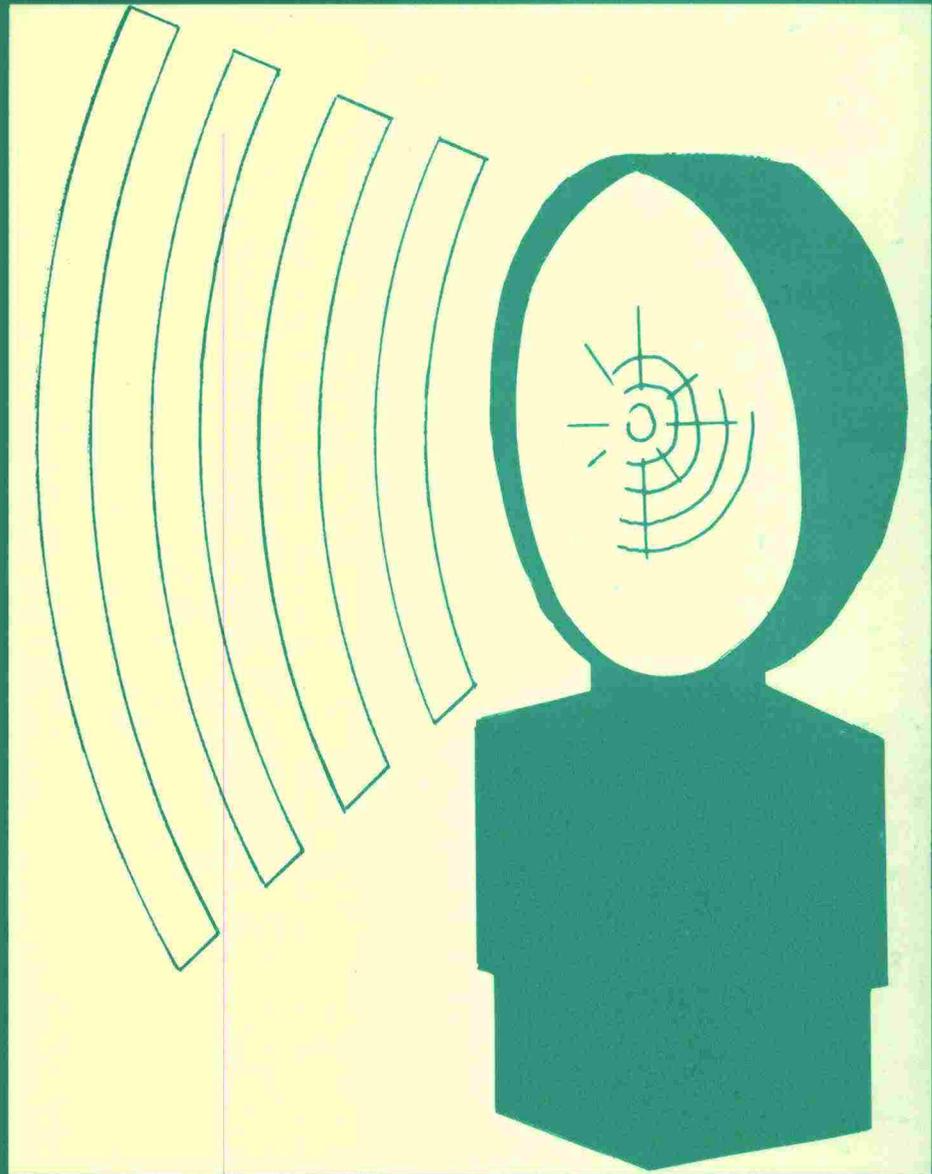




# Quality requirements for warning flashers and lanterns



Helsinki 1991

Finnish National  
Road Administration

NÄYTEKPL.

# **Quality requirements for warning flashers and lanterns**

**Finnish National  
Road Administration**

Helsinki, Finland 1991

ISBN 951-47-4097-1  
TIEL 2130001  
Valtion painatuskeskus  
Helsinki 1991

This publication is available:

**Finnish National  
Road Administration**  
Opastinsilta 12  
P.O. Box 33  
SF-00521 HELSINKI  
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The Finnish Roads and Waterways Administration (now Finnish National Road Administration) has approved the Quality Requirements for Warning Flashers and Lanterns given herein on 12 November 1984. At the same time the Administration cancelled the earlier Quality Requirements which were approved on 1 December 1975.

