light source types**

Lamp type	Ageing	Burning-in period
Incandescent lamp	1 % of the nominal service life, but at least 1 hour	15 minutes
Fluorescent lamp	100 hours	3 hours
Compact fluorescent lamp	100 hours	24 hours
Mercury vapour high-pressure lamp	100 hours	20 minutes
Halogen metal vapour lamp	100 hours	30 minutes
Sodium vapour high-pressure lamp	100 hours	20 minutes
LED	50 hours	1 hour

The ageing and burning-in shall each be carried out at rated voltage.

Non-electrically powered light sources in navigation lights shall be tested after a stabilizing operating phase as actually operated on board.

#### 5.2.2.2.9 Procedure

The luminous intensity shall be measured in the horizontal plane in the middle of the light source of the navigation light and be continuously measured in an arc extending at the sector limits  $20^\circ$  in each case beyond the specified curve of the horizon. The angle between two measurements shall not exceed  $0,2^\circ$ .

These measurements shall also be made with a navigation light inclined around the horizontal axis in all angles corresponding to the angles required in Clause 10 of Annex 1 of the COLREGs.

Further measurements shall be taken in two vertical planes at right angles to the horizontal sector limits, except for sidelights where the vertical planes are intended to lie at an angle of  $60^\circ$  and  $30^\circ$  to the forward sector limit and in the "dead ahead" direction. For all-round lights, the two vertical planes shall lie at the point of the least established luminous intensity, on the one hand, and at  $180^\circ$  to it, on the other. The luminous intensity shall be measured in the specified vertical planes in the middle of the light source of the navigation light and be continuously measured in an arc extending at the vertical sector limits at least  $10^\circ$  in each case beyond the vertical sectors specified in Clause 10 of Annex 1 of the COLREGs. The angle between two measurements shall not exceed  $0,2^\circ$ .

If the light source is interchangeable, the photometric test shall be carried out on three different light sources.

#### 5.2.2.3 Required result

The luminous intensities and their distributions of the measured test pieces shall meet the requirements of this standard.

All the measured values (luminous intensity distribution curves, current and voltage during the measurements, ambient temperature, checking of the calibration of the measuring section) shall be documented.

### 5.2.3 Colorimetric test

#### 5.2.3.1 Purpose and application

This test shall determine the colour of the signal light over the horizontal and vertical radiation range and the uniformity of the colour over the whole required radiation sector.



The base documents used for the test and assessment are:

- the COLREGs or the CCNR/CEVNI requirements;
- this standard and
- CIE 15.

### **5.2.3.2 Procedure**

#### **5.2.3.2.1 Number of test pieces**

The colorimetric test shall be carried out on at least one test piece of each type, each signal colour and each rated voltage from the photometric test. The test shall be carried out with each light source specified by the manufacturer.

#### **5.2.3.2.2 Colorimeter**

Testing of the signal light colour of the navigation light under simulated operating conditions shall be carried out with a maximum-precision colorimeter for absolute measurement, e.g. in accordance with the tristimulus colorimetry method described in CIE 15. The photoelectric detector for the colorimetry shall be matched very finely to the standard spectral value functions  $\bar{x}(\lambda)$ ,  $\bar{y}(\lambda)$  and  $\bar{z}(\lambda)$  for the 2° field size as specified in ISO/CIE 10527 on partial filtering.

For measuring the signal light colour, the sensitivity of the measuring system shall be at least 1 lux.

The photoelectric detector for the colorimetry shall have a neutral colour tube reducing the internal reflections but not covering parts of the detector surface. The detector shall be temperature-stabilized so that, as far as possible, it is not affected by the ambient temperature.

#### **5.2.3.2.3 Calibration of the measuring section**

The measuring system for the colorimetry shall be checked before each prototype test with a suitable calibrated light source and calibrated colour filters. The check shall be documented.

The colorimeter, the light source and the colour filters shall be calibrated to the national standard.

#### **5.2.3.2.4 Scattered light**

The colorimetric test shall be carried out in a darkened room in which the limiting surfaces particularly close to the mounted navigation light shall be of a neutral colour and be designed to have low reflectivity to ensure that only the light colour emitted directly by the signal light of the navigation light to be tested is measured by the photoelectric detector of the colorimeter.

