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TECHNICAL REQUIREMENTS

PTV 884

BENOR

TECHNICAL REQUIREMENTS

FOR

THERMOPLASTICS FOR ROAD MARKING

COPRO - A not-for-profit impartial product control body for the construction industry

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FOREWORD

This document contains the technical requirements for thermoplastics for road marking. The requirements included in these PTV respond to needs established by the various interested parties according to local customs.

The customer and/or user can require conformity of thermoplastics for road markings to the requirements of the PTV 884 to be demonstrated by way of a lot control.

The conformity of thermoplastics for road marking can also be certified under the voluntary BENOR mark. With the BENOR mark, the supplier has to declare the performance of thermoplastics for all the characteristics relevant to guaranteeing the application and limit values imposed by this PTV 884.

BENOR certification is based on full product certification in accordance with EN ISO/IEC 17067.

1 INTRODUCTION

1.1 TERMINOLOGY

1.1.1 Definitions

Coefficient of retroreflected luminance, R_L	Quotient of the luminance L of a field of the road marking in a direction of observation by the illuminance E⊥ at the field perpendicular to the direction of the incident light (definition of EN 1436, unit: mcd m^{-2} lx^{-1}).
Drop on materials	The antiskid aggregates, the drop-on glass-beads and the mixtures of glass beads and antiskid aggregates have to meet the requirements of the standard EN 1423 and PTV 881.
Luminance coefficient under diffuse illumination, Qd	Quotient of the luminance of a field of the road marking in a given direction by the illuminance on the field (unit: mcd·m^{-2}·lx^{-1}), definition of EN 1436.
Producer	The party responsible for producing the thermoplastics for road marking.
Product	The result of an industrial activity or process. Meant by this in the context of these technical requirements is thermoplastics for road marking. It is the collective term for all product articles and product types to which these PTV apply.
Product article	Set of units of a product with the same characteristics and performance that are produced in a specific manner and comply with the technical file.
Production unit	Technical facility/facilities tied to a geographical location used by a producer and in which one or more products are made.
Reference document	Document specifying the technical characteristics with which the materials, equipment, raw materials, production process and/or the product must comply (a standard, specification or any other technical specification).
Removability	The state of being removable entirely without damage to the road surface and without leaving evident residual traces.
Road marking assembly	Road markings, possibly combined with retro reflective road studs, can provide for horizontal road signing. Road markings can be realized by the application of an assembly consisting of a thermoplastic material (compliant with this PTV) and drop-on glass beads or a mixture of glass beads and anti-skid aggregate.
Roll-over class	Number of wheels passages over a point of a road surface within a specified period of time.

Supplier	The party having to ensure that thermoplastics for road marking complies with the technical requirements. This definition can apply to the producer, the dealer, the importer or the distributor.
Structured road marking	Structured road marking, in the sense of not allowing measurement of the luminance factor and/or the SRT value is a road marking with a structured surface that does not have areas of road marking of regular dimensions and planeness. This may be by the formation of patterns, profiles, random texture or other features.
Test	Technical action comprising the determination of one or more properties of a raw material or product according to a specified process.
Thermoplastic	Solvent-free marking product which is supplied in block, granular or powder forms, which is heated to a molten state prior to application to road surfaces, and which forms a cohesive film by cooling.
Type I and type II road markings	Type II road markings are road markings with special properties intended to enhance the retroreflection in wet or rainy conditions, type I road markings do not necessarily have such special properties.
Type testing	A series of checks to determine (initial type testing) the characteristics of a product article and its conformity.
Yellow Orange	In this regulation the colour is yellow orange when the chromaticity coordinates lie within the region defined by the corner points of class Y2 of the EN 1436, article 4.4.1 table 6.

