SLOVENSKI STANDARD
oSIST prEN 1871:2009

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Materiali za oznaḍ evanje voziḡḍ a - Barve, hladna plastika in vroḍ a plastika - Fizikalne lastnosti

Road marking materials - Paint, cold plastic and thermoplastic marking materials - Physical properties

Straßenmarkierungsmaterialien - Markierungsfarben, Kaltplastikmassen und Heißplastikmassen - Physikalische Eigenschaften

Produits de marquage routier - Peintures, enduits à froid et à chaud - Propriétés physiques

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Road marking materials - Paint, cold plastic and thermoplastic marking materials - Physical properties

Produits de marquage routier - Peintures, enduits à froid et à chaud - Propriétés physiques

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 226.

If this draft becomes a European Standard, 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.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (prEN 1871:2008) has been prepared by Technical Committee CEN/TC 226 “Road equipment”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1871:2000.

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 EC Directive(s).

For relationship with the Construction Product Directive (89/106/EEC), see informative Annex ZA, which is an integral part of this document.

The annexes A, B, C, D, E, F, G, H, J K and L of this European Standard are normative.

Introduction

This European Standard gives the physical properties of paint, cold plastic and thermoplastic road marking materials used in horizontal signalization. It includes Annexes for test methods. Identification requirements are covered in prEN 12802.

1 Scope

This European Standard specifies the laboratory requirements and test methods for paint, cold plastic and thermoplastic road marking materials, both permanent and temporary.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1436, *Road marking materials – Road marking performance for road users*

EN 12802, *Road marking materials – Laboratory methods for identification*

EN 13459-1, *Road marking materials – Quality control – Part 1: Sampling from storage and testing*

ISO 787-11, *General methods of test for pigments and extenders – Part 11: Determination of tamped volume and apparent density after tamping*

ISO 1514, *Paints and varnishes - Standard panels for testing*

ISO 2812-1, *Paints and varnishes. Determination of resistance to liquids. General methods.*

ISO 4892, *Plastics – Methods of exposure to laboratory light sources - Part 1: General guidance*

ISO 4892, *Plastics – Methods of exposure to laboratory light sources - Part 2: Xenon-arc sources*

ISO 4892, *Plastics – Methods of exposure to laboratory light sources - Part 3: Fluorescent UV lamps*

ISO 7724-2, *Paints and varnishes – Colorimetry – Part 2 : Colour measurement*

3 Terms and definitions

For the purposes of this standard the following terms and definitions applies.

3.1
paints
a liquid product containing suspended solids. It can be supplied in single or multicomponent systems. When applied it produces a cohesive film by the process of solvent evaporation, or solvent evaporation and a chemical reaction.

3.1.1
solvent Paints
solvent paints are liquid products containing solids and liquid additives suspended in an organic solvent. They can be supplied in single or multi-component systems. The solids comprise are inorganic and/or organic fillers, pigments and additives.

3.1.1.1
High Solid paints (HS)
High Solid paints are liquid products containing solids and liquid additives suspended in a solution of the binder in an organic solvent. The content of solvents is limited to 25% weight by weight.

3.1.1.2
single-Component-High Solid paints (SCHS)
the cohesive film of a single-component High Solid is formed only by evaporation of the solvent and physical curing.

3.1.1.3
multi-Component-High Solid paints (MCHS)
multi-component-High Solid paints consist of two or more components. The cohesive film is formed after mixing all components by the evaporation of the solvent and a chemical reaction. The Application is possible within the pot-life-time.

3.1.2
waterborne Paints
a liquid product containing suspended solids in an aqueous liquid. It can be supplied in single or multicomponent systems. When applied it produces a cohesive film by the process of aqueous liquid evaporation and /or chemical process

3.1.2.1
dispersions
dispersions are liquid or viscous products containing solids and liquid additives dispersed in an aqueous liquid. The aqueous liquid consists of the binder polymers and mainly of water. The solids comprise inorganic and/or organic fillers, pigments and additives. The content of volatile organic solvents is limited to 2 % weight by weight, the total amount of volatile organic compounds (VOC) is limited to 3 % weight by weight.