#### **5.2.3.2.5 Goniometer table**

The colorimetric test shall be carried out on a goniometer table. The navigation lights shall be assembled on the goniometer table with suitable clamping devices in the same way as they are fitted on board and be rotated and inclined horizontally and vertically around the mid-point of the light source as the centre of rotation in accordance with the set requirements.

#### **5.2.3.2.6 Geometry**

The measuring distance between the mid-point of the navigation light or of the light source and the measuring surface of the photoelectric detector for the colorimetry shall be set so that the detector surface is illuminated fully and uniformly without any structural projections of the light-emitting surface of the navigation light surface.

#### **5.2.3.2.7 Power supply**

During the test, the electrically powered navigation light shall be operated with a test voltage, principally d.c. voltage, via a quickly and finely adjusting power supply unit that keeps the current and voltage constant. The voltage shall be measured as close to the test piece as possible.

The equipment used for setting and controlling the current and voltage shall be calibrated to the national standard.

#### **5.2.3.2.8 Ageing and stabilizing**

For ageing and stabilizing, see 5.2.2.2.8.

#### **5.2.3.2.9 Procedure**

The colour shall be measured with goniometers and the measurements shall be taken in the horizontal and vertical directions at least every 10 ° within the specified sectors.

#### **5.2.3.3 Required result**

The colour loci of the measured test pieces shall lie within the colour ranges specified in this standard for the particular signal colour.

All the measured values (colour loci, current and voltage during the measurements, ambient temperature, checking of the calibration of the measuring section) shall be documented.

### **5.2.4 Measurement of luminous intensity and colour locus under the influence of temperature**

If a light source other than an incandescent lamp (e.g. LED) is used, according to the photometric and colorimetric tests described above, the influence of the ambient temperature on the luminous intensity and the colour locus of the navigation light shall be tested (cf. 4.10.2). Absolute measurements are not required for this; it is adequate to compare the luminous intensity and colour locus in a specific direction of radiation at the ambient temperatures given in 4.10.2 with the luminous intensity and colour locus at room temperature. This may be done, for example, in a conditioned cabinet with a glass door and without the use of a swivelling or inclining device. After each temperature change, thermal equilibrium shall be attained before recording the measured values. The shifts in the measured results caused by the influence of the ambient temperature shall then be inserted in a relationship to the results of the previous absolute measurements. The test is successful if the requirements are still met taking into account the shifts.

### **5.2.5 Measurement of flashing lights**

In the case of flashing lights, the following deviations from 5.2.2 and 5.2.3 shall be taken into account:

- a) three horizontal light intensity distribution curves shall be plotted, one at 0° inclination, one at -2° inclination and one at +2° inclination. The step size between two measured points shall not exceed 2°;
- b) at the point where the smallest luminous intensity was determined when plotting these three curves, a further vertical curve with an inclination from -10 ° to +10 ° and a step size not exceeding 1° shall be plotted;
- c) the required minimum luminous intensity shall be attained at all the measuring points in the range of the vertical angle of - 2° to + 2° (4.4);
- d) the colour locus shall be determined at 10 points that shall be distributed over the four curves plotted.

### 5.3 Explanations, supplements or amendments to points in EN 60945

#### 5.3.1 Corrosion (salt mist)

The test can only be waived if the navigation light is an enclosed system (at least IP 67 according to EN 60529) and the enclosure materials are corrosion-resistant.

#### 5.3.2 Extreme power supply

Unless otherwise specified in this standard, all the tests in this standard deviating from EN 60945 shall be carried out with rated voltage only.

#### 5.3.3 Dry heat

The test for resistance to dry heat shall be as specified in EN 60945. For deviating temperature ranges, see 4.10.2.

#### 5.3.4 Damp heat

The test is omitted.

#### 5.3.5 Vibration

For the vibration test as described in the "Vibration" clause of EN 60945, the following deviations are specified:

The resonance search shall be carried out in the range 2 Hz to 15 Hz with an altitude of  $\pm 2,5$  mm and from 15 Hz to 100 Hz with a constant acceleration of 2,3 g.

NOTE 1 It should be taken into account that navigation lights mounted on masts are often subjected to vibration stresses that are greater than the stresses (vibrations) occurring on the bridge, for example.

The abovementioned vibration amplitudes also apply to the vibration endurance test.

The light source shall be operated with rated voltage during the test.