The Quality Requirements apply to all warning flashers and lanterns used in connection with devices intended for warning or closing off road traffic.

Approvals of warning flashers and lanterns issued on the basis of the earlier Quality Requirements continue to be in force, nevertheless so that approvals issued prior to 1 December 1975 are cancelled and the devices to which they apply should be withdrawn from use by the end of 1986.

This translation is made in 1991.

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## 1. GENERAL

### 1.1 Concepts

In these guidelines a device emitting a flashing amber light are referred to as flashing signals or simply as flashers, and devices emitting a steady-burning red light are referred to as lantern signals or simply as lanterns. A centrally controlled series of several devices, in which the triggering of the light pulses in separate devices is connected so that the flashes occur one after another, is called a series flasher.

These guidelines apply to signal lights which are powered by batteries or rechargable accumulators or by mains operated power supplies.

### 1.2 Approval for use

All flashing signals and signal lanterns within the meaning of Section 2 of the Road Traffic Act and intended for use on roads must have the written approval of the Finnish Roads and Waterways Administration. The manufacturer or supplier of the devices must furnish the devices with a notice, either as shown in the accompanying model drawing (Appendix 3) or of other form, which gives the following information:

- name of the manufacturer
- type and year of manufacture of the device
- the text "Approved by the Finnish Roads and Waterways Authority"
- number and date of the Letter of Approval of the Finnish Roads and Waterways Authority

The notice of approval must be fixed to the device so as to be clearly visible in use and so that it does not become detached.

The approval of devices takes place on the basis of a test report from the Finnish State Technical Research Centre, a certificate of examination from the Electrical Inspection Centre (for mains operated devices), and a technical examination performed by the Finnish Roads and Waterways Administration. The device must satis-

fy the requirements given hereafter in respect of both its constructional and photometric characteristics. The test report from the Finnish state Technical Research Centre should provide a summary of the test results in accordance with Appendix 4.

An approval is valid until further notice, but nevertheless for not more than 10 years.

## 2. CONSTRUCTION

### 2.1 Housing and body

The housing and body of the device should be appropriate for the purpose of use in respect of both mechanical durability and constructional characteristics.

### 2.2 Mechanism

The mechanism should be of such construction that the device emits only either a flashing amber light or a steady-burning red light. The mechanism should include a photocell which regulates operation in accordance with the level of illumination, unless otherwise mentioned in relation to some type. The mechanism of the device should operate in all possible positions. The mechanism should be so constructed and protected as to be suitable for the conditions of use.

### 2.3 Lens

For a device emitting light omnidirectionally in the horizontal plane the diameter and height of the lens should be at least 8 cm. For a device emitting light over a limited sector (sectors) of the horizontal plane the illuminating surface of the lens should be at least 14 cm in diameter.

The lens should be manufactured from a solid-dyed material and its surface should be easily cleaned. The lens should be furnished with marks identifying the manufacturer.

#### 2.4 Power supplies

As the power supply of the device a power supply of rated voltage complying with the manufacturer's recommendations should be used, which can be a

- dry battery
- accumulator
- power supply for 220 V mains connection.

Power supplies of all types should be fit for use in the temperature range  $-40^{\circ}\text{C}$  -  $+40^{\circ}\text{C}$ . The power supplies should function normally in all possible positions.

#### 2.5 Fastening and locking apparatus, exchange of power supply and lamp

It should be possible to fasten and lock the device securely (e.g. to a boom). It should be possible to lock the housing, or it should be so constructed that it can be opened only with a special key. It should be possible to exchange the power supply and lamp only by unlocking the lock or by opening the housing using the proper special key.

#### 2.6 Lamp

In devices fitted with a mains-operated filament lamp the lamp should work for at least 500 h. In devices fitted with a gas discharge tube the gas discharge tube should work for at least 4000 h in continuous operation. After 340 h operation at the rated voltage of the power supply the gas discharge tube must not exhibit any preliminary signs of mechanical failure. The "luminous energy" (see Section 3.222) must not diminish during this period by more than 10 %.

## 2.7 Equipment and special requirements

### 2.70 General

The device should have a power switch which clearly shows when the power is switched off. In order to prevent misuse the power switch should be protected by the housing or other fixing mechanism, unless otherwise mentioned in relation to some type.

