BS EN 12368:2015

BSI Standards Publication

Traffic control equipment — Signal heads

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National foreword

This British Standard is the UK implementation of EN 12368:2015. It supersedes BS EN 12368:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/526, Road traffic control signals.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 12368:2015) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by December 2015, and conflicting national standards shall be withdrawn at the latest by March 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12368:2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

The main changes in this revision are as follows:

a) Introduction: Paragraph 6 added outlining reasons for possible degradation of optical performance;

b) Scope: Individual optical units included in addition to complete signal heads which were in the previous version;

c) Clauses 4 to 8 Requirements re phrased to clearly identify Product Characteristics as required in the CPR;

1) 4.2 Signal head:- Class V IP65 added as some signals are required with the higher sealing for example in tunnels. A warning note was also added that higher sealing levels can lead to risk of trapped moisture;

2) 4.3 Mountings, poles with brackets and catenaries: removed as topic considered outside of the scope of this standard as the infrastructure to which signals are mounted are the subject of other standards. Table ZA.1 and Clause 8 of DoP updated accordingly to remove these characteristics;

3) 4.4 Deflection: removed as infrastructure, poles, gantries catenaries etc considered outside of the scope of this standard, as the infrastructure to which signals are mounted are the subject of other standards. Table ZA.1 and Clause 8 of DoP updated accordingly to remove these characteristics;

New sub-clause 4.3 Added to clearly state Product Characteristic of Performance Under Impact;

New sub-clause 4.4 Added to clearly state Product Characteristic of Constructional Integrity;

4) 5.2. Electrical safety: Addition detail added noting intended use of signal in a traffic system and that therefore electrical requirements of EN 50556 also apply;

5) 6.1 General: Text added noting that whilst it is normally expected that all aspects in a signal would be of the same performance, this can vary for special applications;

6) 6.3 Luminous Intensities: Allowance for dimming of signals added;

7) 6.4 Distribution if Luminous Intensity: Clarification added as to the meaning of the wording “substantially uniform” distribution;

8) 6.6 Phantom Signal: A note added;

9) 6.9 Background screen of signals: Simplified. Table 8 of background screen sizes removed and all subsequent tables re numbered (i.e.Tables 9 to 17 have become Tables 8 to 14);

10) 6.10 Visible Flicker: Characteristic and a note added;

11) 7 Construction and environmental test methods: Clarification added with reference to optical units of different diameters;

Table 9:- Class AJ2 replaced with duration and axis, as the AJ2 reference was a reference to EN 50556 simply for the duration and axis of the tests as the spectrum was always defined in EN 12368;

12) 8.1 General: Clarification of test tolerances added, optical measurement tolerances and measurement environment temperature tolerance;

13) 8.2 Measurement of luminous intensities: A method of stabilisation added;

14) 8.3. Measurement of luminance for uniformity tests: Method clarified;

15) 8.4. Measurement of phantom signal: specification for the illuminance source change to simplify the equipment needed;

16) 8.6. Measurement of combined colours: The need to plot colours on the chromaticity diagram Figure 3 clarified;

d) 10.1 Marking and labelling: The labelling needs changed increasing the level of information available adding diameter and dimming;

e) 10.2 Product Information: definition of reference axis clarified to include reference centre and the relationship to the light emitting surface. Need for instructions for safe use as required in the CPR article 11.6 also added to this sub-clause;

f) Clause 11: Clause updated to align with AVCP format for CPR, Table 15 removed as not part of the revised AVCP;

11.2.2. Test Modules: Definition expanded to cover alternative types of enclosures;

g) Table A.1: Dimmed operation added;

h) Annex ZA to align with Annex ZA format for CPR;

Table ZA.1: Scope increased to include dimming performance where signals have dimming and the possible use of hoods and visors where provided;

Table ZA.2: Intended uses expanded to indicate possible use of visors and hoods;

Figures ZA1: updated to show diameter and dimming performance.

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

Introduction

Signal heads are mainly used to transfer safety messages to the road user to achieve specific reactions. Signal heads in road traffic transfer this information optically by signal lights which have a specific meaning and which differ in their colour of light and in the design of their illuminating surface.

The visibility of a signal light depends on the colour, luminous intensity, luminous intensity distribution, luminance and luminance uniformity, the surrounding luminance (background luminance), the size of the illuminating area of the signal light, the phantom light and the distance and angle between observer and signal head.

Four angular distributions of luminous intensities for signal lights are specified. The user can choose between an extra wide, wide, medium and narrow beam signal to obtain a good recognition of the signal for short distances in urban areas, for long distances in rural areas. To achieve a good performance the standard provides a number of different performance levels and two different diameters for the roundels.

This European Standard does not require limits for the recognition of red or green signals with reduced luminous intensities operating in a failure mode. These limits depend on the surrounding lights (on or off) and on the situation. However, for a simple rule a red signal is considered as failed if the luminous intensity in the reference axes is $I \leq 10$ cd, and a green signal is considered as being in operation if the luminous intensity is $I \geq 0{,}05$ cd.

The working environment for signal heads is relatively harsh and equipment that is deemed "fit for purpose" is expected to last in this exposed, corrosive environment for a minimum of 10 years. It is essential that all materials and manufacturing processes take this into account. The supplier should detail all steps taken to comply with this clause.

The optical performance of signal heads in use is a function of lens soiling, mirror soiling and a decrease of luminous flux from the lamp. To maintain the performance of the signal heads during service, it is important to ensure that after lamp replacement and cleaning of lens and mirror the light output is restored to as near 100 % as possible and never lower than 80 % of the declared specified performance(s).

For devices randomly selected from series production it is important that the product characteristic as to minimum luminous intensity of the light emitted, are in each relevant direction, of the minimum values prescribed.

1 Scope

This European Standard applies to signal heads with one or more signal lights of the colours red, yellow and/or green signal lights for road traffic with 200 mm and 300 mm roundels and to optical units to be integrated in signal heads to produce the individual signal lights. It defines the product characteristics for the visual, structural, environmental performances and testing of signal heads and optical units for pedestrian and road traffic use.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

EN 50556, *Road traffic signal systems*

EN 60068-2-1, *Environmental testing - Part 2-1: Tests - Test A: Cold (IEC 60068-2-1)*

EN 60068-2-2, *Environmental testing - Part 2-2: Tests - Test B: Dry heat (IEC 60068-2-2)*

EN 60068-2-5, *Environmental testing — Part 2-5: Tests — Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing (IEC 60068-2-5)*

EN 60068-2-14, *Environmental testing - Part 2-14: Tests - Test N: Change of temperature (IEC 60068-2-14)*

EN 60068-2-30, *Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30)*

EN 60068-2-64, *Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance (IEC 60068-2-64)*

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

EN 60598-1:2008, *Luminaires - Part 1: General requirements and tests (IEC 60598-1)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
signal head
device which comprises one or more optical units, including the housing(s), together with all the mounting brackets, fixings, hoods, visors, cowls and background screens, whose task is to convey a visual message to vehicle and pedestrian traffic

3.2
optical unit
assembly of components designed to produce a light of the specified nominal size, colour, luminous intensity and shape

3.3
optical surface
surface of the material adjacent to the atmosphere. It is the surface to which the impact, water and dust ingress tests are applied

Note 1 to entry: In many cases it is the external surface of the lens.

3.4
lens
light transmitting element of the optical unit which distributes the luminous flux from the light source into preferred directions of the signal light

3.5
background screen
opaque board placed around the optical unit, either incorporated in the housing of the optical unit or detachable, intended to increase the contrast and to enhance visibility

3.6
hood (visor, cowl)
device located above the front of an optical unit to reduce phantom effect or to restrict the field of view

3.7
phantom signal
false signal that is created by sunlight striking an optical unit

3.8
reference axis
axis specified by the supplier, used for environmental and optical tests. If not specified by the manufacture will be taken as perpendicular to the centre of the optical surface

3.9
Factory Production Control (FPC)
permanent internal control of production exercised by the manufacturer

3.10
batch
quantity of a product manufactured with no change in raw material, equipment, settings or operation as defined in the FPC system manual of the manufacturer

3.11
individual (and non-series)
product manufactured under a manufacturing process that is specifically conceived for one unique production.

4 Constructional Product Characteristics

4.1 General

The manufacturer shall ensure the design is such that there is a facility for maintenance. Any component requiring replacement shall be designed such that this is easily accommodated and does not affect the optical performance of the signal head.

The construction and choice of materials shall be such that they will provide declared performance for a reasonable economic lifetime of the product as verified by the relevant tests given in this European Standard.