3.1.2.2
dispersion paints
the volatile component is mainly water. The content of organic solvents is limited to 2 % weight by weight, the total amount of volatile organic compounds (VOC) is limited to 3 % weight by weight.
The solid content is lower than 80 % weight by weight. The cohesive film of a Dispersion paint is produced by the process of water evaporation.

3.1.2.3
high solid dispersions:
the volatile component of a High solid dispersion is mainly water with a content lower than 20 % weight by weight, the content of solids is equal to or higher than 80 % weight by weight. The content of organic solvents is limited to 2 % weight by weight, the total amount of volatile organic compounds (VOC) is limited to 3 % weight by weight. The cohesive film of a High-Solid dispersion is produced by the process of water evaporation and a chemical cross-linking reaction.

3.2
cold plastics
cold plastics are viscous products supplied in two or multi-component forms (at least one main component and a hardener system). They are free from solvents. The cohesive film is formed after mixing of all components only by a chemical reaction. Following the reaction the liquid becomes a solid.

3.2.1
cold-Setting Reactive Materials (cold plastics)
cold plastics consist of a minimum of two components. One component contains a hardener and another component the accelerator. Depending on the system the components are mixed in various ratios. The application is only possible within the pot-life-time.

3.2.2
energy Induced Curing Materials (EICM)
ernergy induced curing materials produce a cohesive film under the influence of energy (e.c. heat, UV-radiation).

3.3
thermoplastics
a solvent-free marking substance supplied in block, granular or powder forms. It is heated to a molten state and then applied. It forms a cohesive film by cooling.

NOTE Additional materials to those described in 3.1 to 3.3 can include, if recommended by the manufacturer, primers which are liquid products which may contain solids and liquid additives suspended in an organic solvent or in water. The solids comprise inorganic and/or organic fillers, pigments and additives. The content of volatile organic solvents is not limited. Primers are used to precoat road surfaces before the road marking system is applied. They improve the adhesion of the road marking and protect against disintegration, discolouring etc. caused by incompatible compounds in the road surface.

4 Requirements

Samples representative of each component of the material shall be taken from storage in accordance with ENV 13459-1.

The requirements and standard test methods are described in 4.1 to 4.3.

Alternative test methods may be used providing that:

- the resulting values are comparable to those obtained using the standard methods; and,
- the repeatability of the alternative methods, determined in accordance with ISO 5725-2, can be shown to be not less than that of the methods given in this standard.

4.1 Paint

4.1.1 Chromaticity co-ordinates and luminance factor.

The daytime visibility of road marking paint shall be defined by the luminance factor β. The colour shall be defined by *x,y* chromaticity co-ordinates of the CIE standard system when measured in accordance with the method specified in EN 1436

Panels shall be prepared and measurements carried out according to Annex A. For the luminance factor the classes in Table 1a shall apply. The chromaticity co-ordinates are confined by specified regions in the *x,y* colour diagram by means of the corner points shown in Table 1b.

Table 1a - Classes of luminance factor

Colour	Class	Luminance factor β
White	LF5 LF6 LF7	≥ 0,75 ≥ 0,80 ≥ 0,85
Yellow	LF1 LF2	≥ 0,40 ≥ 0,50

Table 1b - Chromaticity co-ordinates of white and yellow road marking products

Corner point N°		1	2	3	4
White	*x*	0,355	0,305	0,285	0,335
	y	0,355	0,305	0,325	0,375
Yellow	*x*	0,494	0,545	0,465	0,427
	y	0,427	0,455	0,535	0,483

4.1.2 Hiding power

When tested in accordance with Annex B, and applied at a wet dosage of 200g/m2, the contrast ratio (hiding power) for white and yellow paints shall comply with the classes as given in Table 2.

Table 2 - Classes of hiding power

Colour	Class	Hiding Power
White	HP0	No requirement
	HP2	≥ 90%
	HP3	≥ 92%
	HP4	≥ 95%
Yellow	HP0	No requirement
	HP1	≥ 88%
	HP2	≥ 90%

4.1.3 Storage stability

The paint shall be free from skin and settlement that cannot be re-incorporated by stirring. The paint shall have a rating equal to or above 4 when tested in accordance with Annex C.

The components of multicomponent paint shall each be tested separately in different containers.