The test is regarded as having been successful if the navigation light continues to function and no damage has occurred to the prototype or its subassemblies and components.

NOTE 2 For navigation lights with interchangeable light sources, a sensor may be fitted to the light source in addition to the sensor on the enclosure of the test piece required in the "Vibration" clause of EN 60945. The signals of the two sensors should then be considered equally.

#### 5.3.6 Rain and spray

This test is omitted if the navigation light is proven to meet the requirements of IP 67 according to EN 60529 at least.

The "Rain and spray" (exposed equipment) test described in EN 60945 shall be carried out on a navigation light in operation. The navigation light shall be switched on 1 h before the test. Cold water with a temperature not exceeding 15 °C shall be used for the test.

The degree of protection of the prototype shall be IP X6 as specified in EN 60529.

The protection shall be regarded as adequate as long as water ingress does not have an adverse effect on the operation of the prototype.

**5.3.7 Solar radiation**

If a test has been carried out as described in EN 60945, a colorimetric test as described in 5.2.3 shall then be successfully undergone.

**5.3.8 EMC**

The tests shall be carried out only on electrically powered navigation lights that are not purely resistive loads.

**5.4 Tests outside the scope of EN 60945**

**5.4.1 Shock**

The test shall be carried out in accordance with test Ea of IEC 60068-2-27 with the acceleration and shock pulse duration given in Table 5:

**Table 5 — Acceleration and shock pulse duration**

Peak acceleration (A)	15 g
Pulse duration (D)	11 ms
Pulse shape	Half-sine pulse

For the test, the navigation light shall be mounted by means of its fastening elements in the on-board position as specified by the manufacturer. The test shall be carried out in three axes (X, Y, Z) at right angles to each other. Three shocks shall be introduced in each of the six directions. During the test, the functioning of the navigation light shall be demonstrated.

The test is considered to be successful if no damage is established.

**5.4.2 Enclosure temperature of electrically powered navigation lights**

This test determines the enclosure temperature of the navigation light.

Procedure and limits: ambient temperature 20 °C; air speed in test chamber ≤ 1 m/s; burning time of the navigation light before the test ≥ 2 h; maximum allowable surface temperature according to Table 6:

**Table 6 — Enclosure temperature of navigation lights**

	Maximum allowable temperature rise °C
Surface temperature – metallic components	50
Surface temperature – non-metallic components	65

The surface temperature shall be measured only on components that can be reached with the hand.

The test is considered to have been successful if the abovementioned components of the navigation light do not exceed the maximum allowable temperatures.

**5.4.3 Mechanical tensile test on prehoistable navigation lights**

Prehoistable navigation lights shall be tested for dimensional stability with the tensile forces indicated below.

The tensile forces for the test shall be at least 30 times the dead weight of the test piece. The test piece shall be operated for one hour in the energized state in a low-draught environment before the test is carried out for a period of 15 min.

## 6 Equipment manual

The wording of the equipment manual shall be as specified in EN 60945.

The equipment manual shall adequately describe the light sources with which the navigation light is to be operated

## 7 Marking

Instead of the marking requirements specified in EN 60945, each navigation light shall be marked permanently in a position clearly visible even after installation on board with the following information:

- zero signal direction by a mark on the reference circle lights;
- range in nautical miles;
- origin mark (manufacturer's identification mark);
- approval mark;
- type designation;
- nominal wattage of the light source in watts, if different values lead to different ranges;
- three-bladed propeller for navigation lights that have a vertical light distribution only for motor boats (COLREGs Annex I, 10 (a)).

As a deviation from EN 60945, a serial number mark is not generally required.

## Annex A (informative)

### Electrical light sources

#### A.1 Examples of electrical light sources

**A.1.1** The requirements in A.1.2 to A.1.8 apply to the light sources shown in Figures A.1 and A.2.

**A.1.2** Light sources shall be used only in the specified position in navigation lights. A maximum of two clear positions are allowed. Unintentional twisting and intermediate positions shall be excluded. The most unfavourable position is selected for the test.

**A.1.3** Light sources shall have no properties that have an adverse effect on their efficiency, e.g. streaks or spots on the bulb or faulty arrangement of the filament in the bulb.

**A.1.4** In an incandescent lamp, the operating temperature shall not fall below 2 360 K.

**A.1.5** Holders and caps shall be used that meet the special requirements of the "navigation light" optical system and of the mechanical stressing of on-board operation.