The complete signal head shall pass the tests specified in Clause 7 for impact resistance, constructional integrity, ingress and tolerance to temperature, damp heat and solar radiation.

The manufacturer shall detail in his documentation what maintenance shall be carried out, including cleaning methods and materials, to ensure that the optical performance shall be maintained to at least 80 % of the minimum values set out in the appropriate parts of 6.3 and 6.4.

During the declared lifetime of the optical unit the colours shall remain within the colour boxes of Table 7.

4.2 Signal head

There are 5 classes for the Ingress Protection, IP, rating in accordance with EN 60529 of a signal head:

Class I: IP34

Class II: IP44

Class III: IP54

Class IV: IP55

Class V: IP65

Where separate protection of the optical units is required they shall be protected to IP55 or IP65.

NOTE A level of sealing in accordance with IP65 may result in a risk of water collection within the optic housing due to condensation.

The signal head, including its optical components, shall be so designed that after installation, during its lifetime as defined by the supplier, including any replacement of components, the optical and mechanical product characteristics are guaranteed.

4.3 Performance under impact product characteristic

There are 3 classes of performance under impact, IR1, IR2 and IR3. When required by the regulatory authority this characteristic shall be determined in accordance with Clause 7 Constructional and environmental test methods Table 8 — Impact resistance.

4.4 Constructional integrity product characteristic

The product is expected to survive levels of vibration that may be expected in normal operation. This characteristic shall be determined in accordance with Clause 7 Constructional and environmental test methods Table 9 — Constructional integrity.

5 Environmental, electromagnetic compatibility (EMC) and electrical product characteristics

5.1 Environmental characteristics

The signal heads shall comply with one or more of the following classes of operational temperature ranges:

Class A +60 °C to –15 °C

Class B +55 °C to –25 °C

Class C +40 °C to –40 °C

5.2 Electrical safety and EMC characteristics

The signal heads shall comply with the requirements of EN 50293.

Whilst this specification is for a traffic signal product, it is clear that this product is connected to a “Traffic system” and as such the connections/wiring etc that is required between it and any controller shall meet the requirements of EN 50556 for electrical safety and in particular attention is drawn to 5.1 Electric safety.

6 Optical Product Characteristics

6.1 General

The optical units of a signal head should normally be of the same classes regarding luminous intensity, dimming, distribution of luminous intensity and phantom light, but it is permissible in special cases that the classes are different.

EXAMPLE In signal head with red, yellow and green signals it may be requested that the red be brighter than the yellow and green on high speed roads.

6.2 Diameter of signal lights

Roundel signal lights for road traffic conditions shall have a nominal diameter of 200 mm or 300 mm ± 10 %.

As the requirements for visibility depend on the local conditions of road lay-out and infrastructure, on traffic conditions and light conditions, it is not feasible to give strict rules for the situations where either 200 mm or 300 mm roundel signals should be used.

6.3 Luminous intensities of signal lights

The performance levels for signal lights, for both 200 mm and 300 mm roundels, shall be as specified in Table 1.

Table 1 — Luminous intensities (*I*) for red, yellow and green signal lights in the reference axis

Performance level	1	2	3
I_{min}	100 cd	200 cd	400 cd
I_{max} class 0	200 cd	400 cd	600 cd
I_{max} class 1	400 cd	800 cd	1 000 cd
I_{max} class 2	1 100 cd	2 000 cd	2 500 cd

For example the performance level 2/1 is the designation of a signal light with: I_{min} = 200 cd; I_{max} = 800 cd.

Dimmed operation is an operating mode of the road traffic signal system in which the luminous intensity of the signal heads is reduced. These classes of dimmed operation are available:

Class D0 Dimmed operation is not required.

Class D1 As declared by the manufacturer.

For Class D1, the manufacturer shall declare the performance of their signal in dimmed operation against the optical product characteristics of this specification and operational voltage ranges.

NOTE Refer to CLC/TS 50509 Annex B regarding dimmed operation in the Netherlands and Annex C regarding dimmed operation in Spain.

6.4 Distribution of luminous intensity

In Tables 2, 3, 4 and 5 four angular distributions of luminous intensity for signal lights are specified as minimum luminous intensities, expressed as percentage values dependent on the choice of the following categories:

A as a percentage of the measured values on the axis 0° horizontal and 0° vertical (the reference axis);

B as a percentage of the minimum values as defined in Table 1 required on the axis 0° horizontal and 0° vertical (the reference axis).

Outside the area described in Tables 2 to 5 (as applicable) the luminous intensities shall not exceed the maximum of the relevant class of performance level.

The Tables 2 to 5 contain the minimum luminous intensities in % of the values in their reference axis. Only the listed combinations of classes and performance levels shall be applied.

Within the field of measurement, the light pattern shall be substantially uniform, i. e. the light intensity in each direction at each test point shall meet at least the level achieved by the next consecutive measurement. e.g. if at 0,0 the measurement is 100 and at +5 the measurement is 85 then in between the two a measurement should be at least 85. If doubt arises during the testing of luminance (test 8.2), then test 8.2 can be stopped and Uniformity test 8.3 can be completed. It should be noted that the maximum luminous intensity is defined by the classes selected by the regulatory authority from Table 1 — Luminous intensities (I) for red, yellow and green signal lights in the reference axis

Table 2 — Extra wide-beam signal (Type E) possible combinations B 1/0, B 1/1, B 2/2

α_{horiz}	0°	± 2,5°	± 5°	± 10°	± 15°	± 20°	± 30°
α_{vert}							
0°	100	–	85	80	–	60	40
–1,5°	–	–	–	–	–	–	–
–3°	80	–	75	–	–	–	–
–5°	60	–	–	45	–	–	–
–10°	50	–	–	–	–	20	–
–20°	20	–	–	–	–	–	10
– means no specific values are required							

Table 3 — Wide beam signal (Type W) possible combinations A 1/0, A 1/1; A 2/0, A 2/1; A 3/0, A 3/1; B 1/2; B 2/1,B 2/2; B 3/2

α_{horiz}	0°	± 2,5°	± 5°	± 10°	± 15°	± 20°	± 30°
α_{vert}							
0°	100	–	85	55	–	3	1
–1,5°	–	–	–	–	–	–	–
–3°	80	–	75	–	–	–	–
–5°	60	–	–	35	–	–	–
–10°	30	–	–	–	–	8	–
–20°	2	–	–	–	–	–	2
– means no specific values are required							

Table 4 — Medium wide beam signal (Type M) possible combinations A 2/0, A 2/1; A 3/0, A 3/1; A 2/2; A 3/2

α_{horiz}	0°	± 2,5°	± 5°	± 10°	± 15°	± 20°	± 30°
α_{vert}							
0°	100	–	75	40	10	1	*
–1,5°	–	–	–	–	–	–	*
–3°	75	–	60	–	–	–	*
–5°	50	–	–	20	–	–	*
–10°	12,5	–	–	–	–	6	*
–20°	1,5	–	–	–	–	–	1
– means no specific values are required * means no requirements							

Table 5 — Narrow beam signal (Type N) possible combinations A 2/0, A 2/1; A 3/0, A 3/1; B 2/2; B 3/2

α_{horiz}	0°	± 2,5°	± 5°	± 10°	± 15°	± 20°	± 30°
α_{vert}							
0°	100	75	65	15	1,5	*	*
–1,5°	95	90	–	–	–	*	*
–3°	70	–	45	–	–	*	*
–5°	40	–	–	10	–	*	*
–10°	6	–	–	–	5	*	*
–20°	*	*	*	*	*	*	*
– means no specific values are required * means no requirements							

6.5 Luminance uniformity

The luminance uniformity of the roundel as the ratio of the lowest and greatest luminance $L_{min} : L_{max}$ shall be ≥1 : 10 for types E, W and M and ≥1 : 15 for type N.

6.6 Maximum phantom signal

For each signal colour the maximum phantom signal I_{ph} for light incident at an angle of 10° to the reference axis shall comply with of Table 6, where I_s is the actual measured luminous intensity I of the signal light:

Table 6 — Requirement for the ratio of I_s to I_{ph}

Signal light function	Class 1	Class 2	Class 3	Class 4	Class 5
red, yellow	>1	>5	>4	>8	>16
green	>1	>5	>8	>16	>16

The phantom signal is measured in laboratory conditions for a single geometrical situation (refer to 8.4), but illustrates the phantom light that can be seen in a signal light in a range of situations with the sun in a low position behind the observer. Phantom light may cause ambiguity as to which signal lights are on or off unless it is weak in comparison to the signal itself. Phantom light can be reduced by particular designs of the optics, black interiors, anti-phantom devices or hoods etc. Care shall be taken to ensure that the phantom light is weak in all relevant situations.