1.1.2 Abbreviations

PTV	Technical Requirements
Qd	Luminance coefficient under diffuse illumination
R_L	Coefficient of retroreflected luminance

1.1.3 References

G0025	Guide for the obtainment of an attestation of fitness for use G0025 Test sites on the road of Road marking assemblies
EN 1097-6	Tests for mechanical and physical properties of aggregates - Part 6: Determination of particle density and water absorption
EN 1427	Bitumen and bituminous binders - Determination of the softening point - Ring and Ball method

EN 1436	Road marking materials - Road marking performance for road users and test methods
EN 1824	Road marking materials - Road trials
EN 1871	Road marking materials - Physical properties
EN 12802	Road marking materials - Laboratory methods for identification
EN 13459	Road marking materials - Sampling from storage and testing
EN ISO/IEC 17067	Conformity assessment - Fundamentals of product certification and guidelines for product certification schemes (ISO/IEC 17067:2013)

This PTV contains dated and undated references. Only the cited version applies to dated references. The latest version always applies to undated references, including any errata, addenda and amendments.

Of all the EN standards referred to in these requirements, the corresponding Belgian publication NBN EN applies in each case. COPRO can allow the use of a publication other than the Belgian one provided its content is identical to that of the Belgian publication.

1.2 AVAILABILITY OF THIS PTV

The current version of this PTV is available free of charge on the COPRO website.

A paper version of this PTV can be ordered from COPRO. COPRO has the right to charge for this.

No changes may be made to the original PTV approved by the sectoral commission and/or confirmed by the Management body of COPRO.

1.3 STATUS OF THIS PTV

1.3.1 Version of this PTV

This PTV concerns version 6.0, which replaces version 5.0.

1.3.2 Approval of this PTV

This PTV was approved by the Sectoral Commission on the 30th of September 2024.

1.3.3 Confirmation of this PTV

This PTV was confirmed by the Management body of COPRO on the 3rd of December 2024.

1.3.4 Registration of this PTV

This PTV was submitted to BENOR non-profit organisation on the 9th of December 2024.

1.4 HIERARCHY OF RULES AND REFERENCE DOCUMENTS

1.4.1 Legislation

If certain rules contained in this PTV are inconsistent with applicable law, the rules arising from the legislation shall prevail. It is the responsibility of the supplier to monitor this and report any contradictions to COPRO in advance.

1.4.2 Directives concerning health and safety

If certain technical requirements are inconsistent with the directives concerning health and safety, such directives shall prevail. It is the responsibility of the supplier to monitor this and report any contradictions to COPRO in advance.

1.4.3 Tender documents

If certain rules from the applicable tender document are inconsistent with these technical requirements, the supplier can report this to COPRO.

1.5 QUESTIONS AND COMMENTS

Questions or comments concerning these technical requirements are directed to COPRO.

2 CONTEXT OF TECHNICAL REQUIREMENTS

2.1 PTV REDACTION

2.1.1 Redaction of this PTV

These technical requirements for the thermoplastics for road marking are drawn up by the Sectoral Commission Road marking materials of COPRO.

2.2 OBJECTIVES

2.2.1 Purpose of this PTV

The aim of this PTV is to specify requirements for the thermoplastics used for road markings.

2.3 SCOPE

2.3.1 Subject of these technical requirements

The subject of these technical requirements are white and yellow orange structured or non-structured - both non-preformed - thermoplastics for road markings. White thermoplastics are to be used for permanent road markings, yellow orange thermoplastics for temporary road markings, both in circulation areas . Other products and colours intended for road markings are not covered by this PTV.

Note: Preformed thermoplastics are not covered by this PTV but by the PTV 888.

The thermoplastics that are the subject of the PTV are intended to be dropped on with glass beads or with mixtures of glass beads and antiskid aggregates during the application, in order to form a road marking assembly.

Note: Preformed thermoplastics are not covered by this PTV but by the PTV 888.

This PTV does not cover the compatibility of thermoplastic materials with old marking materials. If necessary, the compatibility of two products will have to be evaluated on a case-by-case basis.

Thermoplastics are not applied directly to hydraulic concrete surfaces but after application of a primer, recommended by the manufacturer. This primer is not covered by the PTV.

2.3.2 Circulars

COPRO can supplement this PTV with one or more circulars forming an integral part of this PTV.