4.1.4. UV ageing

4.1.4.1 General

The paint shall be applied as in A.3 to panels as described in A.2 and tested in accordance with ISO 4892-3 by either of the two test procedures described in 4.1.4.2 and 4.1.4.3. The difference in luminance factor $\Delta\beta$ shall be as in Table 3 (where $\Delta\beta$ = original luminance factor – luminance factor after test). The chromaticity co-ordinates shall be as given in Table 1b.

4.1.4.2 UV

The specimens shall be tested in accordance with ISO 4892-3 for 168 h under lamp type II (UVB - 313) in cycles of 8 h of radiation at 60 °C ± 2 °C and 4 h of condensation at 50 °C ± 2 °C.

Table 3 - Classes of difference in luminance factor after UV ageing

Colour	Class	$\Delta\beta$
White and Yellow	UV0 UV1 UV2	No requirement ≤ 0,05 ≤ 0,10

4.1.5 Bleed resistance

When tested in accordance with Annex D the difference in luminance factor $\Delta\beta$ shall be as in Table 4. The chromaticity co-ordinates shall be as in Table 1b.

NOTE This test is only applicable for paint which is to be applied directly to asphaltic surfaces.

Table 4 - Classes of difference in luminance factor after bleed resistance test

Colour	Class	$\Delta\beta$
White and Yellow	BR0 BR1 BR2	No requirement ≤ 0,03 ≤ 0,05

4.1.6 Alkali resistance

When tested in accordance with Annex ~~D~~ E the paint film shall show no deterioration of the surface.

NOTE This test is only applicable for paint which is to be applied directly to hydraulic concrete surfaces.

4.2 Thermoplastics

The materials shall be melted according to the manufacturers recommendations. If nothing is stated follow Annex H. For tests after heat stability Annex H shall be followed.

4.2.1 Tests before heat stability test

4.2.1.1 Chromaticity co-ordinates and luminance factor

When tested in accordance with Annex F the luminance factor shall be given as in Table 5 and the chromaticity co-ordinates as in Table 1b.

Table 5 - Classes of luminance factor for thermoplastics and cold plastics

Colour	Class	Luminance factor β
White	LF3 LF4 LF5 LF6	≥ 0,65 ≥ 0,70 ≥ 0,75 ≥ 0,80
Yellow	LF1 LF2	≥ 0,40 ≥ 0,50

4.2.1.2 Softening point

When tested in accordance with Annex G the softening point of the material shall comply with the classes as given in Table 6.

Table 6 - Classes of softening point for thermoplastics

Class	Softening point in °C
SP0	No requirement
SP1	≥ 65
SP2	≥ 80
SP3	≥ 95
SP4	≥ 110

4.2.1.3 Alkali resistance

When tested in accordance with Annex E the specimen shall show no deterioration of the surface.

NOTE : This test is only applicable for thermoplastics which are to be applied directly to hydraulic concrete surfaces.

4.2.1.4 Cold impact

When tested in accordance with Annex J the number of specimens passing the test shall comply with the classes as given in Table 7.

Table 7 - Classes for cold impact

Class	Temperature of test in °C	Ball	Number of specimens passing
Cl 0	No requirement		No requirement
Cl 1	0	a	6
Cl 2	-10 ± 3	a	6
Cl 3	-10 ± 3	b	6

4.2.1.5 UV ageing

The material shall be applied at the manufacturer's stated thickness to panels as described in A.2 and tested in accordance with ISO 4892-3 and as described in 4.1.4.2. The difference in luminance factor $\Delta\beta$ shall comply with the classes as in Table 3. The chromaticity co-ordinates shall be as given in Table 1b.

4.2.2 Heat stability

The heat stability of the product shall be tested in accordance with Annex H and the tests specified in 4.2.3 shall be subsequently carried out.

4.2.3 Tests after heat stability test

4.2.3.1 Chromaticity co-ordinates and luminance factor

When tested in accordance with Annex F the difference in luminance factor $\Delta\beta$ shall be no more than 0,10 for both white and yellow. The chromaticity co-ordinates shall be as given in Table 1b.

4.2.3.2 Softening point

When tested in accordance with Annex G the difference in softening point ΔSP shall not be more than ± 10 °C.

4.2.3.3 Indentation

When tested in accordance with Annex K the mean value for the indentation time shall comply with the classes as given in Table 8.