NOTE Traditional signal lights with incandescent lamps and roundels with the inherent colour of the signal lights, either red, yellow or green. This points to a lower value of I_{ph} for green than for red or yellow during measurement, because the illumination is by reddish light (CIE illuminant A, refer to 8.4). However, illumination by the sun – even in a low position – is not as reddish and does not point to quite as low a value for green. This is the reason that some of the classes (classes 3 and 4) have higher requirements to the ratio of I_s to I_{ph} for green than for red and yellow - higher ratios can be reached during the measurement of traditional signal lights and are needed as a safeguard in practical conditions.

This explanation does not apply for signal lights with non-coloured optics, but it may still be a concern in some cases to ensure that the phantom signal of green signal lights is particularly weak.

6.7 Colours of signal lights

The colours of signal lights are red, yellow and green and they shall comply with Table 7 when using anti-phantom devices and including combined colours from real signal and all classes of phantom light, except class 1.

Table 7 — Required chromaticity regions for the colour boundaries of signal lights and combined colours from real signal and phantom light

Colour of signal light	Colour boundaries of signal lights	Boundary
Red	$y = 0{,}290$	red
	$y = 0{,}980 - x$	purple
	$y = 0{,}320$	yellow
Yellow	$y = 0{,}387$	red
	$y = 0{,}980 - x$	white
	$y = 0{,}727\ x + 0{,}054$	green
Green	$y = 0{,}726 - 0{,}726\ x$	yellow
	$x = 0{,}625\ y - 0{,}041$	white
	$y = 0{,}400$	blue

6.8 Signal lights with symbols

Symbols shall only be placed on roundels of signal lights which demonstrate compliance with 6.3 to 6.7. The optical performance for symbols is derived by using the performance of the full roundel.

Class S1: Symbols placed on roundels meeting 100 % of one of the levels set out in Table 1.

Class S2: Symbols placed on roundels meeting 50 % of one of the levels set out in Table 1 (only pedestrian traffic).

6.9 Background screen of signal lights

Signal lights shall have an opaque background screen or a rim of 25 mm which gives a permanent background providing contrast. The background screen may be incorporated in the housing of the signal head or may consist of a detachable screen.

6.10 Visible flicker

No light flicker shall be visible. When the light sources of a signal head are operating in a pulse mode, the manufacturer shall inform the test laboratory as to the frequency of the light emitted, and the performance shall be verified by testing. This frequency shall not be less than 90 Hz.

NOTE In some member states a photograph of the signal may be required as recorded evidence of an offence of crossing the light whilst at red. In this instance even a small amount of flicker may interfere with accurate photographic evidence (the signal may appear to be off at the instance the photograph is taken), and in this instance the purchaser may request “NO Flicker” and define it.

7 Constructional and environmental test methods

Impact resistance, constructional integrity, ingress and tolerance to temperature, damp heat and solar radiation is tested in accordance with Tables 8, 9, 10 and 11 respectively.

Signal heads with optical units of the two different nominal diameters (200 and 300 mm) are different products in all aspects and shall be tested separately, even when of the same physical construction.

Table 8 — Impact resistance

IMPACT test EN 60598-1:2008, 4.13.4	0,51 kg ball of 50 mm diameter dropped from:	**class IR 1**	**class IR 2**	**class IR 3**
		100 mm	400 mm	1 300 mm
NOTE Surface cracks are allowed providing complete penetration does not occur, i.e. the integrity of the seal is not broken.				

Table 9 — Constructional integrity

Random vibration	**Frequency range: 10 Hz to 200 Hz**
EN 60068-2-64 Test Fh, Duration 2 h in each of 3 axes	ASD levels: 0,02 g^2/Hz (10 Hz to 50 Hz) 0,02 g^2/Hz (50 Hz to 200 Hz with slope 3 dB/octave). Overall RMS acceleration 1,2 g

Table 10 — Water and Dust Ingress

Water penetration and dust EN 60529, test 13 and 14	As required for the specified IP rating
NOTE Ingress is allowed into the signal head provided it does not affect its performance either electrically or optically.	

Table 11 —Tolerance to temperature, damp heat and solar radiation

Test		**Class A**	**Class B**	**Class C**
Dry heat EN 60068-2-2 Test Bb	preconditioning	none		
	initial examination	visual inspection, operational test		
	condition of the specimen during exposure period	equipment switched on as specified in 11.1		
	conditioning temperature	60 °C	55 °C	40 °C
	conditioning time	16 h		
	loading and measurement during exposure period	visual inspection during last hour at exposure temperature and during cooling period		
	non-standard recovery	none		
	final measurement	visual inspection, operational test		
Cold EN 60068-2-1	preconditioning	none		
	initial examination	visual inspection, operational test		
	condition of the specimen during exposure period	equipment off until the final hour		
	conditioning temperature	–15 °C	–25 °C	–40 °C
	conditioning time	16 h		
	loading and measurement during exposure period	visual inspection during last hour at exposure temperature and during heating period		
	non-standard recovery	none		
	final measurement	visual inspection, operational test		
Change of temperature	lower temperature T_A	–15 °C	–25 °C	–40 °C

Test		Class A	Class B	Class C
EN 60068-2-14 Test Nb (This test may be carried out instead of the dry heat and cold test.)	upper temperature T_B	+60 °C	+55 °C	+40 °C
	rate of change of temperature	1 °C/min		
	number of cycles	1		
	initial examination	visual inspection, operational test		
	exposure time t_1	16 h		
	measurements during exposure and time of execution	visual inspection, operational test during the last hour of exposure time t_1 at lower temperature and during cooling period in 5 °C-intervals; during the last hour of exposure time t_1 at upper temperature and during heating period in 5 °C-intervals		
	recovery			
	final measurements	visual inspection, operational tests		
Damp heat, cyclic EN 60068-2-30 Test Db	air temperature	40 °C		
	number of cycles	2		
	initial examination	visual inspection, operational test		
	condition of specimens during exposure			
	mounting or support			
	variant	2		
	intermediate measurements	visual inspection, operational test during first 3 h of both cycles, and cool down period of the 2nd cycle		
	recovery	at standard atmospheric conditions, 2 h		
	electrical and mechanical final measurement	visual inspection, operational test within 30 min after recovery is finished		
Solar radiation incidence to the front of the signal under 45° EN 60068-2-5 Test Sa	preconditioning			
	initial examination	visual inspection, operational test		
	substrate for specimen, position of the irradiation measurement plane	/		
	test procedure and object of the test	B equipment on and fully loaded, this test may be carried out as an alternative to the dry heat test Bb		
	air temperature inside the test chamber during irradiation	40 °C		
	maximum permissible air velocity inside the test chamber	2 m/s		
	humidity conditions	/		
	test duration	1 cycle		

Test		Class A	Class B	Class C
	loading and measurement during exposure (measurement of the temperature of the specimen included)	equipment on as specified in 11.1		
	recovery			
	final measurements	visual inspection, operational test		
NOTE Visual inspection means to look for physical problems. Operational test means to look for correct operation of the light source.				

8 Optical test methods

8.1 General

The described test methods are for indoor (laboratory) measurements in an environment of draft-free air and a temperature of (25 ± 2) °C.

The photometer or spectrophotometer used for the measurement of luminous intensity and luminance shall be stable, not subject to fatigue and have a linear response in the relevant range. In addition, the spectral sensitivity shall closely follow the CIE spectral luminous efficiency curve $V(\lambda)$ in order to ensure a maximum error of 3 % even for light sources with emission in narrow bands of wavelengths such as red, yellow and green LED's.

NOTE The photometer or spectrophotometer may be subjected to the following requirements according to CIE 69:

— $V(\lambda)$ match error $f_1 \leq 3$ %

— Linearity error $f_3 \leq 1$ %

— Display unit error $f_4 \leq 3$ %

— Fatigue error $f_5 \leq 0{,}5$ %

— Temperature coefficient $\alpha \leq 0{,}2$ % / K

The signal head shall be operated with the manufacturer's equipment. The supplier of the signal head shall specify the operating voltage for the tests. He shall declare the operational tolerances of this value. For all light sources the specification from the manufacturer shall include nominal flux/luminous intensity relative to the specified voltage/wattage and the position of the source in the optical geometry of the signal. The manufacturer shall provide the signal head with light sources and specifications (for the luminous flux or luminous intensity measurements).