Warning devices other than those fitted with gas discharge tubes should have a place for a spare lamp.

It is preferable that the device should have a carrying handle.

There should be a notice in a well-protected place stating the rated voltage and also the voltage and power of the lamp which is to be used.

If connection by means of a cable is used the connectors must have marks indicating the polarity. It should be possible to carry out measurement of the terminal voltage of the battery or accumulator without disconnecting the connectors.

Every device should be accompanied by instructions for use from which the handling and care of the device should be clear. The instructions for use must also contain information concerning suitable types of power supply and lamps, and further on the minimum voltage at which when using each type of power supply the device complies with the requirements for luminous intensity at temperatures of +5°C and -20°C.

### 2.71 Special requirements for flashing signals fitted with gas discharge lamps

Automatic lighting-up, acting in accordance with the level of illumination, is not required.

Lighting-up of the flasher by means of a switch external to the housing is approved.

#### 2.72 Special requirements for accumulator operated devices

There should be a plug in the housing by means of which charging of the accumulator can be carried out without removing the accumulator from its housing.

The accumulators should last at least 300 charging cycles.

The mechanism should be equipped so that total discharge of the accumulators cannot occur.

For charging of the accumulators a charger must be available by means of which the accumulators of one or more devices can be charged without removing the accumulators from their housings. The charger should be equipped so as to prevent unintentional over-charging. The charger should be approved by the Finnish Electrical Inspection Centre.

#### 2.73 Special requirements for mains operated devices

Mains operated warning devices should be approved by the Finnish Electrical Inspection Centre.

The cable used for connection to the mains should be a weather and oil resistant rubber sheathed and insulated cable (VSKN) or a cable of corresponding properties.

In the power supply of the device or in the warning device itself there should be a signal lamp which indicates the presence of the mains voltage.

The switch of the power supply must be inside a locked case. The connectors and connection plugs used must ensure reliable contact and remain connected in normal use.

The warning device should be equipped with an automatic back-up system for the event of a possible interruption of the mains supply. For this purpose the system should be of such construction and rated voltage that suitable accumulators or batteries (e.g. 12 V) can be used in place of the mains power supply. When using the power supply of the back-up operating system the device should satisfy the requirements specified in Section 3 for the duration of at least one load period (16 h) at a temperature of +5°C.

An automatic lighting-up system acting according to the level of illumination is not required.

### 3. PHOTOMETRIC CHARACTERISTICS

#### 3.1 The colour of the light

##### 3.10 General

The colour of the light emitted by the device should be produced by means of a lens manufactured of solid-dyed material. The use of separate filters is prohibited.

##### 3.11 Devices emitting a flashing amber light

The colour coordinates of the light emitted by the flasher should be located in the yellow region shown on the chromaticity diagram given in Appendix 1 when determined at the recommended nominal voltage. (CIE: International Commission on Illumination Publication CIE no. 2.2 (TC-1.6) 1975, Colors of Light Signals).

### 3.12 Devices emitting a steady-burning red light

The colour coordinates of the light emitted by the lantern should be located in the red region shown on the chromaticity diagram given in Appendix 1 when determined at the recommended nominal voltage. (CIE: International Commission on Illumination Publication CIE no. 2.2 (TC-1.6) 1975, Colors of Light Signals).

## 3.2 Luminous intensity

### 3.21 Devices emitting a flashing amber light omnidirectionally in the horizontal plane

The average effective luminous intensity of the flash should be not less than 2 cd in the horizontal plane and not less than 0.5 cd in the planes which form an angle of +5° and -5° with the horizontal plane which passes through the optical centre point of the lens. In planes which form an angle of less than 5° with the horizontal plane which passes through the optical centre point of the lens the luminous intensity should be at least as great as that obtained by straight-line interpolation between the aforesaid values. The average effective luminous intensity is calculated from the formula (DIN 5037 Blatt 2):

$$\bar{I}_e = \bar{I} \frac{\int_{t_1}^{t_2} i(t) dt}{a + (t_2 - t_1)}, \text{ where}$$