2.4 REFERENCE DOCUMENTS

2.4.1 Product standards

There is no applicable product standard(s) for thermoplastics for road marking.

2.4.2 Tender documents

The tender document(s) can refer to this PTV 884.

2.4.3 Test methods

The applicable test method(s) are mentioned in chapter 4.

2.4.4 Other

Other applicable reference documents are mentioned in article 1.1.3.

3 REQUIREMENTS

3.1 PRODUCTION UNIT AND EQUIPMENT

No requirements are set for the production unit and equipment.

3.2 RAW MATERIALS

Premix glass beads comply to PTV 882 for thermoplastics for spray application and to PTV 882 or PTV 881 for thermoplastics for extrusion.

3.3 PRODUCTION PROCESS

The packaging shall provide that the average of the effective content of 10 packages is not less than the nominal content. No package at all may have a content lower than 95 % of the declared content.

3.3.1 Softening point

The softening point of the thermoplastic at the end of the production process shall be determined.

The manufacturer shall state tolerances for the softening point, the range shall be ≤ 20 °C.

The softening point is tested in accordance with article 3.4.3.

3.4 THERMOPLASTIC FOR ROAD MARKING

3.4.1 General

3.4.1.1 The thermoplastic for road marking meets the requirements set out in articles 3.4.2 to 3.4.8.

3.4.1.2 The supplier shall in each case declare the performance for the characteristics set out in articles 3.4.2 to 3.4.8 for the thermoplastic for road marking.

3.4.1.3 Article 3.4.9 to 3.4.15 are the identification tests. These tests are realised to allow a limited series of tests to verify whether the manufactured or delivered thermoplastic is identical to the thermoplastic that was subjected to the entire series of tests. The test results are compared to the declared value (see also article 3.6 type testing).

For type testing of the identification characteristics, tolerances apply to the manufacturers declared values for the tested properties. The initial test results shall be within the tolerances mentioned in the next articles.

For re-identification of a thermoplastic, it may not be necessary to test all the values. Reference values for the tested properties shall be the values declared by the manufacturer.

3.4.2 Chromaticity coordinates and luminance factor

The chromaticity coordinates are in accordance with EN 1871 table 2.

The class of the luminance factor is in accordance with EN 1871 article 4.3.2.1 table 6 LF6 (≥ 0,80) for white thermoplastics and LF2 (≥ 0,50) for yellow orange temporary thermoplastics.

The chromaticity coordinates and luminance factor are determined in accordance with EN 1871 Annex F.

3.4.3 Softening point

The class of softening point in accordance with EN 1871 article 4.3.2.2 table 7 shall be SP2.

The softening point is determined in accordance with EN 1871 Annex G (Wilhelmi) for type testing (see article 3.6) or for lot control. In other cases the softening point is determined in accordance with EN 1427 or EN 1871 Annex G.

3.4.4 Cold impact resistance

The class of cold impact resistance in accordance with EN 1871 article 4.3.2.4 table 8 shall be CI 1.

The cold impact resistance is determined in accordance with EN 1871 Annex I.

3.4.5 Chromaticity coordinates and luminance factor after heat stability test

The chromaticity co-ordinates after heat stability are in accordance with EN 1871, table 2. The difference in luminance factor $\Delta\beta$ is in accordance with EN 1871 article 4.3.3.1.

The heat stability is tested in accordance with EN 1871 Annex H. The chromaticity coordinates and luminance factor are tested in accordance with EN 1871 Annex F.

3.4.6 Softening point after heat stability test

The difference in softening point ΔSP is in accordance with EN 1871 article 4.3.3.2.

The heat stability of the thermoplastic is tested in accordance with EN 1871 Annex H. The softening point is determined in accordance with EN 1871 Annex G.

3.4.7 Indentation after heat stability test

The minimum class for indentation in accordance with EN 1871 article 4.3.3.3 table 9 shall be minimum IN3. The heat stability of the thermoplastic is determined in accordance with EN 1871 Annex H.