8.2 Measurement of luminous intensities

The luminous intensity is measured with the optical unit on a goniometer. The angles in Tables 2, 3, 4 and 5 are chosen to correspond with a goniometer, where the horizontal axis is fixed and the vertical axis is moveable in space, see Figure 1 (type 1 CIE 70:1987). For a goniometer with another arrangement the angles have to be recalculated correspondingly (see CIE 54:2001, Annex B).

The distance of measurement shall be such that the inverse square distance law is applicable ($I = r^2 E$). The measuring equipment shall be such that the angular aperture of the detector viewed from the reference centre of the lamp is ≤ 10' (minutes of arc).

The total effect of systematic and random errors in the goniometer shall not exceed:

a) For measurement of luminous intensity: 5 % of the actual intensity

b) For measurement of angular direction: beams with half peak side angle:

1) $2° < \alpha < 4°$: 0,1°

2) $4° < \alpha < 8°$: 0,2°

3) $8° < \alpha$: 0,4

Light sources shall be suitably aged so that their electrical and optical characteristics are stable.

Prior to measurement, the optical unit shall have been in operation in order to stabilize. Red and green optical units are stabilized for at least 30 min with constant light after which measurements can be performed at leisure. Yellow optical units are stabilized for 15 min in a flashing mode with (60 ± 1) flashes per minute (1 Hz) and a light dark ratio of 1:1 after which measurements can be performed with constant light within at most 2 min.

NOTE The light output from some yellow optical units based on yellow LED's is particularly sensitive to temperature rise from self-generated heating during operation. However, yellow optical units are not operated continuously during long intervals and, therefore, it is not necessary to require the same stabilization procedure for yellow as for red and green optical units.

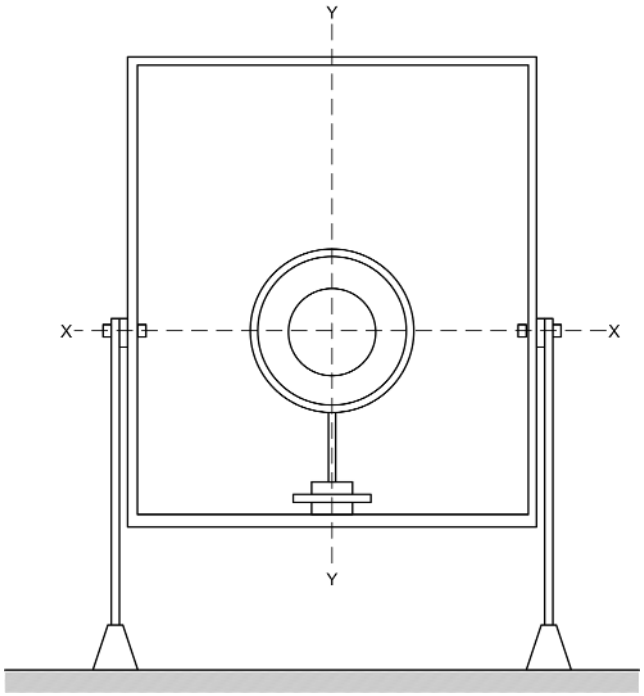


Figure 1 — Goniometer for measuring luminous intensities with fixed horizontal axis X

8.3 Measurement of luminance for uniformity tests

The light emitting surface of an optical unit shall appear as essentially circular, not hexagonal, elliptical or any other characteristic shape deviating from circular.

Local luminance values of the light emitting surface shall be measured on the reference axis with a circular measuring field of a diameter of 25 mm. This field is moved by translation in both directions, or rotation about the optical axis in successive steps of a maximum pitch of 25 mm (in any direction) so as to have covered the entire light emitting surface. For those cases, where the measuring field is fully within a central circular area of the light emitting surface of a diameter of 180 mm for 200 mm roundels and 270 mm for 300 mm roundels, the smallest and the greatest luminance values are selected and the luminance ratio is calculated as the ratio of the two.

NOTE The circular measuring field of 25 mm can be defined either by optics as with a luminance meter placed at a distance, or with a circular mask placed in front of the light emitting surface. The translation of the field can be done either by translating a luminance meter without change of direction, or by translating the optical unit.

The total error (systematic and random) of luminance measurements should not exceed 5 %.

8.4 Measurement of phantom signal

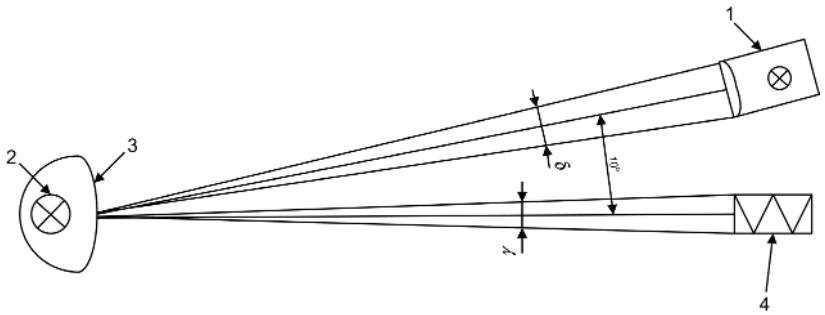
For measurements of phantom signal the signal head shall be fitted with its signal light source. The manufacturer shall specify the light source(s) in accordance with 10.2. The light source generating a phantom signal according to Figure 2 is a projector simulating CIE illuminant A. The light from the projector shall illuminate the light emitting surface of the optical unit with a maximum illuminance of E = 1000 lx and local deviations of at most 10 % of E. For this particular test no hood shall be fitted.

The reference axis of the signal head and the axis of the projector shall form an angle of 10°. The maximum permitted angular spread of illuminating directions is limited to 0,5°. The plane formed from both axes shall be the operational vertical plane. The arrangement shall be in a way that the projector radiates the light as if from above the signal head.

To avoid also measuring a frontal phantom signal of a convex polished lens it is necessary to cover the image of the projector on the illuminating surface of the optical unit by means of a mask. The diameter of the mask shall be 30 mm (for 200 mm roundels) or 45 mm (for 300 mm roundels).

The measured reflected luminous intensity I_r is converted to a phantom signal I_{ph} at an illuminance of 40 000 lx by:

$$I_{\mathrm{ph}} = I_{\mathrm{r}} \times \frac{40000\,\mathrm{lx}}{E} \qquad (1)$$



Key

1 projector

2 signal head

3 plane of the light emitting surface

4 photometer

Figure 2 — Typical arrangement for the measurement of the luminous intensity of phantom signal (γ = photometer head aperture, δ = source aperture)

Measurements of phantom signal depend strongly on the geometry of measurement. 10 m distance for measurements is preferred for obtaining comparable results and it should be used to use the following distances and apertures:

— photometer head aperture: γ <= 10’ (minutes of arc), corresponding to a 2,9 cm diameter effective photometer head opening at 10 m distance;

— source aperture: δ <= 2,0°, corresponding to a 35 cm diameter opening of effective light exit at 10 m distance.

The photometer shall be placed so that the reference axis of the signal head and the axis of the photometer coincide. With switched on projector the mean luminous intensity I_{ph} in the plane of the illuminating field of the signal head shall be measured while the signal is switched off. The ratio between the luminous intensity I_s of the real signal and the luminous intensity I_{ph} of the phantom signal shall be as given in 6.6 and Table 6.

8.5 Measurement of the colour

For the measurement of the colour the arrangement of Figure 2 shall be altered in a way that a colorimeter replaces the photometer.

The chromaticity co-ordinates P_s (x_s, y_s) of the real signal shall be measured with projector switched off.