$\bar{I}_e$  = the effective luminous intensity

$\bar{I}$  = the arithmetic mean of the luminous intensity measured over the region of a 360° sector with a fixed light

$$i(t) = \frac{I(t)}{I_{\max}}, \text{ where}$$

$I(t)$  = the luminous intensity in an arbitrary direction measured at the lowest permitted voltage of the power supply as a function of time during the duration of the flash

$I_{\max}$  = the maximum value of the luminous intensity  $I(t)$

$t_1$  = the moment of time in seconds at which the luminous intensity  $\bar{I} \cdot i(t)$  during the flash has reached the value  $\bar{I}_0$ ; in other words

$$\bar{I} \cdot i(t)_{t=t_1} = \bar{I}_0$$

$t_2$  = the moment of time in seconds at which the luminous intensity  $\bar{I} \cdot i(t)$  during the flash has fallen to the value  $\bar{I}_0$ ; in other words

$$\bar{I} \cdot i(t)_{t=t_2} = \bar{I}_0$$

$$a = 0.2 \text{ s}$$

### 3.22 Devices emitting a flashing amber light over a limited sector (sectors) in the horizontal plane

#### 3.221 Flashers fitted with filament lamps

The average effective luminous intensity should be not less than 5 cd over the region (regions) of a solid angle, the apex of which is at the optical centre point of the lens and the size of which is  $\pm 10^\circ$  in the horizontal plane and  $\pm 5^\circ$  in the vertical plane with respect to the normal to the lens passing through the optical centre of the lens. In addition the luminous intensity should be so distributed that it is not less than 2.5 cd anywhere within the region of the aforesaid solid angle.

The effective luminous intensity in the direction  $\alpha$  is obtained from the formula:

$$I_{e\alpha} = \frac{\int_{t_1}^{t_2} I_{\alpha}(t) dt}{a + (t_2 - t_1)}, \text{ where}$$

$I_{e\alpha}$  = the effective luminous intensity

$I_{\alpha}(t)$  = a function which represents the relation between the luminous intensity measured for the lowest permitted voltage of the power supply and time during the duration of the flash and in the direction being investigated

$t_1$  = the moment of time in seconds at which the luminous intensity  $I_{\alpha}(t)$  during the flash has achieved the value  $I_{e\alpha}$ ; in other words

$$I_{\alpha}(t)_{t=t_1} = I_{e\alpha}$$

$t_2$  = the moment of time in seconds at which the luminous intensity  $I_{\alpha}(t)$  has fallen to the value  $I_{e\alpha}$ ; in other words

$$I_{\alpha}(t)_{t=t_2} = I_{e\alpha}$$

### 3.222 Flashers fitted with gas discharge tubes (impulse flashers)

An impulse flasher is a type of flasher in which the pulse of light is produced by a periodic discharge in a gas discharge tube. The duration of the pulse of light is extremely short, regularly being between 20  $\mu s$  and 100  $\mu s$  (microseconds).

For flashers fitted with gas discharge tubes instead of the effective luminous intensity the time integral of the luminous intensity of the light pulse is measured, i.e. the so-called "luminous energy", the unit of which is  $cd \cdot s$ . The term "luminous energy" means the time integral of the luminous intensity of the light pulse.

$$E = \int_0^{\tau} I(t) dt, \text{ where}$$

$I(t)$  = the luminous intensity (cd) of the light pulse as a function of time

$\tau$  = the duration of the light pulse in seconds.

The following conditions are specified for the "luminous energy":

Over the entire region of the vertical angle  $\pm 5^\circ$  the "luminous energy" of the light pulse must not fall below the following values:

Horizontal angle	"Luminous energy" cd . s
$\pm 10$	0.75
$\pm 20$	0.30

The average "luminous energy" over the entire region of the horizontal angle  $\pm 20^\circ$  must not then fall below 0.75 cd . s.

The requirements are illustrated in the figure of Appendix 2, in which the lower limit for the "luminous energy" and the lowest average value are delineated.

### 3.23 Devices emitting a steady-burning red light over a limited sector (sectors) in the horizontal plane

The average luminous intensity should be not less than 5 cd over the region (regions) of a solid angle, the apex of which is at the centre of the lens and the size of which is  $\pm 10^\circ$  in the

horizontal plane and  $\pm 5^\circ$  in the vertical plane with respect to the normal to the lens passing through the optical centre of the lens. In addition the luminous intensity should be so distributed that it is not less than 2.5 cd anywhere within the region of the aforesaid solid angle.