The indentation is determined in accordance with EN 1871 Annex J, at a test temperature of 20 °C.

3.4.8 Durability on road trial, tested on the thermoplastic in a road marking assembly

The requirements for the road marking assembly are mentioned in the following table.

Characteristic	Minimum requirements			
	White			Yellow orange temporary
	Not structured		Structured	Not structured
	Type I	Type II	Type II	Type I
Luminance coefficient under diffuse illumination (Qd)	Q2	Q2	Q2	Q2
Retroreflection under vehicle headlamp illumination, Dry (RL)	R2	R2	R2	R3
Retroreflection under vehicle headlamp illumination, wet (RL)	RW0	RW1	RW1	RW0
Retroreflection under vehicle headlamp illumination, rain (RL)	RR0	RR1	RR1	RR0
Skid resistance	S1	S1	S0	S1
Colour (x,y)	EN 1436 Table 6	EN 1436 Table 6	EN 1436 Table 6	EN 1436 Table 6 (Y2)
Removability	NA	NA	NA	pass
Minimum roll-over class where above-mentioned characteristics still comply	P5	P5	P5	T2

The road marking assembly, consisting of the thermoplastic material and drop-on materials is subjected to a durability test on the road, in accordance with the G0025 guide.

The results are evaluated according to G0025.

3.4.9 Density

The density shall be declared.

The maximum accepted deviation from the declared value is 0,15 g/cm^3 for type testing and for re-identification.

The density of the thermoplastic is tested in accordance with EN 1097-6.

3.4.10 Organic content

The organic content shall be declared.

The maximum accepted absolute deviation from the declared value is 2,5 percent by weight for type testing and for re-identification.

The organic content expressed as a percentage of the thermoplastic is determined in accordance with EN 12802 Annex B or, if identification of the constituents is not required, according to article 4.3.

3.4.11 Identification of the organic constituents

Initial type testing includes determination of the infrared spectrum of the organic constituents.

When assessing the identity of two infrared spectra (re-identification) it has to be checked if all absorption-/transmission peaks are present or there are additional occurrences which are significantly different from the baseline to stand out. The relative height levels between peaks must not change significantly.

The identification of organic constituents shall be determined in accordance with EN 12802 Annex B.

3.4.12 Identification of pigment and fillers

Initial type testing includes determination of the infrared spectrum of the pigments and fillers.

When assessing the identity of two infrared spectra (re-identification) it has to be checked if all absorption-/transmission peaks are present or there are additional occurrences which are significantly different from the baseline to stand out. The relative height levels between peaks must not change significantly.

The identification of pigment and fillers, shall be determined in accordance with EN 12802 Annex C.

3.4.13 Titanium dioxide content

The titanium dioxide content shall be declared.

The maximum accepted absolute deviation from the declared value is 1,5 percent by weight for type testing and for re-identification.

The titanium dioxide content shall be determined in accordance with EN 12802 Annex D.

3.4.14 Glass bead content

The glass bead content shall be declared.

The maximum accepted absolute deviation from the declared value is 5,5 percent by weight for type testing and for re-identification.

The glass bead content shall be determined in accordance with EN 12802 Annex E.

3.4.15 Ash content

The ash content shall be declared.

The maximum accepted absolute deviation from the declared value is 3,5 percent by weight for type testing and for re-identification.

The ash content shall be determined in accordance with EN 12802 Annex H.

3.5 CLASSIFICATION

3.5.1 Classification

In function of the use or application the thermoplastics can be classified in:

- White thermoplastic for spray application;

- White thermoplastic for extruded not structured type I or type II road markings;

- White thermoplastic for extruded structured type II road markings;

- Yellow orange temporary thermoplastics for spray application;

- Yellow orange temporary thermoplastics for extrusion.

3.6 TYPE TESTING

3.6.1 General

3.6.1.1 The type test comprises laboratory validation of the characteristics according to articles 3.4.2 up to 3.4.7 and validation on the road trial site on the N63 in Baillonville, Belgium for the characteristic of article 3.4.8.