**A.1.6** The cap of an incandescent lamp shall be securely connected to the bulb so that the incandescent lamp withstands a torque of 2,5 Nm without undergoing any change or damage after burning in for 100 hours at 10 % overvoltage.

**A.1.7** An incandescent lamp shall be legibly and permanently marked on the cap or on the bulb with:

- origin mark;
- rated voltage;
- nominal wattage and/or
- rated luminous intensity and
- approval mark.

The efficiency of an incandescent lamp shall not be impaired by the marking on the bulb.

**A.1.8** Incandescent lamps shall be within the tolerances indicated in A.2.

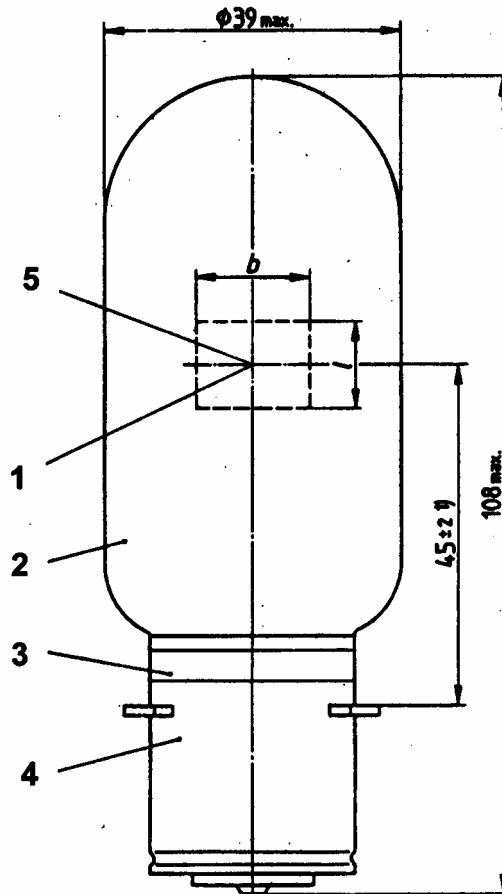
## A.2 Incandescent lamps placed on the market for navigation lights

### A.2.1 Types of construction

#### A.2.1.1 Type (B)

Rated voltages 24 V, 115 V and 230 V are approved for type (B) as specified in Table A.1 and Figure A.1.

Dimensions in millimetres



#### Key

- 1 Light centre  
The permissible deviation for the light centre of the 24 V/40 W lamp is  $\pm 1,5$  mm
- 2 Bulb, clear
- 3 Marking area
- 4 Lamp cap P 28 s, cap position L  
L Wide tongue of the lamp cap P 28s is on the left-hand side for a vertical lamp looking towards the direction of radiation
- 5 Permissible deviation of the filament axis from the cap axis in the light centre =  $\pm 1,5$  mm

**Figure A.1 — Example of type (B) with lamp cap P 28s and clear bulb**



Table A.1 — Rated voltage, nominal wattage, dimensions and test values

Rated voltage V	Nominal wattage W	Max. wattage <sup>b</sup> W	Test values <sup>a</sup>		Filament mm	
			Horizontal luminous intensity <sup>b</sup> Cd	Colour temperature K	<i>b</i>	<i>l</i>
24	40	43	45 to 65	2 360 to 2 856	0,72 <sup>+0,1</sup> <sub>0</sub>	13,5 <sup>+1,35</sup> <sub>0</sub>
115	60	69			15 <sup>+2,5</sup> <sub>0</sub>	11,5 <sup>+1,5</sup> <sub>0</sub>
230	65	69				

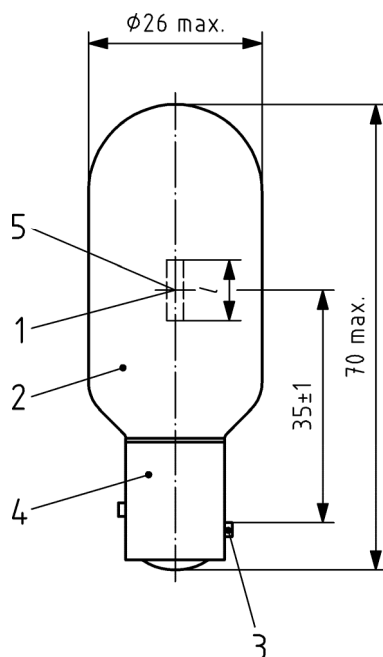
<sup>a</sup> Before measuring the initial values, the incandescent lamps are to be aged at the rated voltage for 60 minutes in the position of normal use.