#### 4. OPERATION

##### 4.1 Lighting-up and extinguishing

In devices which should be equipped with a photocell for automatically lighting-up and extinguishing the device according to the level of illumination, the automatic mechanism should be so arranged that the device is always in operation when the level of ambient illumination is below 50 lx and that the device does not operate when the level of ambient illumination is above 500 lx.

The automatic lighting-up and extinguishing should be so arranged that the device is not extinguished by a light of 100,000 cd in the horizontal plane of the device coming from a distance of 10 m.

##### 4.2 Frequency of flashers

The frequency of flashing of a device emitting a flashing amber light should be  $90 \pm 30$  flashes per minute when the level of illumination is 0 lx - 50 lx.

##### 4.3 Operating duration

The device should be equipped with a power supply such that the aforesaid photometric requirements are satisfied for a period of not less than 7 days with the device being in operation for 16 hours per day at a temperature of  $+5^\circ\text{C}$ .

#### 4.4 Weather resistance

A device equipped with a battery or accumulator should operate for the duration of one load period (16 h) at a temperature of +40°C.

The mechanism of a device equipped with a battery or accumulator should operate for the duration of one load period (16 h) at a temperature of -40°C.

A device equipped with a battery should satisfy the aforesaid photometric requirements when the device has been operating for the duration of one load period (16 h) at a temperature of -20°C.

A device equipped with an accumulator should similarly satisfy the aforesaid photometric requirements when the device has been operating for the duration of three load periods (16 h) at a temperature of -20°C.

After device has undergone the corrosion test the device shall not exhibit any observable damage or changes. In the corrosion test the device is subjected for two periods of 24 hours to a salt mist, with the device being allowed to dry for 2 hours between these two periods. The salt mist is produced by spraying at a temperature of  $+35^{\circ}\text{C} \pm 2^{\circ}\text{C}$  a solution consisting of  $20 \pm 2$  parts by weight of salt dissolved in 80 parts by weight of distilled water.

After the device has undergone the high temperature test the device shall not exhibit any observable damage or changes. In the high temperature test the device is kept continuously for 12 hours at  $+65^{\circ}\text{C} \pm 2^{\circ}\text{C}$ .

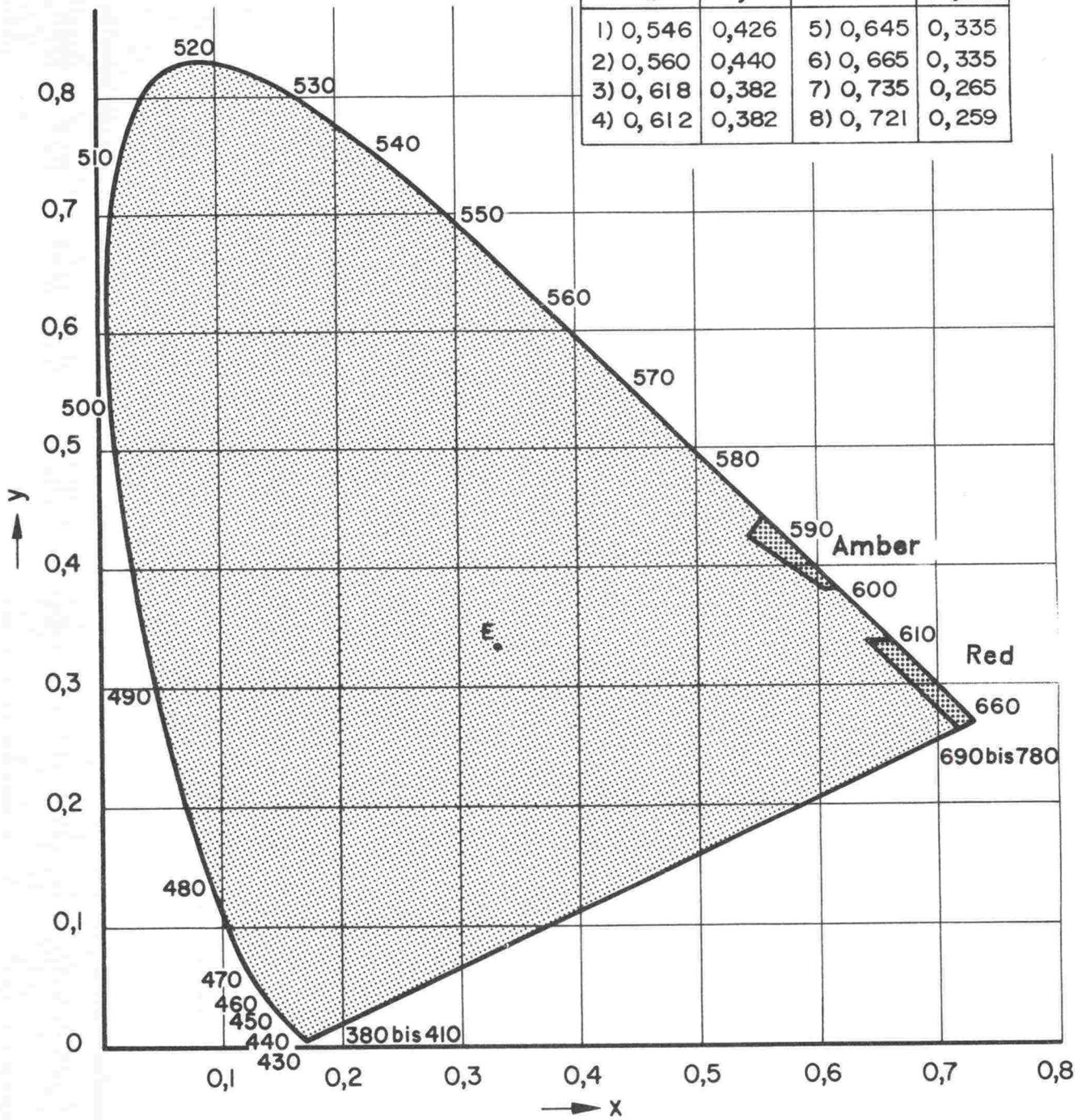
#### 4.5 Resistance of the lens to cleaning