8.6 Measurement of combined colours

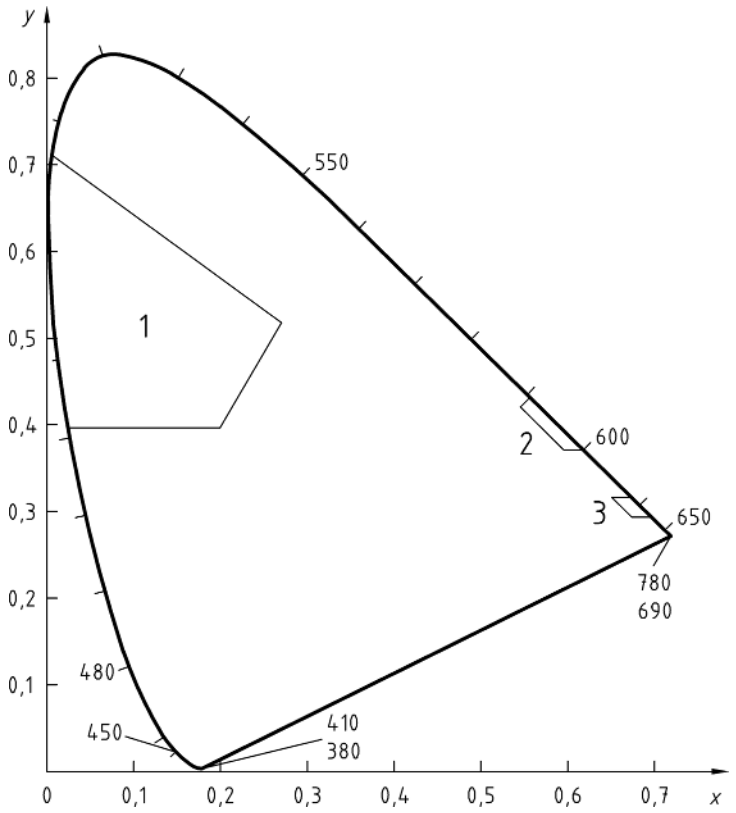
The chromaticity coordinates P_{ph} (x_{ph}, y_{ph}) of the pure phantom signal shall be measured while the projector is switched on and the signal light is switched off in accordance with 8.4.

The chromaticity co-ordinates of the combined colour at 40 000 lx nominal are calculated as follows:

$$x_{s+ph} = \frac{I_s \times y_s^{-1} \times x_s + I_{ph} \times y_{ph}^{-1} \times x_{ph}}{I_s \times y_s^{-1} + I_{ph} \times y_{ph}^{-1}} \quad (2)$$

$$y_{s+ph} = \frac{I_s + I_{ph}}{I_s \times y_s^{-1} + I_{ph} \times y_{ph}^{-1}} \quad (3)$$

The combined colour shall be within the relevant chromaticity region of Table 7. This can be determined by plotting the chromaticity point of the combined colour into the chromaticity diagram shown in Figure 3, where the chromaticity regions are indicated by means of the corner points shown in Table 12.



Key

1 green

2 yellow

3 red

Figure 3 — CIE-chromaticity diagram with boxes for the colours of signal lights and combined colours

Table 12 — Chromaticity co-ordinates of the corners of the recommended chromaticity regions from Table 7 for signal lights

Colour	1		2		3		4	
	x	*y*	*x*	*y*	*x*	*y*	*x*	*y*
Red	0,660	0,320	0,680	0,320	0,710	0,290	0,690	0,290
Yellow	0,536	0,444	0,547	0,452	0,613	0,387	0,593	0,387
Green	0,009	0,720	0,284	0,520	0,209	0,400	0,028	0,400

9 Tolerances

1) Measurement tolerances shall be for each unit of optical measurement as detailed in Clause 8.

2) Test arrangements for optical measurement shall be set up for angles if not otherwise quoted to 0,1°.

3) The operating tolerances of all components for optical measurement which affect the performance parameters shall be stated in supplier documentation.

4) All items selected from general suppliers data but used to closer tolerances to achieve the performance levels shall be declared in documentation supplied with the test unit. The testing authority shall test the unit within those operating tolerances, these will be noted and become part of the detail included in the certification.

10 Marking, labelling and product information

10.1 Marking and labelling

The finished equipment which contains any electrical, electronic or optical parts shall be clearly and durably marked with the information a) to e). The marking may be inside the unit to provide an acceptable external appearance but it shall be visible when access is obtained to the internal parts.

a) Power rating (voltage, current and frequency);

b) Manufacturer's name, trademark or identification mark;

c) Manufacturer's model or type reference;

d) Date of manufacture (month and year);

e) Details of the classes of construction, i.e:

- Nominal diameter;
- Dimming;
- Performance level on luminous intensity including maximum luminous intensity;
- Luminous intensity distribution classification;
- Phantom classification;
- Symbol classification;
- Environmental classification.

Example of marking:

Signals company Ltd	
230 volts; 0,23 A per optical unit: 50 Hz	
Model	667/1/20345/001
Manufactured	94-12
Nominal diameter	200 mm
Luminous intensity	Class 2/1
Dimmed operation	Class D0
Distribution of luminous intensity	Category B Type E
Maximum phantom signal	Class 2
Symbol class	S2
Impact resistance	Class IR 2
Ingress	Class 3 (IP54)
Tolerance to temperature, damp heat and solar radiation	Class B (-25 to 55 °C)

Marking and labelling shall be affixed in such a way that the visibility and legibility of the regulatory marking is not reduced and provided that such marks are not likely to deceive third parties as to the meaning and form of the regulatory marking. Marking required under this clause which is also required for regulatory purposes need not be repeated [for this clause] and is deemed to satisfy the requirements of this clause.

10.2 Product information

The manufacturer or authorised representative shall provide the information a) to g):

a) definition of the reference axis, reference centre and light emitting surface;

b) instructions on the assembly and mounting of the signal head in relation to the reference axis;

c) details of any limitations in location or usage;

d) instructions of the light source to be used;

e) instructions on the operation, maintenance and cleaning of the signal head;

f) for each standard signal head the measurement data to prove compliance with the relevant requirements of this standard;

g) instruction on the safe use of the product.

11 Assessment and verification of constancy of performance - AVCP

11.1 General

The compliance of, Traffic control equipment – Signal heads, with the requirements of this standard and with the performances declared by the manufacturer in the DoP shall be demonstrated by:

— determination of the product-type on the basis of type testing.

— factory production control by the manufacturer, including product assessment.

The manufacturer shall always retain the overall control and shall have the necessary means to take responsibility for the conformity of the product with its declared performance(s).

11.2 Type testing

11.2.1 General

All performances related to characteristics included in this standard shall be determined when the manufacturer intends to declare the respective performances unless the standard gives provisions for declaring them without performing tests. (e.g. use of previously existing data, CWFT (Classified Without Further Testing) and conventionally accepted performance).

Assessment previously performed in accordance with the provisions of this standard, may be taken into account provided that they were made to the same or a more rigorous test method, under the same AVCP system on the same product or products of similar design, construction and functionality, such that the results are applicable to the product in question.

NOTE 1 Same AVCP system means testing by an independent third party, under the responsibility of a notified product certification body.

For the purposes of assessment, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family

NOTE 2 Products may be grouped in different families for different characteristics.

Reference to the assessment method standards should be made to allow the selection of a suitable representative sample.

In addition, the determination of the product-type shall be performed for all characteristics included in the standard for which the manufacturer declares the performance:

— at the beginning of the production of a new or modified Signal head (unless a member of the same product range), or

— at the beginning of a new or modified method of production (where this may affect the stated properties); or

they shall be repeated for the appropriate characteristic(s), whenever a change occurs in the Traffic control equipment – Signal heads, design, in the raw material or in the supplier of the components, or in the method of production (subject to the definition of a family), which would affect significantly one or more of the characteristics.

Where components are used whose characteristics have already been determined, by the component manufacturer, on the basis of assessment methods of other product standards, these characteristics need not be re-assessed. The specifications of these components shall be documented.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the DoP, although this does not replace the responsibility on the Signal head manufacturer to ensure that the Signal head as a whole is correctly manufactured and its component products have the declared performance values.

11.2.2 Test samples, testing and compliance criteria

To establish conformity against a product class in this European Standard a test module shall pass a series of optical, constructional and environmental tests. In addition, the supplier shall declare that the module meets the requirements for size, for electrical safety, EMC, background screens and symbols set out in the standard. Details of the requirements to be tested and to be declared are given in Annex A.

To demonstrate conformity against the standard the supplier shall provide a fully constructed signal head with three optical units (test module). The supplier may submit at the same time or subsequently, optical/constructional variants of the original for certification, including individual optical units. He shall not, however, be able to claim compliance for a signal head with three optical units by submitting a single optical unit of each of the three colours.

During the environmental tests the test module shall cycle through each of the optical units at one minute intervals, except for the hot and cold tests where one unit shall be permanently on during the hot test and during the cold test all units shall be extinguished except for the last hour prior to recovery when the signal shall cycle at 1 min intervals.

No lamps are required to be fitted and/or remain in place during the impact test. Lamp failure is allowed during testing.

Test modules shall be submitted in form a, b or both:

a) a 3 optical unit signal head

b) an individual unit mounted in its appropriate signal head assembly.

