



SLOVENSKI STANDARD
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BÜXca Yý U.
SIST EN 12899-1:2002

Stalna vertikalna cestna signalizacija - 1. del: Stalni prometni znaki

Fixed, vertical road traffic signs - Part 1: Fixed signs

Ortsfeste, vertikale Straßenverkehrszeichen - Teil 1: Ortsfeste Verkehrszeichen

Signaux fixes de signalisation routière verticale - Partie 1: Panneaux fixes

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English Version

Fixed, vertical road traffic signs - Part 1: Fixed signs

Signaux fixes de signalisation routière verticale - Partie 1 :
Panneaux fixes

Ortsfeste, vertikale Straßenverkehrszeichen - Teil 1:
Verkehrszeichen

This European Standard was approved by CEN on 4 February 2007.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 12899-1:2007) 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of an identical text or by endorsement, at the latest by May 2008, and conflicting national standards shall be withdrawn at the latest by August 2009.

This document supersedes EN 12899-1:2001.

This European Standard 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 Directives.

For relationships with EU Directives, see informative Annex ZA, which is an integral part of this standard.

This European Standard consists of the following Parts under the general title:

Fixed, vertical road traffic signs —

Part 1: (This part) Fixed signs

Part 2: *Transilluminated traffic bollards (TTB)*

Part 3: *Delineator posts and retroreflectors*

Part 4: *Factory production control*

Part 5: *Initial type testing*

It is based on performance requirements and test methods published in CEN, CENELEC, CIE (International Commission on Illumination) and ISO documents together with standards of the CEN member organizations.

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

Introduction

This European Standard is designed for use by road authorities. It can also be used by private developers who wish to use signs on their own land similar to those used on public highways.

This European Standard:

- can be used to implement type approval and certification testing;
- derives from performance requirements and test methods published in CEN, CENELEC, CIE and ISO documents together with standards of the CEN member organizations;
- does not require the replacement of existing signs;
- covers performance requirements and test methods;
- defines performance limits and a range of performance classes. Colorimetric and retroreflective properties, as well as the luminance and illuminance, are specified;

The retroreflective requirements and tests in respect of materials based on glass bead technology are specified in this standard. The performance of retroreflective materials using microprismatic technology is specified in the relevant ETA which enables CE marking of such material.

Wind actions can be specified by the use of either values in this standard or by the methods specified in EN 1991-1-4.

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Structural requirements for signs complete with sign supports include performance under static and dynamic loading. Provision is made for safety in use, including vehicle impact.

1 Scope

This Part 1 of EN 12899 specifies requirements for complete sign assemblies (including supports), signs (sign plates with sign faces), sign plates (without sign faces) and for other major components (retroreflective sheeting, supports and luminaires).

The main intended use of fixed signs is for the instruction and guidance of road users on public and private land.

Matters not covered by this standard:

- a) sign gantry and cantilever structures;
- b) signs with discontinuous messages, e.g. using light emitting diodes (LED), or fibre optics;
- c) variable message signs;
- d) signs used for temporary purposes;
- e) foundations;
- f) tests for extremely low temperatures.

2 Normative references

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

EN 1011, *Welding - Recommendations for welding of metallic materials*

EN 1991-1-4, *Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions*

EN 1993-1-1, *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1995-1-1, *Eurocode 5: Design of timber structures - Part 1-1: General - Common rules and rules for buildings*

EN 1999-1-1, *Eurocode 9: Design of aluminium structures — Part 1-1: General rules – General rules and rules for buildings*

EN 10240, *Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants*

EN 12665:2002, *Light and lighting – Basic terms and criteria for specifying lighting requirements*

EN 12767, *Passive safety of support structures for road equipment - Requirements and test methods*

EN 12899-4, *Fixed vertical road traffic signs – Part 4: Factory production control*

EN 12899-5, *Fixed vertical road traffic signs – Part 5: Initial type testing*

EN 13032-1, *Light and lighting - Measurement and presentation of photometric data of lamps and luminaires – Part 1: Measurement and file format*

EN 13201-3, *Road lighting – Part 3: Calculation of performance*

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

EN ISO 139, *Textiles - Standard atmospheres for conditioning and testing (ISO 139:2005)*

EN ISO 877:1996, *Plastics - Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors (ISO 877:1994)*

EN ISO 1461 *Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods (ISO 1461:1999)*

EN ISO 4892-2, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

EN ISO 6272, *Paints and varnishes - Rapid-deformation (impact resistance) tests*