<sup>b</sup> In the radiation range  $\pm 10^\circ$  relative to the horizontal line through the mid-point of the filament, these values are not to be exceeded or fallen short of when the lamp is rotated through  $360^\circ$  on its axis.

## A.2.1.2 Type (E)

Rated voltages 12 V and 24 V are approved for type (E) as indicated in Table A.2 and Figure A.2.

Dimensions in millimetres



## Key

- 1 Light centre
- 2 Bulb, clear
- 3 Reference pin
- 4 Lamp cap BAY 15 d
- 5 Permissible deviation of the filament axis from the cap axis in the light centre =  $\pm 1$  mm

Figure A.2 — Example of type (E) with lamp cap BAY 15d and clear bulb

Table A.2 — Rated voltage, nominal wattage, dimensions and test values

Rated voltage V	Nominal wattage W	Max. wattage W	Test values <sup>a</sup>		Filament / mm	
			Horizontal luminous intensity <sup>b</sup> cd	Colour temperature K		
12	10	18	12 to 20	2 360 to 2 856	9 to 13	
24					9 to 17	
12	25	26,5	30 to 48			9 to 13
24						

<sup>a</sup> Before measuring the initial values, the incandescent lamps are to be aged at the rated voltage for 60 minutes in the position of normal use.

<sup>b</sup> In the radiation range  $\pm 30^\circ$  relative to a horizontal line through the mid-point of the filament, these values are not to be exceeded or fallen short of when the lamp is rotated through  $360^\circ$  on its axis.

### A.2.2 Lamp caps

The following lamp caps may be selected:

- P 28s as specified in EN 60061-1, see Figure A.1;
- BAY 15d as specified in EN 60061-1, see Figure A.2.

## Annex B (informative)

### Instructions for the test laboratory

#### B.1 Test report

The minimum information according to Annex E of EN 60945:2002

#### B.2 Test record/check list

##### B.2.1 Test piece data

Name of the manufacturer:

Type designation:

Type of navigation light:

Colour(s) of the navigation light:

Desired range of the navigation light:

Type of light source:

Power supply:

##### B.2.2 Strain-relief device for the cable (if required in 4.5.1)

Exists:	Yes	No
---------	-----	----

Test successful:	Yes	No
------------------	-----	----

##### B. 2.3 Electrical safety according to EN 60945

See 4.5.3

Tested and test successful:	Yes	No
-----------------------------	-----	----

##### B.2.4 Vibration

See 4.8.3 and 5.3.5

Resonance search:

X Resonance(s) at	Hz
-------------------	----

Y Resonance(s) at	Hz
-------------------	----

Z Resonance(s) at	Hz
-------------------	----

Endurance test:

At      Hz, duration	h
----------------------	---

Damage:

Performance check (PC) successful:	Yes	No
------------------------------------	-----	----

##### B.2.5 Mechanical shock

See 4.8.10 und 5.4.1

3 shocks in + X-direction

3 shocks in – X-direction

3 shocks in + Y-direction

3 shocks in – Y-direction

3 shocks in + Z-direction

3 shocks in – Z-direction

Damage:

Performance check (PC) successful:	Yes	No
------------------------------------	-----	----

##### B.2.6 Dry heat

See 4.10.2.2 and 5.3.3

Manufacturer of the climatic cabinet

Type designation of the climatic cabinet:

Serial number of the climatic cabinet:

Most recent calibration of the climatic cabinet:

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Manufacturer of the separate temperature measuring equipment:  
Type designation of the temperature measuring equipment:  
Serial number of the temperature measuring equipment:  
Most recent calibration of the temperature measuring equipment:  
Steady-state temperature:  
Duration:  
Performance check (PC) successful:

°C  
h min  
Yes No

### B.2.7 Low temperature

See 4.10.2.2

Manufacturer of the climatic cabinet  
Type designation of the climatic cabinet:  
Serial number of the climatic cabinet:  
Most recent calibration of the climatic cabinet:  
Manufacturer of the separate temperature measuring equipment:  
Type designation of the temperature measuring equipment:  
Serial number of the temperature measuring equipment:  
Most recent calibration of the temperature measuring equipment:  
Steady-state temperature:  
Duration:  
Test piece switched on after:  
Performance check (PC) successful:

°C  
h min  
h min  
Yes No

### B.2.8 Solar radiation

See 4.8.5 and 5.3.7

Test carried out or waiver exists:  
If not, there shall be a manufacturer's certificate  
stating that the test has been successful  
Inspection after the test:  
Damage:  
Performance check (PC):  
Colorimetric test after the test:  
Successful:  
Overall test successful:

Test Waiver  
  
  
  
  
  
Yes No  
Yes No

### B.2.9 Rain and spray

See 4.8.4 and 5.3.6

Number of hours switched on before test:  
Water temperature:  
Water penetrated:  
Penetrated water having no effect:  
Performance check (PC) successful:

h min  
°C  
Yes No  
Yes No  
Yes No

### B.2.10 Performance test (PT)

See 5.1.2

Photometric test successful:  
Colorimetric test successful

Yes No  
Yes No

### B.2.11 Corrosion (salt mist)

See 4.8.6 and 5.3.1

Performance check (PC):  
Photometric test successful:  
Colorimetric test successful:

Yes No  
Yes No

### B.2.12 Electromagnetic compatibility (EMC)

See 4.8.7 and 5.3.8

Performance check (PC) successful:

Yes No

**B.2.13 Compass safe distance**

See 4.8.8

Navigation light mainly of non-magnetic materials?	Yes	No
Compass safe measurement:	Yes	No
Result:		

**B.2.14 Enclosure temperature**

See 4.8.9 and 5.4.2

Manufacturer of the temperature measuring equipment:		
Type designation of the temperature measuring equipment:		
Most recent calibration of the temperature measuring equipment:		
Room temperature:	°C	
Air speed:	m/s	
Number of hours switched on before the test:	h	min
Surface temperature of the metallic components:	°C	
Surface temperature of the non-metallic components:	°C	
Test successful:	Yes	No

**B.2.15 Mechanical tensile test (prehoistable navigation lights)**

See 4.5.2 and 5.4.3

Weight of test piece:	kg	
Time switched on before the test:	h	min
Period of loading:	min	
Force of loading:	N	
Damage:	Yes	No
Test successful:	Yes	No

**B.2.16 Photometric test**

See 4.2 or 4.3 and 5.2.2

Photometric limit distance determined:	m (approx.)	
Measured distance fixed at:	m	
Manufacturer of the photometer:		
Type designation of the photometer:		
Serial number(s) of the photometer:		
Most recent calibration of the photometer:		
Manufacturer of the calibration lamp:		
Type designation of the calibration lamp:		
Serial number of the calibration lamp:		
Most recent calibration of the calibration lamp:		
Manufacturer of the voltmeter:		
Type designation of the voltmeter:		
Serial number of the voltmeter:		
Most recent calibration of the voltmeter:		
Manufacturer of the ammeter:		
Type designation of the ammeter:		
Serial number of the ammeter:		
Most recent calibration of the ammeter:		
Manufacturer of the power supply unit:		
Type designation of the power supply unit:		
Influence of scattered light checked:		
Calibration of the measuring section tested:		
Period of ageing of light source:	h	min
Period of burning in of light source:	h	min
Voltage applied to test piece:	V	AC / DC
Current consumption of test piece at beginning of the test:	A	
Current consumption of test piece at end of the test:	A	
Luminous intensity distribution curves: please attach		
Mean horizontal luminous intensity:	cd	
Horizontal luminous intensity distribution o.k.:	Yes	No

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Sector limits adhered to:	Yes	No
Horizontal luminous intensity distribution uniform:	Yes	No
Vertical luminous intensity distribution o.k	Yes	No
Range determined in nautical miles (nm) and/or classification: normal/bright/intense		
Flashing light: number of regular light phenomena per min:		
Repeat of the photometric test with two further light sources		
Results of the three tests agree:	Yes	No
Test successful:	Yes	No