3.6.1.2 The type test of the identification characteristics according to articles 3.4.9 up to 3.4.15 is only required to allow a limited series of tests to be used to verify whether the manufactured or delivered thermoplastic is identical to the thermoplastic that was subjected to the entire series of tests according to articles 3.4.2 up to 3.4.8.

3.6.2 Scope

Every product article is tested. For the characteristic 3.4.8 the manufacturer can determine performances with different drop on materials and/or with different dosages of thermoplastic and/or drop on materials.

3.6.3 Requirements

3.6.3.1 At least the characteristics according to articles 3.4.2 up to 3.4.8 are determined in the type test, see also article 3.6.1.2.

3.6.3.2 The type test is generally performed on the samples taken during the road trials for the determination of the performances of the characteristic according to article 3.4.8. If (some) laboratory tests according to articles 3.4.2 up to 3.4.7 are performed on other samples, at least the identification tests according to articles 3.4.10 up to 3.4.13 are performed and the results shall comply to the requirements for re-identification.

3.6.4 Type test report

Sample preparation and the evaluation of the results of the type test are recorded in an assessment report.

3.6.5 Validity

The type test is valid as long as the raw materials are equivalent. The equivalence of the raw materials can be verified with the identification tests on the final product.

3.6.6 Modifications

If a raw material, the composition, the production process, or other relevant parameters are adjusted, the supplier must assess the influence of this modification on the characteristics of the product article, including possible changes in identification (see also article 3.6.5).

It may prove necessary in this regard to re-run the type test or a part of the type test.

3.6.7 Repeat type testing

This article is not applicable.

4 TEST METHODS

4.1 SAMPLING

4.1.1 Sampling method for representative sampling

For lot controls according to article 6.2 the sampling is according to EN 13459.

4.1.2 Sampling method for spot samples

For external control of the factory production control a sample is taken from one pallet or big bag according to the rules of EN 13459.

For factory production control the manufacturer can use other method as long as he shows the method is representative for the produced batch (example given by comparing results of samples taken with this method and compared with the method of the previous paragraph).

4.2 SAMPLE PREPARATION

4.2.1 Sample preparation

The thermoplastic is melted and homogenized at the recommended temperature range indicated by the manufacturer. The preparation of the samples used for re-evaluation is done in the same way as it was done for the preparation of the samples used for type testing. Sample preparation will be recorded on the type-testing report (see article 3.6.4 of this PTV).

4.3 ALTERNATIVE METHOD FOR DETERMINATION OF THE ORGANIC CONTENT

4.3.1 Aim and principle

When it’s not requested to identify the organic constituents according to article 3.4.12 (example given for factory production control), the organic content can be obtained by this alternative method. The organic content is obtained via determination of the inorganic content by ash residue at 450 °C.

4.3.2 Instruments

Instruments:

- electric muffle furnace, adjustable to 450 °C ± 25 °C;

- analytical balance with an accuracy of 0,01 g;

- crucible, adapted to temperatures of 450 °C;

- desiccator, with drying agent, example given silica gel.

4.3.3 Sample preparation

See article 4.2.1.

4.3.4 Method

The thermoplastic is ashed at 450 °C ± 25 °C in a muffle furnace and the loss in mass determined.

Carry out two determinations.

Weight the empty crucible to the nearest 0,01 g (W1). Take a portion of 1 - 10 g of the marking material, carefully homogenized, and weigh again immediately (W2). Place the crucible in the muffle furnace afterwards and raise the temperature to 450 °C ± 25 °C. Keep the crucible in the furnace for at least 2 h at 450 °C ± 25 °C or until constant mass is obtained. Remove the crucible containing the residues, cool in a desiccator and reweigh (W3).

4.3.5 Result

The organic content (OC) is calculated from the percentage of inorganic constituents (residue of combustion, IC) content by mass and shall be determined using the following equations:

$$IC = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

and OC = 100 – IC

where:

- W1 is the mass of the empty crucible,

- W2 is the mass of the crucible together with the sample in grams,

- W3 Is the mass of the crucible together with the residue in grams.