EN ISO 9001, - *Quality management systems - Requirements (ISO 9001:2000)*

ISO 4:1997, *Information and documentation — Rules for the abbreviation of title words and titles of publications*

CIE 15, *Colorimetry*

CIE 54.2, *Retroreflection – Definition and measurement*

CIE 74:1988, *Road signs*

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3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in ISO 4:1997 apply. The photometric terms and definitions given in EN 12665:2002 and the sign descriptions given in CIE 74:1988 also apply, together with the following. 5232661ef70e/sist-en-12899-1-2008

3.1

sign assembly

complete assembly including the sign plate, sign face material and supports

3.2

sign

sign plate with the sign face material applied

3.3

sign plate

fabrication comprising the substrate, reinforcing members and fixings

3.4

protective edge

fabrication intended to reinforce the edge of the sign and to reduce the severity of personal injury in the event of bodily impact with the sign edge

3.5

substrate

material used to support the sign face material

3.6

sign face material

material or materials applied to the substrate to produce the finished surface of the fixed sign

3.7

standard shape sign faces

circles, triangles, squares, diamonds and octagons containing legends in accordance with the provisions of the Vienna Convention

3.8

mounting height (*H*)

distance from ground level to the lower edge of the sign plate

3.9

support

component which supports the sign plate

3.10

temporary deflection

displacement of the structural component under load which returns to zero when the load is removed

3.11

permanent deflection

deflection which remains after the load is removed

3.12

production identification code

code defined by the manufacturer in order to achieve traceability

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4 Retroreflective sign face material

4.1 Glass bead material

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4.1.1 Visual performance

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4.1.1.1 Test conditions

Tests shall be carried out at a temperature of (23 ± 3) °C and a relative humidity of (50 ± 5) % unless otherwise specified.

4.1.1.2 Test samples

Tests shall be conducted on finished products, or on prepared samples representative of finished products and suitable for the test equipment.

Test samples and test panels shall be conditioned in accordance with EN ISO 139 and shall be identified on the back.

4.1.1.3 Daylight chromaticity and luminance factor

When tested in accordance with the relevant procedure specified in CIE 15, using CIE standard daylight illuminant D65 and the standard CIE 45/0 viewing conditions, the chromaticity and the luminance factor β shall conform to Table 1 or Table 2 as appropriate.

Table 1 — Daylight chromaticity and luminance factors. Class CR1

Colour	1		2		3		4		Luminance factor β	
	x	y	x	y	x	y	x	y	Table 3	Table 4
White	0,355	0,355	0,305	0,305	0,285	0,325	0,335	0,375	$\geq 0,35$	$\geq 0,27$
Yellow see Table 3	0,522	0,477	0,470	0,440	0,427	0,483	0,465	0,534	$\geq 0,27$	
Yellow see Table 4	0,545	0,454	0,487	0,423	0,427	0,483	0,465	0,534		$\geq 0,16$
Orange	0,610	0,390	0,535	0,375	0,506	0,404	0,570	0,429	$\geq 0,17$	$\geq 0,14$
Red	0,735	0,265	0,674	0,236	0,569	0,341	0,655	0,345	$\geq 0,05$	$\geq 0,03$
Blue	0,078	0,171	0,150	0,220	0,210	0,160	0,137	0,038	$\geq 0,01$	$\geq 0,01$
Green	0,007	0,703	0,248	0,409	0,177	0,362	0,026	0,399	$\geq 0,04$	$\geq 0,03$
Dark green	0,313	0,682	0,313	0,453	0,248	0,409	0,127	0,557	$0,01 \leq \beta \leq 0,07$	
Brown	0,455	0,397	0,523	0,429	0,479	0,373	0,558	0,394	$0,03 \leq \beta \leq 0,09$	
Grey	0,350	0,360	0,300	0,310	0,285	0,325	0,335	0,375	$0,12 \leq \beta \leq 0,18$	

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Table 2 — Daylight chromaticity and luminance factors. Class CR2

