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Road marking materials - Requirements for factory production control

Produits de marquage routier - Exigences pour le contrôle de la production en usine

Straßenmarkierungsmaterialien - Anforderungen an die werkseigene Produktionskontrolle

This European Standard was approved by CEN on 22 April 2011.

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Foreword

This document (EN 13212:2011) 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of an identical text or by endorsement, at the latest by December 2011, and conflicting national standards shall be withdrawn at the latest by December 2011.

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.

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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, Croatia, 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 the United Kingdom.

The Annex A of this European Standard is normative.

This European Standard is one of a package of inter-related European Standards with a common date of withdrawal (dow) fixed on December 2011 (*including the request of an extension for the co-existence period*):

- EN 1790, *Road marking materials — Preformed road markings*,
- EN 1824, *Road marking materials — Road trials*,
- EN 1871, *Road marking materials — Paint, thermoplastic and cold plastic materials - Specifications*,
- EN 12802, *Road marking materials — Laboratory methods for identification*,
- EN 13197, *Road marking materials — Wear simulator Turntable*,
- EN 13212, *Road marking materials — Requirements for factory production control*,
- EN 13459, *Road marking materials — Sampling and testing*.

1 Scope

This document gives the requirements for factory production control (FPC) for the manufacturer of road marking materials

This document specifies which types of test have to be taken into consideration within the FPC but it leaves the precise methods to be applied to be dependent on the characteristics of the manufacturer's installation and production methods. The precise parameters and methods will be found in the written procedures agreed between the manufacturer and the third party responsible for the initial assessment of the FPC.

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 1423, *Road marking materials — Drop on materials — Glass beads, antiskid aggregates and mixtures of the two*

EN 1424, *Road marking materials — Premix glass beads*

EN 1463 (all parts), *Road marking materials — Retroreflecting road studs*

EN 1790, *Road marking materials — Preformed road markings*

EN 1871, *Road marking materials — Paint, thermoplastic and cold plastic materials — Specifications*

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

EN ISO 9001:2008, *Quality management systems — Requirements (ISO 9001:2008)*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

3 Terms and definitions

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

3.1

retained sample

sample, labelled and stored for some period of time, to be used in case additional testing or verification is needed

3.2

batch

amount of product produced as one complete operation not being part of a continuous process

3.3

factory production control (FPC)

permanent internal control of production exercised by the product manufacturer

3.4

factory

single site of production consisting of one or more production lines where raw materials are converted into final products

4 General requirements for factory production control (FPC)

4.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform to the declared performance characteristics. The FPC system shall consist of written procedures (works' manual), 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. Records shall remain legible, readily identifiable and retrievable for the period defined in the manufacturer's written procedures.

The manufacturer shall be responsible for organizing the effective implementation of the FPC system. Tasks and responsibilities shall be documented and this documentation shall be kept up-to-date.

In each factory, the manufacturer may delegate the action to a person who shall have the necessary authority to:

- identify procedures to demonstrate conformity of the product at appropriate stages;
- identify and record any instance of non-conformity;
- identify procedures to correct instances of non-conformity.

The manufacturer shall establish procedures to ensure that the production tolerances allow for the product performances to be in conformity with the declared values, derived from initial type testing.

The procedures shall be chosen in the interests of ensuring that the level of confidence obtained by the production control is effectively the same for all conceivable situations of manufacture.

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

The manufacturer shall implement these procedures and instructions and record the operations and results. The results shall be used to correct the effects of any deviations and, where necessary, treat any resulting non-conformity and, if required, to revise the FPC system to rectify the cause of non-conformity.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer's FPC procedures.

A complaint register shall contain a short chronological view of the received complaints concerning the products covered by this FPC, identifying the source of complaint, its content and its follow-up.

The complaint register shall contain the additional documents relating to the treatment of the complaint.

The FPC system shall at least include the necessary procedures for:

- records and treatment of non-conformity;
- personnel;
- installations and equipment;
- raw materials;
- manufacturing process;
- conformity control;

- packaging, labelling, handling and storage;
- final testing.

An FPC system conforming to the requirements of EN ISO 9001, and made specific to the requirements of the specific product standard and this document shall be considered to satisfy the above requirements.