In the case of a signal head integrated inside a pole, the manufacturer shall submit the part of the pole that contains the signal head.

The supplier shall provide drawings of every combination of a) and b) for which he wishes to provide backgrounds, (standard as normally supplied) brackets, mounting facilities arrangements etc.

Modules for test shall come complete with any components or devices fitted necessary to meet all of the performance requirements.

The module shall undergo and pass all of the optical tests and then the general and constructional requirements in the order of Clause 7. No repairs, modifications, changes or adjustments of any kind may be carried out during any of the tests or during different types of test.

Where a supplier wishes to declare alternative interchangeable elements shall be subjected to the relevant tests according to this European Standard. The supplier may then reflect these combinations in separate declarations.

Where different brackets are available, only the standard combination (as supplied in the majority of installations) need be tested throughout the complete range of tests. Vibration tests are required on different combinations of brackets and signal heads to ensure that the worst combination is tested. All bracket combinations shall be considered and suppliers should be able to provide evidence of their suitability.

NOTE This might apply where a supplier can provide alternative lamps or lenses to achieve different results.

They shall be tested/assessed in accordance with Table 13.

Table 13 – Number of samples to be tested and compliance criteria

Characteristic	**Requirement**	**Assessment Method**	**No of Samples**	**Compliance Criteria** The product shall comply with the characteristics and classes as required by the regulatory authority in accordance with the definitions in the requirement clauses noted in this table.
General requirements				
Size	6.2	**Mechanical Measurement**	**1 of each type**	Manufacturers declaration nominal diameter (200 mm or 300mm) ± 10 %
Visual performance				
Luminous intensity	6.3	**Measurement as defined in 8.2**	**1 of each type**	Performance levels 1/0; 1/1; 1/2; 2/0; 2/1; 2/2; 3/0; 3/1; 3/2
Distribution of luminous intensity	6.4	**Measurement as defined in 8.2**	**1 of each type**	Type E ;B1/1, B2/2 Type W; A1/1, A2/1, A3/1, B1/2, B2/1, B2/2, B3/2 Type M; A2/1, A3/1, A2/2, A3/2 Type N; A2/1, A3/1, B2/2, B3/2
Luminous uniformity	6.5	**Measurement as defined in 8.3**	**1 of each type**	Types E, W and M equal to or better than 1:10 (i.e. a smaller ratio is acceptable) Types N equal to or better than 1:15 (i.e. a smaller ratio is acceptable)
Maximum phantom signal	6.6	**Measurement as defined in 8.4 and 8.6**	**1 of each type**	Class 1, 2, 3, 4, 5
Colour	6.7	**Measurement as defined in 8.5**	**1 of each type**	red, yellow, green
Symbols	6.8	**Declared by the manufacturer**	**1 of each type**	S1, S2 if applicable
Physical performance				
Environmental requirements	5.1	**Tested as defined in Table 11**	**1 of each type**	Class A, B, C
Impact resistance	4.3	**Tested as defined in Clause 7 Table 8**	**1 of each type**	Class IR1, IR2, IR3
Constructional integrity	4.4	**Tested as defined in Clause 7 Table 9**	**1 of each type**	
Ingress	4.2	**Tested as defined in Clause 7 Table 10**	**1 of each type**	Class I, II, III, IV, V
Electrical requirements				

Electrical safety	5.2	Assessed against EN 50556, and Declared by the manufacturer	**1 of each type**	EN 50556
Electromagnetic compatibility				
Electromagnetic emission	5.2	Tested against EN 50293.	**1 of each type**	EN 50293
Electromagnetic immunity	5.2	Tested against EN 50293.	**1 of each type**	EN 50293

11.2.3 Test reports

The results of the determination of the product-type shall be documented in test reports. All test reports shall be retained by the manufacturer for at least 10 years after the last date of production of the Signal heads to which they relate.

11.2.4 Shared other party results

NOTE The sharing of other party results is in principle applicable to all systems of assessment and evaluation of constancy of performance.

A manufacturer may use the results of the product-type determination obtained by someone else (e.g. by another manufacturer, as a common service to manufacturers, or by a product developer), to justify his own declaration of performance regarding a product that is manufactured according to the same design (e.g. dimensions) and with raw materials, constituents and manufacturing methods of the same kind, provided that:

— the results are known to be valid for products with the same essential characteristics relevant for the product performance;

— in addition to any information essential for confirming that the product has such same performances related to specific essential characteristics, the other party who has carried out the determination of the product-type concerned or has had it carried out, has expressly accepted[1] to transmit to the manufacturer the results and the test report to be used for the latter's product-type determination, as well as information regarding production facilities and the production control process that can be taken into account for FPC;

— the manufacturer using other party results accepts to remain responsible for the product having the declared performances and he also:

— ensures that the product has the same characteristics relevant for performance as the one that has been subjected to the determination of the product-type, and that there are no significant differences with regard to production facilities and the production control process compared to that used for the product that was subjected to the determination of the product-type; and

— keeps available a copy of the determination of the product-type report that also contains the information needed for verifying that the product is manufactured according to the same design and with raw materials, constituents and manufacturing methods of the same kind.

1 The formulation of such an agreement can be done by licence, contract, or any other type of written consent.

11.2.5 Cascading determination of the product-type results

For some construction products, there are companies (often called “system houses”) which supply or ensure the supply of, on the basis of an agreement[2] some or all of the components (e.g. in case of windows: profiles, gaskets, weather strips)[3] to an assembler who then manufactures the finished product (referred to below as the “assembler”) in his factory.

When doing so, the system house shall submit an “assembled product” using components manufactured by it or by others, to the determination of the product-type and then make the determination of the product-type report available to the assemblers, i.e. the actual manufacturer of the product placed on the market.

Provided that the activities for which such a system house is legally established include manufacturing/assembling of products as the assembled one, the system house may take the responsibility for the determination of the product-type regarding one or several essential characteristics of an end product which is subsequently manufactured and/or assembled by other firms in their own factory.

To take into account such a situation, the concept of cascading determination of the product-type might be taken into consideration in the technical specification, provided that this concerns characteristics for which either a notified product certification body or a notified test laboratory intervene, as presented below.

The determination of the product-type report that the system house has obtained with regard to tests carried out by a notified body, and which is supplied to the assemblers, may be used for the regulatory marking purposes without the assembler having to involve again a notified body to undertake the determination of the product-type of the essential characteristic(s) that were already tested, provided that:

— the assembler manufactures a product which uses the same combination of components (components with the same characteristics), and in the same way, as that for which the system house has obtained the determination of the product-type report. If this report is based on a combination of components not representing the final product as to be placed on the market, and/or is not assembled in accordance with the system house’s instruction for assembling the components, the assembler needs to submit his finished product to the determination of the product-type;

— the system house has notified to the manufacturer the instructions for manufacturing/assembling the product and installation guidance;

— the assembler (manufacturer) assumes the responsibility for the correct assembly of the product in accordance with the instructions for manufacturing/assembling the product and installation guidance notified to him by the system house;

— the instructions for manufacturing/assembling the product and installation guidance notified to the assembler (manufacturer) by the system house are an integral part of the assembler’s Factory Production Control system and are referred to in the determination of the product-type report;

— the assembler is able to provide documented evidence that the combination of components he is using, and his way of manufacturing, correspond to the one for which the system house has obtained the determination of the product-type report (he needs to keep a copy of the system house’s determination of the product-type report);

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2 This can be, for instance, a contract, license or whatever kind of written agreement, which should also contain clear provisions with regard to responsibility and liability of the component producer (system house, on the one hand, and the assembler of the finished product, on the other hand.

3 These companies may produce components but they are not required to do so.

— regardless the possibility of referring, on the basis of the agreement signed with the system house, to the latter's responsibility and liability under private law, the assembler remains responsible for the product being in compliance with the declared performances, including both the design and the manufacture of the product, which is given when he affixes the regulatory marking on his product

11.3 Factory production control (FPC)

11.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market comply with the declared performance of the essential characteristics.

The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures.

This factory production control system documentation shall ensure a common understanding of the evaluation of the constancy of performance and enable the achievement of the required product performances and the effective operation of the production control system to be checked. Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the compliance of the product with the declared performances of the essential characteristics.

In case the manufacturer has used shared or cascading product-type results, the FPC shall also include the appropriate documentation as foreseen in 11.2.4 and 11.2.5.

11.3.2 Requirements

11.3.2.1 General

The manufacturer is responsible for organizing the effective implementation of the FPC system in line with the content of this product standard. Tasks and responsibilities in the production control organization shall be documented and this documentation shall be kept up-to-date.