Table 8 - Classes for indentation

Class	Indentation time
IN0	No requirement
IN1	5 s to 45 s
IN2	46 s to 2 min
IN3	2 min 1 s to 5 min
IN4	5 min 1 s to 20 min
IN5	> 20 min

4.2.2.4 Tröger wear

When tested in accordance with Annex L the mean value for volume loss shall comply with the classes as given in Table 9.

Table 9 - Classes for Tröger wear

Class	Volume loss in cm^3 3 mm thick/16 periods	Volume loss in cm^3 1,5 mm thick/5 periods
TW0	No requirement	No requirement
TW1	< 2,5	-
TW2	2,5 to 5	-
TW3	-	< 1,5
TW4	-	1,5 to 3

4.2.3.5 UV ageing (Xenon arc)

The material shall be applied at the manufacturer's stated thickness to panels as described in A.2 or Marshall specimens as described in K.3.2 and tested in accordance with ISO 4892-2. The difference in luminance factor $\Delta\beta$ shall comply with the classes as given in Table 3. The chromaticity co-ordinates shall be as given in Table 1b.

The UV test is performed for 1 000 h in either sprayed or flooded cycles of 18 min duration and with dry intervals of 102 min. Relative humidity shall be 50 %, black standard temperature 45 °C, and irradiation (between 290 nm and 800 nm) 550 W/m^2. The Marshall test specimens shall be placed horizontally in the equipment.

NOTE Equipment that can be used for the UV test on Marshall test specimens are Xeno test 250, Sun test or Sun test CPS+.

4.2.3.6 Tröger wear (after UV ageing)

When tested in accordance with ISO 4892-2 and Annex L the mean values for the difference in volume loss shall comply with the classes as given in Table 10.

Table 10 - Classes for Tröger wear after UV ageing

Class	Difference in volume loss in cm^3
TWU0	No requirement
TWU1	0 to < 0,5
TWU2	0,5 to 2,5

4.3 Cold plastics

4.3.1 General

For each of the tests at least 500 g of material shall be prepared in the specified manner.

4.3.2 Chromaticity co-ordinates and luminance factor

When applied at the manufacturer's stated thickness and tested in accordance with Annex A the luminance factor shall be as given in Table 5 and the chromaticity co-ordinates as in Table 1b.

4.3.3 Storage stability

The material shall be free from skin and settlement that cannot be incorporated by stirring. The cold plastics shall have a rating equal to or above 3 when tested in accordance with Annex C.
The components of cold plastics shall each be tested separately in different containers.

NOTE See C.3.2 for components containing peroxides.

4.3.4 UV ageing

The material shall be applied at the manufacturer's stated thickness to panels as described in A.2 and tested in accordance with ISO 4892-3 as described in 4.1.4.2. The difference in luminance factor $\Delta\beta$ shall comply with the classes as given in Table 3. The chromaticity co-ordinates shall be as given in Table 1b.

4.3.5 Alkali resistance

When tested in accordance with Annex ~~D~~ E the specimen shall show no deterioration of the surface.

NOTE : This test is only applicable for cold plastics which are to be applied directly to hydraulic concrete surfaces.

4.3.6 Tröger wear

When tested in accordance with Annex ~~K~~ L the mean value for volume loss shall comply with the classes as given in Table 9.

4.3.7 Tröger wear after UV ageing

When tested in accordance with ISO 4892-2 and Annex ~~K~~ L the mean value for the difference in volume loss shall comply with the classes as given in Table 10.

5 Evaluation of conformity

5.1 General

The compliance of road marking materials with the requirements of this document and with the stated values shall be demonstrated by:

- initial type testing;
- factory production control;

5.2 Type testing

5.2.1 Initial type testing (I.T.T.)

Initial type testing shall be carried out in accordance with Annex M.

A base road marking material may be used in a number of different road marking assemblies – see Annex M.

If the ITT is the responsibility of a certification body,

- the certification body is responsible for the sampling for the initial type test of the product;
- the certification body checks if the initial type test is carried out according to the provisions of this standard;
- Tests included in Annex M previously performed in accordance with the provisions of this standard (same product, same characteristic(s), test method, sampling procedure, system of attestations of conformity, etc...) can be taken into account if the certification body (decision of the certification body) can check that
    - the laboratory, which carried out the initial type test of the product has the necessary competence and independence;
    - the samples which were tested are representative for the product for which the ITT is required;
    - the tests were carried out according to the provisions of this product standard.