4.2 System requirements

4.2.1 Personnel

The responsibility, authority and the relationship between personnel that manages, performs or verifies work affecting product conformity, shall be defined. This applies in particular to personnel that need to initiate actions preventing product non-conformities from occurring, actions in case of non-conformities and to identify and register product conformity problems. Personnel performing work affecting product conformity (e.g. operator, sample taking, lab-assistant, warehouse manager...) shall be competent on the basis of appropriate education, training, skills and experience for which records shall be maintained.

4.2.2 Installations and equipment

All weighting, measuring and testing equipment necessary to achieve, or produce evidence of conformity shall be calibrated or verified and regularly inspected according to documented procedures, frequencies and criteria. Control of monitoring and measuring devices shall comply with the appropriate clause of EN ISO 9001.

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.

The manufacturer shall have a scheme or a flow sheet of the plant equipment, resuming the whole production process, from the incoming of the raw material to the storage of the products. This document is the basis for the documentation of the manufacturing processes (see 4.2.4).

4.2.3 Raw materials

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their conformity. The verification of conformity of the raw material with the specification shall be in accordance with EN ISO 9001:2008, 7.4.3.

The manufacturer shall prepare and keep up-to-date documented procedures and instructions for:

- the use of the relevant materials from "approved suppliers";
- the conformity control and testing of raw materials: cullets (glass composition), binder, pigment, fillers, solvent, additive, premix glass beads;
- drop-on antiskid aggregates (also used in mixtures with glass beads) may be either CE-marked products or they shall be tested by the manufacturer as in 4.3.2.4 (acting as a user).

4.2.4 Design process

The FPC system shall document the various stages in the design of products; identify the checking procedure and those individuals responsible for all stages of design.

During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily. Compliance with EN ISO 9001:2008, 7.3 shall be deemed to satisfy the requirements of this sub-clause.

The manufacturing process shall be documented. Processes may also be shown by flowcharts indicating related documents and responsibilities (see also 4.2.3). Processes which are covered by this document and undertaken by subcontractors shall be documented by the manufacturer or the subcontractor as if done on the site of the manufacturer.

4.2.5 Production control

The manufacturer shall plan and carry out production under controlled conditions. Compliance with EN ISO 9001:2008, 7.5.1 and 7.5.2 shall be deemed to satisfy the requirements of this subclause.

The manufacturer shall have a FPC system in order to ensure that all manufactured products fulfil the relevant requirements of the concerned product standard.

The test methods to be applied and the tolerances for the results of all the tests used shall be specified in the FPC system of the manufacturer.

The minimum frequency of final testing for each product shall be as in 4.3.2.

The laboratory for internal control shall have the measuring and test equipments necessary to carry out the tests required by this document and the product standard.

The manufacturer may call upon measuring and test equipment from an external laboratory. The mutual obligations of the manufacturer and the external laboratory for the internal control shall be defined in a written agreement.

The appropriate calibrations shall be carried out on defined measuring and testing equipment.

If products have been delivered before all the results of testing are available, a procedure and records shall be maintained for notifying customers in the event of non conforming products.

Test results on products shall be kept for a period of 5 years.

4.2.6 Test sample

The test samples shall be representative of the product. If the product standard specifies the rules for sampling, these rules shall be followed or the equivalence of an alternative method shall be demonstrated.

4.2.7 Reference sample

When the final testing is successful a sample shall be labelled and stored as a retained sample for the period defined in the manufacturer's written procedures.

The minimum quantities for the retained samples shall be as given in Table 1.

Table 1 – Minimum quantities for reference samples

Product	Reference sample
Paint	0,5 l
Thermoplastic (preformed or not)	1 kg
Cold plastic	the necessary quantity of each of the components in order to make at least 0,5 l of the final mix
Drop-on and premix glass beads	0,25 kg
Antiskid aggregates	1 kg
Mixtures of glass beads and antiskid aggregates	0,25 kg
Preformed road marking (all other types)	0,15 m ²
Road studs	3 studs

4.2.8 Packaging, labelling, handling and storage

Individual products batches 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. Compliance with EN ISO 9001:2008, 7.5.3 shall be deemed to satisfy the requirements of this sub-clause.

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

The identification of stored and delivered products shall provide the necessary information for traceability, including trade name, batch numbers, date of production and date of end of use. In case of delivery in bulk, the system shall provide a suitable method for traceability.