The mean of the two individual results shall be calculated and the binder content given rounded to the nearest 0,1 % by mass.

If the results of the individual determinations of the binder or inorganic content differ by more than 0,5 % by mass from the mean, repeat the procedure.

4.3.6 Test report

The test report sets out at least:

- the details and identification of the sample;
- the average of the two determinations according to the articles 4.3.4 and 4.3.5.

5 PRODUCT IDENTIFICATION

5.1 PRODUCT NAME

5.1.1 Official name

Official name:

- White thermoplastic for spray application;

- White thermoplastic for extruded non structured type I or type II markings;

- White thermoplastic for extruded structured type II road markings;

- Yellow orange temporary thermoplastics for spray application;

- Yellow orange temporary thermoplastics for extrusion;

- Yellow orange temporary thermoplastics for extruded structured road markings.

5.1.2 Commercial name

The commercial name is freely chosen by the supplier insofar as it does not lead to confusion or conflict with the official name.

5.2 IDENTIFICATION

5.2.1 Delivery modes

5.2.1.1 Thermoplastics can be delivered in bulk or in a package.

5.2.1.2 If thermoplastic is delivered in package, it is identified on each packaging unit (example given per bucket or per bag) and per group of packages (example given per pallet).

5.2.2 Individual packages

The following information must be given on each packaging unit:

- name and address of the supplier and/or producer,

- name(s) of the thermoplastic,

- the quantity of the content,

- the batch or production number,

- the shelf life or production date and, if shelf life is not mentioned on the package, reference to a technical datasheet that mention the recommended shelf life (see article 5.2.4),
- statements regarding the conditions for storage and the period of storage If this is not the case, the label must refer to a technical datasheet specific to the thermoplastic.

5.2.3 Group of packages

There are no requirements for identification of the group of packages.

5.2.4 Shelf life

The shelf life of the thermoplastic is stated on the basis of:

- the date preceded by the words: ‘Best before …’ when the date includes an indication of the day, ‘Best before end …’ in other cases,
- or on the basis of the production date and the shelf life in months or years.

5.3 DELIVERY NOTE

5.3.1 Information

Each delivery of thermoplastic is additionally accompanied of the delivery documents.

The following information is given on the delivery documents:

- name and address of the supplier and/or producer,
- name of the customer,
- name(s) of the thermoplastic,
- date of loading,
- quantity of thermoplastic.

6 ASSESSMENT OF DELIVERIES

6.1 PRODUCT CHECK BY THE CUSTOMER ON DELIVERY

6.1.1 Check by the customer

On receipt of the thermoplastic, the customer checks:

- compliance of the delivery note with the ordered goods;
- in case of individual packages, compliance of the identification of the product with the delivery note.

If the thermoplastic is delivered under the voluntary BENOR mark, the conformity of the product is demonstrated and article 6.2 does not apply.

6.2 LOT CONTROL BEFORE DELIVERY

6.2.1 General

The aim of a lot control is to check whether there is sufficient confidence that the characteristics of the thermoplastics of a supplied lot comply with this PTV.

6.2.2 Sampling

6.2.2.1 Sampling is carried out in principle by an impartial body or by the recipient (generally a road authority) on the supplier's premises.

6.2.2.2 Sampling is carried out according to article 4.1.1 and is representative of the entire lot.

6.2.3 Lot size and number of samples

Number of samples are according to EN 13549.

6.2.4 Checking

At least all the characteristics of articles 3.4.2 up to 3.4.8 are tested.

6.2.6 Processing of the thermoplastic

The thermoplastics of a lot may only be processed after all the results of the test are known and satisfactory.

7 PROCESSING OF THE PRODUCT (informative)

7.1 STORAGE OF THE PRODUCT

7.1.1 Storage conditions

No particular storage conditions, the thermoplastic should best be used within the recommended shelf life, see article 5.2.4.