5.2.2 Further type testing

Whenever a change occurs in the base materials, or in the production process, or to an assembly, which would change significantly one or more of the characteristics, the type testing shall be repeated for the appropriate characteristic(s). If the ITT is the responsibility of a certification body, the manufacturer shall declare such changes and the certification body shall decide for which characteristic(s) the ITT shall be repeated.

5.2.3 Sampling, testing and compliance criteria

Sampling shall be carried out in accordance with EN 13459.

The results of all type tests (initial and further testing) shall be recorded and held by the manufacturer and be available for inspection.

5.3 Factory production control (FPC)

The FPC shall be carried out in accordance with EN 13212.

5.4 Inspection of the factory production control

When required, inspection of the factory and of the factory production control shall be made on the provisions contained in EN 13212 and this clause.

5.4.1 Initial inspection of the factory and the factory production control

The initial inspection shall:

- Check that the producer's FPC system complies with all the requirements of the product standard.
- Visit the production unit, review the resources and check the practical application of the system of Factory Production Control.

The certification body shall verify whether all requirements of EN 13212 have been dealt with appropriately in the production control manual and related documents. If this is not the case the certification body will inform the producer of the non-compliances found and request corrective action, including an updated version of the documents if necessary.

During the initial inspection the certification body will investigate whether the documented system is implemented in accordance with the requirements of EN 13212. Items found not to be in compliance are classified as either observations, remarks or non-conformities. These will all be reported to the producer at the end of the initial inspection.

The initial type testing (ITT) is not part of the FPC, but has to be carried out in accordance with the test methods and systems of attestation of conformity described in this standard.

Test results from the FPC shall comply with the requirements of the appropriate part of EN 13212 and the product specification (manufacturer's stated values as referred to in clause ZA.1 of Annex ZA of the relevant product standard). The manufacturer's stated values and a procedure for the evaluation of the test results shall therefore be part of the FPC-system.

Results of production control tests of the road marking materials relating to this product standard shall be available at the time of the initial inspection.

Even if one FPC system is used for different production units on one or different sites, all means of production on all sites have to be visited.

In case of an FPC system conforming with the requirements of EN-ISO 9001, it is the task of the certification body to verify that the quality system meets the requirements of this product standard and EN 13212, and to verify the effective implementation. If the result of those verifications is positive, the FPC system shall be considered to satisfy the above requirements.

5.4.2 Continual surveillance of the factory and the factory production control

The Factory Production Control system shall be subject to surveillance as set out below.

An audit of the Factory Production Control system, including an inspection of the production unit, at a minimum frequency of at least once per year.

Reviews of relevant quality complaints are to be covered as part of the routine audit.

An assessment that any modifications to the Factory Production Control system are in accordance with this European Standard.

Checks on the proper use of product labelling and documentation.

The certification body exercises the surveillance of the FPC on the basis of the requirements of this standard and EN 13212 and on the basis of the initial inspection of the factory and FPC.

The producer is required to have informed the certification body of any changes in the FPC, including modifications to the factory. Failure to do so may result in a non-compliance being raised by the certification body.

It will be the decision of the certification body whether or not a further inspection visit is necessary at the time of the announcement of any such changes.
The certification body shall inform the producer about the results of all continuous surveillance visits and shall also inform the producer of any non-compliances (observations, remarks or non-conformities) it has raised.

The certification body may decide to carry out further visits if serious deficiencies in the FPC are identified.

Where non-compliance is identified, it is the responsibility of the producer to investigate the cause of the problem and report to the certification body effective corrective action measures appropriate to the nature of the non-compliance raised.

In the case of non-implementation of suitable corrective action or continuing non-compliance (non-conformities), the certification body shall advise the producer of the action it intends to take.

Even if one FPC system is used for different production units on one or different sites, all means of production on all sites have to be visited.

In case of an FPC system conforming with the requirements of EN-ISO 9001, it is the task of the certification body to verify that the quality system meets the requirements of this product standard and EN 13212, and to verify the effective implementation. If the result of those verifications is positive, the FPC system shall be considered to satisfy the above requirements.