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product constancy, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-constancies from occurring, actions in case of non-constancies and to identify and register product constancy problems.

Personnel performing work affecting the constancy of performance of the product shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

In each factory the manufacturer may delegate the action to a person having the necessary authority to:

— identify procedures to demonstrate constancy of performance of the product at appropriate stages;

— identify and record any instance of non-constancy;

— identify procedures to correct instances of non-constancy.

The manufacturer shall draw up and keep up-to-date documents defining the factory production control. The manufacturer's documentation and procedures should be appropriate to the product and manufacturing process. The FPC system should achieve an appropriate level of confidence in the constancy of performance of the product. This involves:

a) the preparation of documented procedures and instructions relating to factory production control operations, in accordance with the requirements of the technical specification to which reference is made;

b) the effective implementation of these procedures and instructions;

c) the recording of these operations and their results;

d) the use of these results to correct any deviations, repair the effects of such deviations, treat any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-constancy of performance.

Where subcontracting takes place, the manufacturer shall retain the overall control of the product and ensure that he receives all the information that is necessary to fulfil his responsibilities according to this European Standard.

If the manufacturer has part of the product designed, manufactured, assembled, packed, processed and/or labelled by subcontracting, the FPC of the subcontractor may be taken into account, where appropriate for the product in question.

The manufacturer who subcontracts all of his activities may in no circumstances pass the above responsibilities on to a subcontractor.

NOTE Manufacturers having an FPC system, which complies with EN ISO 9001 and which addresses the provisions of the present European Standard are considered as satisfying the FPC requirements of the Regulation (EU) No 305/2011.

11.3.2.2 Equipment

11.3.2.2.1 Testing

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

11.3.2.2.2 Manufacturing

All equipment used in the manufacturing process shall be regularly inspected and maintained to ensure use, wear or failure does not cause inconsistency in the manufacturing process. Inspections and maintenance shall be carried out and recorded in accordance with the manufacturer’s written procedures and the records retained for the period defined in the manufacturer's FPC procedures.

11.3.2.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their compliance. In case supplied kit components are used, the constancy of performance system of the component shall be that given in the appropriate harmonized technical specification for that component.

11.3.2.4 Traceability and marking

Individual Signal heads and constituent parts, shall be identifiable and traceable with regard to their production origin. The manufacturer shall have written procedures ensuring that processes related to affixing traceability codes and/or markings are inspected regularly.

11.3.2.5 Controls during manufacturing process

The manufacturer shall establish procedures to ensure that the required values of all of the characteristics are achieved at all times.

The manufacturer shall calibrate and maintain the manufacturing, control, measuring or test equipment in such condition that will ensure the production processes produce products in conformity with the ITT, whether or not it

belongs to him. The equipment shall be used in conformity with the specification or the test reference system to which the specification refers.

11.3.2.6 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of the characteristics he declares are maintained. The characteristics, and the means of control, are:

Table 14 — Minimum frequency of testing for product testing and evaluation as part of FPC

Property	Clause, indicating the relevant test method (if any)	Minimum frequency of tests	Minimum number of samples
Chromaticity coordinates	6.7 Colour of signal lights	Per batch	5 %, minimum 1
Optical performance (Luminous intensity)	6.3 Luminous intensities of signal lights	Per batch	5 %, minimum 1

The manufacturer shall record the results of the tests specified above. These records shall at least include the following information:

— identification of the signal head tested;

— date of sampling and testing if applicable (the information shall reflect the time difference between manufacturing and testing);

— test methods performed;

— test results;

— name(s) of the person(s) performing the test(s).

11.3.2.7 Non-complying products

The manufacturer shall have written procedures which specify how non-complying products shall be dealt with. Any such events shall be recorded as they occur and these records shall be kept for the period defined in the manufacturer's written procedures.

Where the product fails to satisfy the acceptance criteria, the provisions for non-complying products shall apply, the necessary corrective action(s) shall immediately be taken and the products or batches not complying shall be isolated and properly identified.

Once the fault has been corrected, the test or verification in question shall be repeated.

The results of controls and tests shall be properly recorded. The product description, date of manufacture, test method adopted, test results and acceptance criteria shall be entered in the records under the signature of the person responsible for the control/test.

With regard to any control result not meeting the requirements of this European Standard, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, throwing away or putting right of product) shall be indicated in the records.

11.3.2.8 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence.

If control or test results show that the product does not meet the requirements, the necessary corrective action shall be immediately taken. Products (or batches) not conforming shall be quarantined and properly identified.

Once the non conformance has been corrected the product shall be re-tested. If it is not practicable to correct the fault the product shall be rejected unless the customer accepts it in a repaired or uncorrected form. The customer's acceptance shall be verified in writing.

For any product delivered before the tests results are available, a procedure and record shall be maintained for notifying customers. A recall procedure shall be provided for any product which is found to be not in conformity with the ITT.

11.3.2.9 Handling, storage and packaging

The manufacturer shall have procedures providing methods of product handling and shall provide suitable storage areas preventing damage or deterioration.

11.3.3 Product specific requirements

The FPC system shall address this European Standard and ensure that the products placed on the market comply with the declaration of performance.

The FPC system shall include a product specific FPC, which identifies procedures to demonstrate compliance of the product at appropriate stages, i.e.:

a) the controls and tests to be carried out prior to and/or during manufacture according to a frequency laid down in the FPC test plan,

and/or

b) the verifications and tests to be carried out on finished products according to a frequency laid down in the FPC test plan

If the manufacturer uses only finished products, the operations under b) shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

If the manufacturer carries out parts of the production himself, the operations under b) may be reduced and partly replaced by operations under a). Generally, the more parts of the production that are carried out by the manufacturer, the more operations under b) may be replaced by operations under a).

In any case the operation shall lead to an equivalent level of compliance of the product as if FPC had been carried out during the production.

NOTE Depending on the specific case, it can be necessary to carry out the operations referred to under a) and b), only the operations under a) or only those under b).

The operations under a) refer to the intermediate states of the product as on manufacturing machines and their adjustment, and measuring equipment etc. These controls and tests and their frequency shall be chosen based on product type and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

The manufacturer shall establish and maintain records that provide evidence that the production has been sampled and tested. These records shall show clearly whether the production has satisfied the defined acceptance criteria and shall be available for at least three years.

11.3.4 Initial inspection of factory and of FPC

Initial inspection of factory and of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 6.3 are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European standard are in place and correctly implemented,

and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice,

and

c) that the product complies with the product-type samples, for which compliance of the product performance to the DoP has been verified.

All locations where final assembly or at least final testing of the relevant product is performed, shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

11.3.5 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken once per year. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated at appropriate time intervals.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to the determination of the product-type and that the correct actions have been taken for non-compliant products.

11.3.6 Procedure for modifications

If modifications are made to the product, production process or FPC system that could affect any of the product characteristics declared according to this standard, then all the characteristics for which the manufacturer declares performance, which may be affected by the modification, shall be subject to the determination of the product-type, as described in 11.2.1.

Where relevant, a re-assessment of the factory and of the FPC system shall be performed for those aspects, which may be affected by the modification.

All assessments and their results shall be documented in a report.

11.3.7 One-off products, pre-production products (e.g. prototypes) and products produced in very low quantity

The Traffic Control Equipment – Signal heads produced as a one-off, prototypes assessed before full production is established, and products produced in very low quantities less than 100 per year) shall be assessed as follows.

For type assessment, the provisions of 11.2.1, 3rd paragraph apply, together with the following additional provisions:

— in case of prototypes, the test samples shall be representative of the intended future production and shall be selected by the manufacturer;

— on request of the manufacturer, the results of the assessment of prototype samples may be included in a certificate or in test reports issued by the involved third party.

The FPC system of one-off products and products produced in very low quantities shall ensure that raw materials and/or components are sufficient for production of the product. The provisions on raw materials and/or components shall apply only where appropriate. The manufacturer shall maintain records allowing traceability of the product.

For prototypes, where the intention is to move to series production, the initial inspection of the factory and FPC shall be carried out before the production is already running and/or before the FPC is already in practice. The following shall be assessed:

— the FPC-documentation; and

— the factory.

In the initial assessment of the factory and FPC it shall be verified:

a) that all resources necessary for the achievement of the product characteristics included in this European Standard will be available, and

b) that the FPC-procedures in accordance with the FPC-documentation will be implemented and followed in practice, and

c) that procedures are in place to demonstrate that the factory production processes can produce a product complying with the requirements of this European standard and that the product will be the same as the samples used for the determination of the product-type, for which compliance with this European standard has been verified.