**B.2.17 Colorimetric test**

See 4.3 or 4.4 and 5.2.3

Measured distance fixed at:	m	
Manufacturer of the colorimeter:		
Type designation of the colorimeter:		
Serial number(s) of the colorimeter:		
Most recent calibration of the colorimeter:		
Manufacture of the calibration lamp:		
Type designation of the calibration lamp:		
Serial number of the calibration lamp:		
Most recent calibration of the calibration lamp:		
Manufacturer of the colour filters:		
Designation of the colour filters:		
Most recent calibration of the colour filters:		
Manufacturer of the voltmeter:		
Type designation of the voltmeter:		
Serial number of the voltmeter:		
Most recent calibration of the voltmeter:		
Manufacturer of the ammeter:		
Type designation of the ammeter:		
Serial number of the ammeter:		
Most recent calibration of the ammeter:		
Manufacturer of the power supply unit:		
Type designation of the power supply unit:		
Influence of scattered light checked:		
Period of ageing of the light source:	h	min
Period of burning in of the light source:	h	min
Voltage applied to test piece:	V	AC / DC
Current consumption of test piece:	A	
List of colour loci measured with angle data: please attach		
Measured colour loci lie within the permitted colour ranges:	Yes	No
Test successful:	Yes	No

**B.2.18 Influence of temperature on colour locus and luminous intensity when using other light sources**

See 4.10.2.1 and 5.2.4

Manufacturer of the climatic cabinet:	
Type designation of the climatic cabinet:	
Serial number of the climatic cabinet:	
Most recent calibration of the climatic cabinet:	
Manufacturer of the separate temperature measuring equipment:	
Type designation of the temperature measuring equipment:	
Serial number of the temperature measuring equipment:	
Most recent calibration of the temperature measuring equipment:	
Type designation of the photometer:	
Serial number(s) of the photometer:	
Most recent calibration of the photometer:	
Manufacturer of the colorimeter:	

Type designation of the colorimeter:		
Serial number(s) of the colorimeter:		
Most recent calibration of the colorimeter:		
Manufacturer of the voltmeter:		
Type designation of the voltmeter:		
Serial number of the voltmeter:		
Most recent calibration of the voltmeter:		
Manufacturer of the ammeter:		
Type designation of the ammeter:		
Serial number of the ammeter:		
Most recent calibration of the ammeter:		
Manufacturer of the power supply unit:		
Type designation of the power supply unit:		
Influence of scattered light checked:	Yes	No
Voltage applied to test piece:	V	AC / DC
Current consumption of test piece:	A	
<u>At normal room temperature:</u>		
Number of hours since climatic cabinet temperature prevailed:		
Temperature measured in the climatic cabinet:	°C	
Luminous intensity 1 min after switching on:	cd	
Colour locus 1 min after switching on:	x	y
Luminous intensity 120 min after switching on:	cd	
Colour locus 120 min after switching on:	x	y
<u>At high temperature:</u>		
Number of hours since climatic cabinet temperature prevailed:		
Temperature measured in the climatic cabinet:	°C	
Luminous intensity 1 min after switching on:	cd	
Colour locus 1 min after switching on:	x	y
Luminous intensity 120 min after switching on:	cd	
Colour locus 120 min after switching on:	x	y
<u>At low temperature:</u>		
Number of hours since climatic cabinet temperature prevailed:		
Temperature measured in the climatic cabinet:	°C	
Luminous intensity 1 min after switching on:	cd	
Colour locus 1 min after switching on:	x	y
Luminous intensity 120 min after switching on:	cd	
Colour locus 120 min after switching on:	x	y
Change of luminous intensity through temperature increase (delta):	cd	%
Change of luminous intensity through temperature decrease (delta):	cd	%
Shift of colour locus through temperature increase:	x	y
Shift of colour locus through temperature decrease:	x	y
Even with changes, luminous intensity lies within permissible range	Yes	No
Even with shifts, colour locus lies within permissible range:	Yes	No
Test successful:	Yes	No

### B.2.19 Marking of the navigation light

See Clause 7

Nominal wattage of the power source:	Yes	No
Zero signal marking:	Yes	No
Range data:	Yes	No
Manufacturer's identification mark:	Yes	No
Type designation:	Yes	No
Approval mark:	Yes	No
Type of navigation light:	Yes	No
Serial number:	Yes	No
Test successful:	Yes	No