Colour	1		2		3		4		Luminance factor β	
	x	y	x	y	x	y	x	y	Table 3	Table 4
White	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	$\geq 0,35$	$\geq 0,27$
Yellow see Table 3	0,494	0,505	0,470	0,480	0,493	0,457	0,522	0,477	$\geq 0,27$	
Yellow see Table 4	0,494	0,505	0,470	0,480	0,513	0,437	0,545	0,454		$\geq 0,16$
Red	0,735	0,265	0,700	0,250	0,610	0,340	0,660	0,340	$\geq 0,05$	$\geq 0,03$
Blue see Table 3	0,130	0,086	0,160	0,086	0,160	0,120	0,130	0,120	$\geq 0,01$	
Blue see Table 4	0,130	0,090	0,160	0,090	0,160	0,140	0,130	0,140		$\geq 0,01$
Green see Table 3	0,110	0,415	0,150	0,415	0,150	0,455	0,110	0,455	$\geq 0,04$	
Green see Table 4	0,110	0,415	0,170	0,415	0,170	0,500	0,110	0,500		$\geq 0,03$
Dark green	0,190	0,580	0,190	0,520	0,230	0,580	0,230	0,520	$0,01 \leq \beta \leq 0,07$	
Brown	0,455	0,397	0,523	0,429	0,479	0,373	0,558	0,394	$0,03 \leq \beta \leq 0,09$	
Grey	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	$0,12 \leq \beta \leq 0,18$	

NOTE The limits specified in Table 1, with the exception of dark green, brown and grey, are recommended in CIE 39.2 as surface colours for visual signalling. When colours deteriorate beyond these chromaticity limits the signs can be unsuitable for the intended purpose. The chromaticity limits specified in Table 2 can ensure a more uniform appearance and consistency in the colour of new signs which are installed at different times than the limits specified in Table 1. Colours conforming to the limits of Table 2 can also be expected to take longer to deteriorate beyond the limits of Table 1.

4.1.1.4 Coefficient of retroreflection R_A

When measured in accordance with the procedure specified in CIE 54.2, using CIE standard illuminant A, the minimum initial coefficient of retroreflection R_A ($\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$) of retroreflective material, using glass bead technology, shall be not less than the values in Table 3 or Table 4, as appropriate.

The coefficient of retroreflection (R_A) of all printed colours, except white, shall be not less than 70 % of the values in Table 3 or Table 4 for Class RA1 and Class RA2 signs respectively.

Table 3 — Coefficient of retroreflection R_A Class RA1

unit: $\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$

Geometry of measurements		Colour							
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Green	Blue	Brown	Orange	Grey
12'	+5°	70	50	14,5	9	4	1	25	42
	+30°	30	22	6	3,5	1,7	0,3	10	18
	+40°	10	7	2	1,5	0,5	#	2,2	6
20'	+5°	50	35	10	7	2	0,6	20	30
	+30°	24	16	4	3	1	0,2	8	14,4
	+40°	9	6	1,8	1,2	#	#	2,2	5,4
2°	+5°	5	3	1	0,5	#	#	1,2	3
	+30°	2,5	1,5	0,5	0,3	#	#	0,5	1,5
	+40°	1,5	1,0	0,5	0,2	#	#	#	0,9
# Indicates "Value greater than zero but not significant or applicable".									

Table 4 — Coefficient of retroreflection R_A Class RA2unit: $\text{cd.lx}^{-1}.\text{m}^{-2}$

Geometry of measurements		Colour								
α	β_1 $\beta_2 = 0$	White	Yellow	Red	Green	Dark green	Blue	Brown	Orange	Grey
12'	+5°	250	170	45	45	20	20	12	100	125
	+30°	150	100	25	25	15	11	8,5	60	75
	+40°	110	70	15	12	6	8	5,0	29	55
20'	+5°	180	120	25	21	14	14	8	65	90
	+30°	100	70	14	12	11	8	5	40	50
	+40°	95	60	13	11	5	7	3	20	47
2°	+5°	5	3	1	0,5	0,5	0,2	0,2	1,5	2,5
	+30°	2,5	1,5	0,4	0,3	0,3	#	#	1	1,2
	+40°	1,5	1,0	0,3	0,2	0,2	#	#	#	0,7
# Indicates "Value greater than zero but not significant or applicable".										

4.1.1.5 Durability

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4.1.1.5.1 Resistance to weathering

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After weathering in accordance with 4.1.1.5.2 or 4.1.1.5.3, the following requirements shall apply.

The chromaticity and luminance factor of materials using glass beads technology shall conform to the requirements of 4.1.1.3 as appropriate.

When tested at an observation angle (α) of 20' and entrance angles ($\beta_1 = 5^\circ$ and 30° , with $\beta_2 = 0^\circ$) the coefficient of retroreflection shall be not less than 80 % of the values required in 4.1.1.4 as appropriate.

4.1.1.5.2 Accelerated natural weathering

Samples of material shall be exposed, inclined at an angle of 45° to the horizontal and facing the equator, in accordance with EN ISO 877:1996, Method A for three years.

4.1.1.5.3 Accelerated artificial weathering

The manufacturer may use accelerated artificial weathering to predict durability but testing shall be commenced by accelerated natural weathering not later than the start of the accelerated artificial weathering. The result of accelerated natural weathering shall take precedence over the result of accelerated artificial weathering.