Once series production is fully established, the provisions of 11.3 shall apply.

Annex A
(informative)

Test, declarations and requirements

Table A.1 — Test, declarations and requirements

Performance parameter		Test or declare	Clause	Requirement	Clause
Size: 200 mm 300 mm		declared	6.2	±10 %	6.2
Impact resistance:	Class IR 1 Class IR 2 Class IR 3	tested	Table 8	Class selected by the regulatory authority	4.1
Random vibration		tested	Table 9	No damage that causes the product not to meet requirements	4.1
Ingress:	IP 55 IP 54 IP 44 IP 34	tested	Table 10	Class selected by the regulatory authority	4.2
Temperature range:	Class A Class B Class C	tested	Table 11	Class selected by the regulatory authority	5.1
Electrical safety		declared		EN 50556	5.2
Luminous intensity Performance level Performance level Performance level Dimmed operation	 1/0; 1/1; 1/2 2/0; 2/1; 2/2 3/0; 3/1; 3/2 Class D0 Class D1	tested	8.2	 Minimum and maximum As declared by the manufacturer	6.3
Distrib. Luminous intensity Type E Type W Type M Type N	 Class B Class A/B Class A Class A/B	tested	8.2	Minimum	6.4
Luminance uniformity Types E; W and M Type N		tested	8.3	 ≥ 1:10 ≥ 1:15	6.5
Maximum phantom signal ratio Class 1 Class 2 Class 3		tested	8.4	red/yellow green >1 >1 >5 >5 >4 >8	6.6

Class 4 Class 5			>8 >16 >16 >16	
Colour of signal lights Red Yellow Green	tested	8.5	Within colour boundaries of Table 7	6.7
Combined colours (if required)	tested	8.6	Within colour boundaries of Table 7	6.7
Class S1 Class S2	declared	6.8	100 % of Table 1 50 % of Table 1	6.8
Background screens	declared	6.9		

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/111 "Circulation Fixtures" given to CEN by the European Commission and the European Free Trade Association.

If this European Standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.

This annex deals with the CE marking of the Signal heads intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as in Clause 1 of this standard, related to the aspects covered by the mandate, and is defined by Table ZA.1.

Table ZA.1 — Relevant clauses for product and intended use

Construction product: Traffic control equipment - Signal heads **Intended use:** Signal heads to be permanently installed for the instruction of road users, with red, yellow and green signal lights with 200 mm and 300 mm roundels equipped with the visors, hoods etc. with which they are intended to be used. Portable signal lights are specifically excluded from this standard.			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Visibility characteristics			
Luminous intensities of signal lights 6.3	6.3	None	Performance class
Distribution of luminous intensity	6.4	None	Declared value
Luminance uniformity 6.5	6.5	None	Declared ratio value
Phantom performance			
Maximum phantom signal	6.6	None	Performance class
Chromaticity coordinates			
Colour of signal lights	6.7	None	Pass/fail
Durability mechanical		None	Class IP Rating Complete signals and / or Replaceable

optical performance	4.1 (impact resistance) 4.2 (Sealing of signals or individual modules)		components
Dangerous substances			Either Substance “x” = less than “y” ppm Or - NPD

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product.

In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option “No performance determined” (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedure for AVCP of Traffic control equipment – Signal heads

ZA.2.1 System(s) of AVCP

The AVCP system(s) of Traffic control equipment – Signal heads indicated in Table ZA.1 established by EC Decision(s) decision of the Commission 96/579/EC as given in Annex III of the mandate for circulation fixtures (M/111), is shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es) of performance.

Table ZA.2 — System(s) of AVCP

Product(s)	Intended use(s)	Level(s) or class(es) of performance	AVCP system(s)
Traffic control equipment - signal heads	Signal heads installed for the instruction of road users, with red, yellow and green signal lights with 200 mm and 300 mm roundels. Portable signal lights are specifically excluded from this European Standard.		1
System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2			

The AVCP of the Traffic control equipment — Signal heads in Table ZA.1 shall be according to the AVCP procedures indicated in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3 — Assignment of AVCP tasks for Traffic control equipment — Signal heads under system 1

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use, which are declared	11.3
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	11.3
Tasks for the notified product certification body	determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	[Essential characteristics of Table ZA.1 relevant for the intended use indicated in Annex III of the mandate]	11.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared, namely [those indicated in Annex III of the mandate]. Documentation of the FPC.	11.3
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use, which are declared, namely [those indicated in Annex III of the mandate]. Documentation of FPC	11.3

ZA.2.2 Declaration of performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of the different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

— the reference of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and date of issue of the harmonised standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

(a) the intended use or uses for the construction product, in accordance with the applicable harmonised technical specification;

(b) the list of essential characteristics, as determined in the harmonised technical specification for the declared intended use or uses;

(c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

(d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared.

(e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

(f) for the listed essential characteristics for which no performance is declared, the letters "NPD" (No Performance Determined);

Regarding the supply of the DoP, article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DoP.

[In case of structural products, methods for determining the properties related to Basic Work Requirement (BWR) N° 1 “Mechanical resistance and stability” (including such aspects of BWR N°4 “Safety in use”, which relate to mechanical resistance and stability) and aspects of BWR N° 2 “Resistance to fire”, to be declared as information accompanying the CE marking.

ZA.2.2.3 Example of DoP

The following gives an example of the contents of a DoP

DECLARATION OF PERFORMANCE

1. Unique identification code of the product-type:

Traffic Signal

xxxx

2 Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

Type number

3. Intended use or uses of the construction product, in accordance with the applicable harmonised technical specification, as foreseen by the manufacturer:

Traffic Products – Signal heads. EN 12368

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):

Manufacturers Address

Tel. +

Fax: +

Email:

5. Where applicable, name and contact address of the authorised representative of the manufacturer whose mandate covers the tasks specified in Article 12(2),

Authorised Representative Address

Tel. +

Fax: +

Email:

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 1

7. In case of the declaration of performance concerning a construction product covered by a harmonised standard:

Notified factory production control certification body No. 5678 performed the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of conformity of the factory production control

8. Declared performance

Essential characteristics	**Performance**	**Harmonised technical specification**
Optical Performance		EN 12368
Luminous intensities of signal lights	**Class / Classes achieved**	
Distribution of luminous intensity	**Class / Classes achieved**	
Luminance uniformity	**Class / Classes achieved**	
Maximum phantom signal	**Class / Classes achieved**	
Colour of signal lights	**Compliant**	
Durability mechanical optical performance	 **Class / Classes achieved** **IP Class for Signals and Replaceable parts**	
Dangerous substances		Either Substance “x” = less than “y” ppm Or - NPD

10. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

……...… …… ……

(name and function). (place and date of issue) (signature)

ZA.3 CE marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly.

— to the Traffic control equipment — Signal heads

or

— to a label attached to it.

Where this is not possible or not warranted on account of the nature of the product, it shall be affixed:

— to the packaging

or

— to the accompanying documents.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed,

— the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity,

— the unique identification code of the product-type

— the reference number of the declaration of performance *[see example of DoP]*

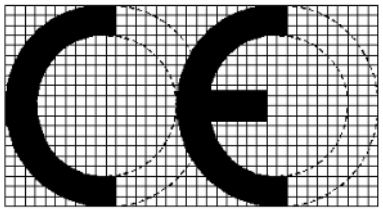
— the level or class of the performance declared *[see example of DoP]*

— the dated reference to the harmonised technical specification applied.

— the identification number of the notified body,

— the intended use as laid down in the harmonised technical specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

	***CE conformity marking***
1234	***Identification number of the certification body***
AnyCo Ltd, P.O. Box 21, B - 1050	***Name or identifying mark and registered address of the manufacturer***
15	***Last two digits of the year, in which the marking was affixed***
Any 001	***DoP number***
EN 12368 2015	***Dated Number of European Standard applied, as referenced in the OJEU***

Traffic control equipment – Signal heads		
Impact resistance	**Class IR 2**	***Description of product and information on regulated characteristics***
Luminous intensity	**Class 2**	
Distribution of luminous intensity	**Type E**	
Luminance uniformity	**≥ 1:10**	
Maximum phantom signal	**Class 2**	
our of signal lights	**Within boundaries of Table 7 of** EN 12368	
Dangerous substances	**NPD**	
[Other characteristics are not relevant for this type of product]		

Figure ZA.1 — Example CE marking information of products under AVCP system 1

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

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