The manufacturer shall follow all requirements for the labelling described in the product standard of each material and, if any, in the Annex ZA concerning this product.

4.2.9 Records and treatment of non-conformity

The records shall include everything that is necessary to ensure the traceability and all results of tests executed to control the raw materials, to control the production process and the product. Traceability shall include the recording of to whom products or batches were first sold.

Records shall include at least the following information:

- identification of the product tested;
- date of sampling and testing;
- test methods performed;
- test results etc.

The manufacturer shall have written procedures (including a recall procedure) which specify how non-conforming 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. Compliance with EN ISO 9001:2008, 8.3 shall be deemed to satisfy the requirements of this subclause.

If the result of any test shows that the product does not meet the declared performance, the necessary corrective action shall be taken. Products or batches not conforming to declared performance shall be isolated and properly identified.

If the non-conformity can be corrected, the necessary verification of conformity shall be repeated once the non-conformity has been corrected.

4.2.10 Corrective action

The manufacturer shall have documented procedures that instigate action to eliminate the cause of non-conformities in order to prevent recurrence. Compliance with EN ISO 9001:2008, 8.5.2 shall be deemed to satisfy the requirements of this sub-clause.

4.3 Final testing

4.3.1 General

The minimum frequency of final testing for each product and evaluation as part of FPC shall be as 4.3.2.

4.3.2 Specific requirements

4.3.2.1 General

Where applicable, test methods, threshold values and tolerances shall be taken from the concerned product standard or in EN 12802.

Alternative quantitative analytical 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.

4.3.2.2 Paint (EN 1871)

The final conformity testing shall be as given in Table 2.

Table 2 – Paint FPC final testing minimum frequency

Property	Minimum frequency of tests
Viscosity	every batch
Density	every batch
Solid content or Ash content	every batch

4.3.2.3 Thermoplastics (EN 1871)

The final conformity testing shall be as given in Table 3.

Table 3 – Thermoplastics FPC final testing minimum frequency

Property (before heat stability test)	Minimum frequency of tests
Softening point or indentation	At least once a day for each product
Binder content or ash content	At least once a day for each product
Colour and luminance factor (x,y; β)	At least once a day for each product

4.3.2.4 Cold plastics (EN 1871)

- a) The final conformity testing shall be as given in Table 4 on each liquid component.

Table 4 – Cold plastics FPC final testing minimum frequency

Property	Minimum frequency of tests
Density	every batch
Viscosity	every batch
Binder content or ash content	every batch

Some components can deteriorate over a period of time.

Care shall be taken over the length of the storage.

- b) The final conformity testing shall be as given in Table 5 on the final product (mix).

Table 5 – FPC final testing minimum frequency on cold plastics

Property	Minimum frequency of tests
Colour and luminance factor (x,y; β)	every batch

4.3.2.5 Drop-on materials and premix glass beads (EN 1423 and EN 1424)

- a) The final conformity testing shall be as given in Table 6 for a representative sample of drop-on or premix glass beads.

Table 6 – FPC final testing minimum frequency of drop-on and premix glass beads

Property	Minimum frequency of tests
Granulometry	Every batch but at least every 5 000 kg
Quality (defective beads)	Every batch but at least every 5 000 kg
Refractive index (except for class A glass beads)	Every batch but at least every 5 000 kg
Surface treatment	Every batch but at least every 5 000 kg
Dangerous elements (Pb, As, Sb)	Every 1 000 t but at least once a month

- b) The final conformity testing shall be as given in Table 7 for a representative sample of anti-skid aggregates.

Table 7 – Anti-skid aggregates FPC final testing minimum frequency

Property	Minimum frequency of tests
Colour and luminance factor (whiteness of non transparent materials)	every delivery (for user) or every 10 000 kg (for manufacturer)
Granulometry	every delivery (for user) or every 10 000 kg (for manufacturer)
Friability index	every delivery (for user) or every 20 000 kg (for manufacturer)

- c) Mixtures of glass beads and antiskid aggregates.

The manufacturer of such mixtures shall keep, for every final batch, the different exact quantities (in kg) of glass beads and (the different types of) antiskid aggregates mixed together.

The manufacturer shall also keep a representative sample of every batch of mixture of glass beads and antiskid aggregates.