### B.2.20 Marking of the light source

See 4.9

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In the test documents submitted, is/are the light source(s) unmistakably identifiably documented:	Yes	No
Rated voltage:	Yes	No
Nominal wattage:	Yes	No
Manufacturer's identification mark:	Yes	No
Test successful:	Yes	No

### **B.2.21 Equipment manual**

See Clause 6

Instructions in English:	Yes	No
Description of installation ok:	Yes	No
Description of troubleshooting ok:	Yes	No
Is/are the light source(s) unmistakably identifiably documented in the equipment manual	Yes	No
Test successful:	Yes	No



## Annex C (normative)

### COLREGs

#### C.1 Ranges and luminous intensities

**Table C.1 — Range and luminous intensities according to Annex I, 8 of the COLREGs**

Range $D$ in nautical miles	Luminous intensity $I_B$ in candela $K = 0,8$
1	0,9
2	4,3
3	12
4	27
5	52
6	94

#### C.2 Colour ranges

**Table C.2 — Colour ranges according to Annex I, 7 of the COLREGs**

The limits of the individual colour ranges are determined by the following coordinates of the vertices:

- (i) White:
 

x	0,525	0,525	0,452	0,310	0,310	0,443
y	0,382	0,440	0,440	0,348	0,283	0,382
- (ii) Green:
 

x	0,028	0,009	0,300	0,203
y	0,385	0,723	0,511	0,356
- (iii) Red:
 

x	0,680	0,660	0,735	0,721
y	0,320	0,320	0,265	0,259
- (iv) Yellow:
 

x	0,612	0,618	0,575	0,575
y	0,382	0,382	0,425	0,406

## Annex D (normative)

### CCNR and CEVNI

#### D.1 Ranges and luminous intensities

The following table contains the permissible limit values of  $l_0$ ,  $l_B$  and  $t$  for the various signal lights; the values given apply to the light radiated by the signal lights.

$l_0$  and  $l_B$  are given in cd and the range  $t$  in km.

**Table D.1 — Ranges and luminous intensities according to the provisions of the CCNR [4], Article 8 and CEVNI [5], Annex 5, II, 1**

Types of signal lights		White		Green/red		Yellow		Blue	
		min.	max.	min.	max.	min.	max.	min.	max.
Normal	$l_0$	2,7	10,0	1,2	4,7	1,1	3,2	0,9	2,7
	$l_B$	2,0	7,5	0,9	3,5	0,8	2,4	0,7	2,0
	$t$	2,3	3,7	1,7	2,8	1,6	2,5	1,5	2,3
Bright	$l_0$	12,0	33,0	6,7	27,0	4,8	20,0	6,7	27,0
	$l_B$	9,0	25,0	5,0	20,0	3,6	15,0	5,0	20,0
	$t$	3,9	5,3	3,2	5,0	2,9	4,6	3,2	5,0
Intense	$l_0$	47,0	133,0	-	-	47,0	133,0	-	-
	$l_B$	35,0	100,0	-	-	35,0	100,0	-	-
	$t$	5,9	8,0	-	-	5,9	8,0	-	-

#### D.2 Colour ranges

**Table D.2 — Colour ranges according to the provisions of the CCNR [4], Article 7 and CEVNI [5], Annex 4, II, 2**

Colour of the signal light		Coordinates of the vertices					
		x	y	x	y	x	y
White	x	0,310	0,443	0,500	0,500	0,453	0,310
	y	0,283	0,382	0,382	0,440	0,440	0,348
Red	x	0,690	0,710	0,680	0,660		
	y	0,290	0,290	0,320	0,320		
Green	x	0,009	0,284	0,207	0,013		
	y	0,720	0,520	0,397	0,494		
Yellow	x	0,612	0,618	0,575	0,575		
	y	0,382	0,382	0,425	0,406		
Blue	x	0,136	0,218	0,185	0,102		
	y	0,040	0,142	0,175	0,105		

## Bibliography

- [1] 96/98/EC, Marine Equipment Directive, (MED)
- [2] 94/25/EC, Recreational Craft Directive, (RCD)
- [3] 82/714/EEC, Council Directive of 4 October 1982 laying down technical requirements for inland waterway vessels
- [4] EN 60061-1, *Lamp caps and holders together with gauges for the control of interchangeability and safety — Part 1: Lamp caps (IEC 60061-1:1969 + Addenda A:1970 to N:1992, modified)*