The lens shall not exhibit any observable damage or changes after the fuel and lubricant tests. In the fuel test the lens is wiped lightly with a cotton cloth which has been dipped in a mixture which consists of 70 % n-heptane and 30 % toluol. The mixture is allowed to act for 5 minutes, after which the lens is cleaned and examined. In the lubricant test the lens is wiped lightly with a cotton cloth which has been dipped in lubricating oil and the substance is allowed to act for 5 minutes, after which the lens is cleaned and examined.

Chromaticity Diagram

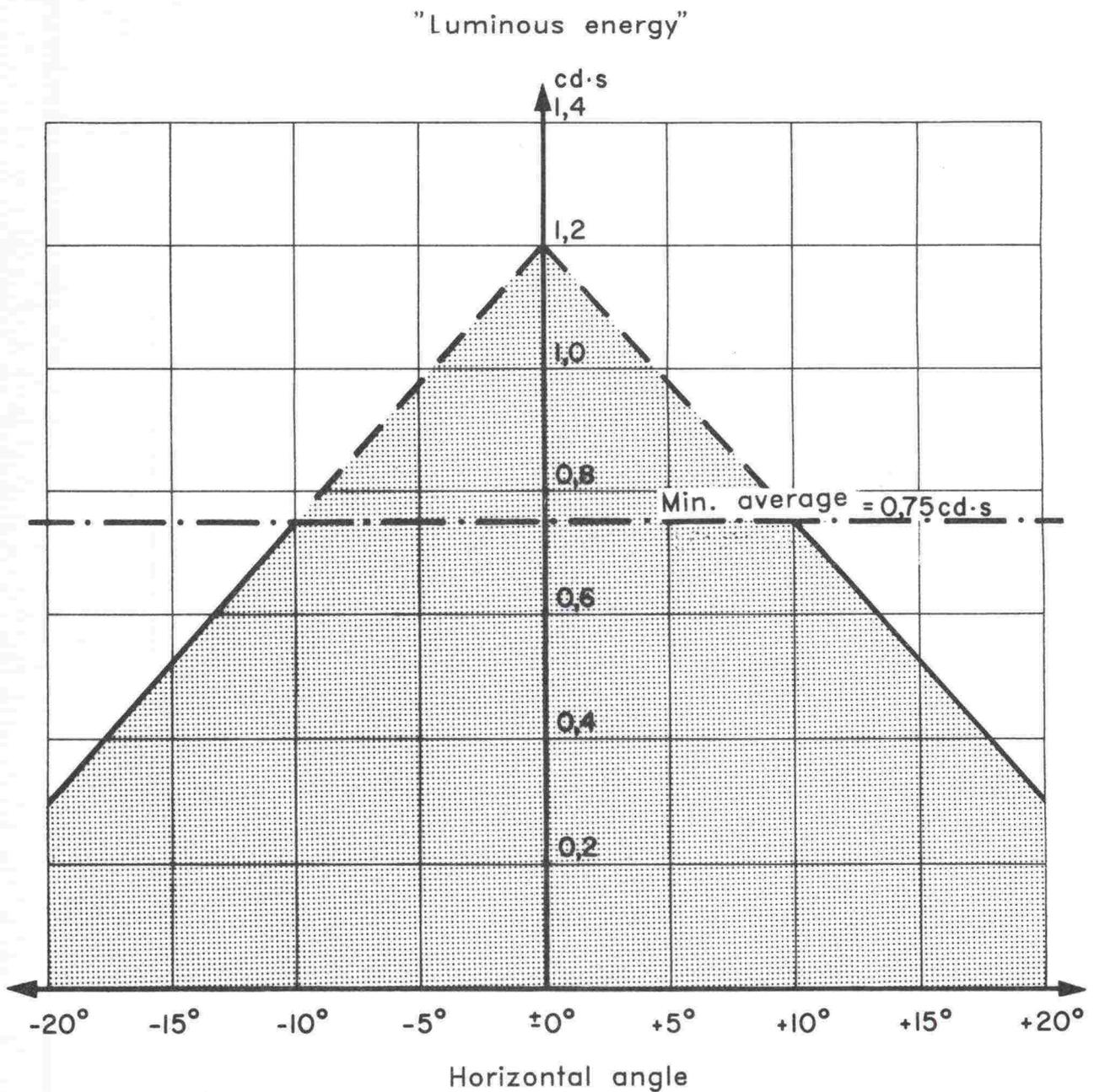
Coordinates of corner points

Amber		Red	
x	y	x	y
1) 0,546	0,426	5) 0,645	0,335
2) 0,560	0,440	6) 0,665	0,335
3) 0,618	0,382	7) 0,735	0,265
4) 0,612	0,382	8) 0,721	0,259



### "Luminous Energy" of an Impulse Flasher

The lower limit for the "luminous energy" and its minimum average value in the solid angle:  
 vertical angle +5  
 horizontal angle +20



MANUFACTURER	
type/year xx/xx	
approved type	
FRWA	KI-xxxx/ xx.xx.xxxx

1.2	Manufacturer/importer		
	Type and year of manufacture of device		
2.1	HOUSING:		
	Dimensions		Weight when operational                      kg
2.2	MECHANISM AND COLOUR OF LIGHT:		