4.3.2.6 Preformed road markings (EN 1790)

4.3.2.6.1 Production control for self-adhesive preformed road marking

The minimum production control shall be as given in Table 8.

Table 8 - Self-adhesive preformed road marking FPC minimum testing frequency

Property	Minimum frequency of tests	Tolerance
Adhesive - Mass per unit area (for self-adhesive road markings)	at least once a day per each product	$\pm 10 \text{ g/m}^2$

The method to determine mass per unit area shall be as given in Annex A.

4.3.2.6.2 Final conformity control

The minimum production control shall be as follows.

- a) Family 1 products (other types of preformed – fully finished - road markings of EN 1790; e.g. cold applied preformed road markings or preformed thermoplastic road markings with drop-on beads) shall be as given in Table 9.

Table 9 – All cold applied preformed road markings and hot applied with drop-on products FPC minimum testing frequency

Property	Minimum frequency of tests
Colour and luminance factor ($x, y; \beta$)	Every 2000m ²
Daytime visibility (Q_d)	Every 2000m ²
Retroreflection ($R_L/R_W/R_R$)	Every 2000m ²
Skid resistance value (SRT)	Every 2000m ²
Ash content	Every 5000m ²

- b) Family 2 products (preformed thermoplastic road markings without drop-on beads - defined in EN 1790) shall be as given in Table 3.

4.3.2.7 Road studs (EN 1463)

The minimum production control shall be as follows:

- a) on the bodies, see Table 10:

Table 10 – Road studs FPC minimum frequency of tests (bodies)

Property	Minimum frequency of tests
Dimensions	at least once a day and at least for 1 unit per 5 000 units
Resilience/depressibility only on depressible studs	at least once a day and at least for 1 unit per 5 000 units

b) on the optical parts, see Table 11:

Table 11 – Road studs FPC minimum frequency of tests (optical parts)

Test	Minimum frequency of tests
Colour of the reflected light	at least 3 units per batch
Night-time visibility (R value).	at least 3 units per batch

These tests shall be done by visual comparison with a laboratory calibrated sample.

Annex A (normative)

Preformed self-adhesive road marking – Test method for determination of mass per unit area of the adhesive.

A.1 Scope and field application

This annex specifies a method for determining the mass per unit area of the adhesive that is coated onto preformed road marking.

A.2 References

EN ISO 2286-2, *Rubber- or plastics-coated fabrics – Determination of roll characteristics - Part 2: Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate* (ISO 2286-2).

A.3 Sampling

Two situations can occur:

- 1) the adhesive is applied by transfer to the road marking and can be sampled as adhesive layer on protective release film(s);
- 2) the adhesive is directly coated on the road marking. In this case, the adhesive layer has to be sampled directly from the coating machine by means of release film(s).

A.4 Apparatus

- a) Balance, accurate to ± 10 mg.
- b) Cutter, capable of cutting, from the sample of adhesive layer, a test piece of area $100 \text{ cm}^2 \pm 1 \text{ cm}^2$.
- c) It has been found convenient to use a circular cutter for this purpose, but square or rectangular test pieces may be used provided they are within the accuracy specified above.

A.5 Preparation of test samples

Using the cutter (A.4 b)), cut three test pieces from the sample, from positions spaced reasonably evenly and close to the diagonal across the width of the sample so that the full width of the adhesive layer is represented.

A.6 Procedure

Weigh the adhesive with protective release films, let m_1 be the total mass.

Peel off the release films and weigh the films. Let m_2 and m_3 be the masses of the films.

If the adhesive layer has only one protective release film, let m_3 be zero.

A.7 Calculation and expression of results

For each of the three test pieces, calculate the mass of adhesive m_a , in grams, using the formula:

$$m_1 - (m_2 + m_3) \quad (\text{A.1})$$

For each of the three test pieces, calculate the mass of adhesive per unit area M_a , in grams per square meter, using the formula:

$$m_a * 10^4 / A \quad (\text{A.2})$$

where A is the area of the test piece, in square centimetres.

Calculate the mean of the three determinations, expressing the final results to the nearest 1 g/m².

Take this mean as the mass per unit area of the adhesive under test.

A.8 Test report

The test report shall include the following information:

- reference to this standard;
- type and identification of the product;
- result of the test, expressed in accordance with A.7;
- details of any deviations from the procedure specified;
- date of the test.