The apparatus shall be either an air-cooled or water-cooled Xenon arc weathering device capable of exposing samples in accordance with EN ISO 4892-2.

Preparation of test specimens shall be in accordance with the general guideline given in EN ISO 4892-2.

The samples shall be exposed in accordance with EN ISO 4892-2 using the parameters given in Table 5, for a period of 2000 h.

Table 5 — Artificial weathering test parameters

Exposure parameters	Air-cooled lamp	Water-cooled lamp
Light/dark/water spray cycle	Continuous light with water spray on specimens for 18 min every 2 h	Continuous light with water spray on specimens for 18 min every 2 h
Black standard temperature during light only periods	(65 ± 3) °C using a black standard thermometer	(65 ± 3) °C using a black standard thermometer
Relative humidity	(50 ± 5) %	(50 ± 5) %
Irradiance (W/m ²) controlled at — over 300 nm to 400 nm range — over 300 nm to 800 nm range	60 550	60 630
NOTE 1 Water used for specimen spray should contain no more than 1 ppm silica. Higher levels of silica can produce spotting on samples and variability in results. Water of the required purity can be obtained by distillation or by a combination of deionization and reverse osmosis.		
NOTE 2 Whilst irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will generally mean that irradiance error will be in the order of ± 10 %.		

4.1.2 Impact resistance

When tested in accordance with EN ISO 6272, using a mass of 450 g with a contact radius of 50 mm dropped from a height of 220 mm, there shall be no cracking or, for sign face sheeting material, delamination from any substrate, outside a circle of 6 mm radius with the point of impact as the centre.

The test sign shall be supported as it would be when installed, or the test sample shall be supported over an open area of 100 mm x 100 mm.

4.2 Microprismatic material

The performance of retroreflective materials using microprismatic technology can be found in the relevant European Technical Approval (ETA). The manufacturer shall obtain the performance specifications from the purchaser.

NOTE The testing procedure for retroreflective materials using microprismatic technology can be found in the relevant European Technical Approval (ETA).

5 Structural performance

5.1 General

Steel constructions and steel mounting elements shall conform to EN 1993-1-1.

Aluminium constructions shall conform to EN 1999-1-1.

Timber constructions shall conform to EN 1995-1-1.

Welded fabrications shall conform to EN 1011, as appropriate.

Other materials are acceptable but if they are used they shall enable conformity to this standard.

All components and assemblies shall withstand dead and live loading, multiplied by the appropriate partial safety factor from 5.2.

Verification of performance may either be by calculation or by testing.

When verification of performance is to be by calculation, the structural performance of signs and their supports and fixings shall be calculated in accordance with 5.4.3.

When verification of performance is to be done by testing, tests shall be made in accordance with 5.4.4. The deflections to be calculated shall be those between the sign and support, or between the supports and the foundations.

The deflections of sign plates are evaluated relative to the supports. The deflections of supports are evaluated separately, except in the case of large supporting structures such as sign gantries, the deflections of which are not considered as they are outside the scope of this document.

When supports are to be supplied for stock, or otherwise where the conditions of use are not known at the time of manufacture of the support, the support manufacturer shall supply information on the structural performance of the support to enable the structural performance of the complete assembly to be calculated. The structural information to be provided shall be:

either

(a) for supports of constant cross-section:

- maximum bending moment M_u (kNm);
- stiffness for bending EI (kNm²);
- maximum moment for torsion T_u (kNm);
- stiffness for torsion G_t (kN·m²);

NOTE 1 EI = modulus of elasticity x moment of inertia.

NOTE 2 G_t = shear modulus x torsion constant.

For a non-constant cross-section, equivalent values shall be given related to the actual length of the support.

or (b) the type and grade of material and all the dimensions;

or (c) verification of conformity to a purchaser's prescriptive specification for materials and dimensions.

Information to be provided in case (a) may be obtained by calculation in accordance with 5.4.3 or by physical testing in accordance with 5.4.4. The criterion for the maximum bending moment M_u and the maximum moment for torsion T_u shall be as 5.4.4.4.

The declared maximum bending moment shall be given at the designed ground level. If the weakest point is other than at ground level the equivalent value at ground level shall be given.

Any other relevant information shall be given as part of the manufacturer's supporting data, e.g. details and strength of fixings integral to the supports.

NOTE 3 Case (b) can be adequate for supports of simple construction, for instance comprising a standard metal tube of any standard cross-sectional shape.