	Flashing amber <input type="checkbox"/>	Automatic lighting-up                      yes <input type="checkbox"/>	and extinguishing                      no <input type="checkbox"/>
2.3	LENS:		
	Visible omnidirectionally in horizontal plane		<input type="checkbox"/>
	Visible in limited sector of horizontal plane		<input type="checkbox"/>
	Diameter                      mm	Marks:	
Height                      mm			
2.4	POWER SUPPLY:		Rated voltage and type
	Dry battery <input type="checkbox"/>	Accumulator <input type="checkbox"/>	220 V AC <input type="checkbox"/>
	220 V AC <input type="checkbox"/>		
2.6	LAMP:		
	Filament lamp <input type="checkbox"/>	Voltage                      V	
	Discharge lamp <input type="checkbox"/>	Power/current                      W/A	
2.70	POWER SWITCH                      inside housing <input type="checkbox"/>	outside <input type="checkbox"/>	
2.73	MAINS OPERATED DEVICES		
	SETI registration no. / date:		
	Operational duration on back-up supply		days
4.3	OPERATIONAL DURATION at temperature of + 5°C		days
4.4	OPERATIONAL DURATION at temperature of - 20°C		days
Additional particulars (including exceptions from requirements):			

ISBN 951-47-4097  
TIEL 2130001