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**Polimerni materiali - Reciklirani polimerni materiali - Karakterizacija recikliranega polietilena (PE)**

Plastics - Recycled Plastics - Characterisation of Polyethylene (PE) recyclates

Kunststoffe - Kunststoff-Rezyklate - Charakterisierung von Polyethylen (PE)-Rezyklaten

Plastiques - Plastiques recyclés - Caractérisation des recyclats de polyéthylène (PE)

**Ta slovenski standard je istoveten z: EN 15344:2007**

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**ICS:**

13.030.50	Recikliranje	Recycling
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ICS 13.030.50; 83.080.20

English Version

## Plastics - Recycled Plastics - Characterisation of Polyethylene (PE) recyclates

Plastiques - Plastiques recyclés - Caractérisation des  
recyclats de polyéthylène (PE)

Kunststoffe - Kunststoff-Rezyklate - Charakterisierung von  
Polyethylen (PE)-Rezyklaten

This European Standard was approved by CEN on 25 October 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 15344:2007) has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by NBN.

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of an identical text or by endorsement, at the latest by June 2008, and conflicting national standards shall be withdrawn at the latest by June 2008.

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

This standard is one part of a series of CEN publications on Plastics Recycling which is structured as follows:

- EN 15342 Plastics—Recycled Plastics—Characterization of polystyrene (PS) recyclates
- EN 15343 Plastics—Recycled Plastics—Plastics recycling traceability and assessment of conformity and recycled content
- EN 15344 Plastics—Recycled Plastics—Characterisation of Polyethylene (PE) recyclates
- EN 15345 Plastics—Recycled Plastics—Characterisation of Polypropylene (PP) recyclates
- EN 15346 Plastics—Recycled plastics—Characterisation of poly(vinyl chloride) (PVC) recyclates
- EN 15347 Plastics — Recycled Plastics — Characterisation of plastics wastes
- EN 15348 Plastics—Recycled plastics—Characterization of poly(ethylene terephthalate) (PET) recyclates
- CEN/TR 15353 Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics

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 the United Kingdom.

## Introduction

Recycling plastics waste is one type of material recovery process intended to save resources (virgin raw materials, water, and energy), while minimising harmful emissions into air, water and soil as well as any impacts on human health. The environmental impact of recycling has to be assessed over the whole life cycle of the recycling system (from the waste generation point to the disposal of final residues). To ensure that recycling constitutes the best environmental option for treating the available waste, some prerequisites should preferably be met:

- recycling scheme being contemplated should generate lower environmental impacts than alternative recovery options;
- existing or potential market outlets should be identified that will secure a sustainable industrial recycling operation;
- collection and sorting schemes should be properly designed to deliver recyclable plastics waste fractions fitting reasonably well with the available recycling technologies and with the (changing) needs of the identified market outlets, preferably at minimum costs to society.

This standard has been produced in accordance with the guidance produced by CEN on Environmental Aspects and in accordance with CEN/TR 15353, *Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics*.

NOTE CEN/TR 15353 considers the general environmental aspects which are specific to the recycling process.

It is often impossible to trace back each individual product at the end user stage and to check whether the product has been used correctly through its life. Consequently products are out of industrial control for a period of time. It is possible that during this period contamination with other materials may occur that could affect the product's suitability for recycling into the intended application.

## 1 Scope

This European Standard defines a method of specifying delivery conditions for polyethylene (PE) recyclates. It gives the most important characteristics and associated test methods for assessing PE recyclates intended for use in the production of semi-finished/finished products.

It is intended to support parties involved in the use of recycled PE to agree on specifications for specific and generic applications.

This standard is applicable without prejudice to any existing legislation.

This standard does not cover the characterisation of plastics wastes. See EN 15347.

## 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 12099, *Plastics piping systems — Polyethylene piping materials and components — Determination of volatile content*

EN 15348:2007, *Plastics — Recycled plastics — Characterization of poly(ethylene terephthalate) (PET) recyclates*

EN ISO 179-1, *Plastics — Determination of Charpy impact properties — Part 1: Non-instrumented impact test (ISO 179-1:2000)*

EN ISO 180, *Plastics — Determination of Izod impact strength (ISO 180:2000)*

EN ISO 472:2001, *Plastics — Vocabulary (ISO 472:1999)*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1:1993 including Corr 1:1994)*

EN ISO 527-2, *Plastics — Determination of the tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994)*

EN ISO 1043-1:2001, *Plastics — Symbols and abbreviated terms — Part 1: Basic polymers and their special characteristics (ISO 1043-1:2001)*

EN ISO 1133, *Plastics — Determination of the melt mass flow-rate (MFR) and the melt-volume flow rate (MVR) of thermoplastics (ISO 1133:2005)*

EN ISO 1183-1, *Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2004)*

EN ISO 3451-1, *Plastics — Determination of ash — Part 1: General methods (ISO 3451-1:1997)*

ISO 3534-2, *Statistics — Vocabulary and symbols — Part 2: Applied statistics*

ISO 22498, *Plastics — Vinyl chloride homopolymer and copolymer resins — Particle size determination by mechanical sieving*

CEN/TR 15353:2007, *Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics*

### 3 Terms, definitions and abbreviated terms

For the purposes of this European Standard, the terms and definitions given in EN ISO 472:2001 and CEN/TR 15353:2007 apply. The abbreviated terms related to recyclates are given in EN ISO 1043-1:2001.

### 4 Characterisation of PE recyclates

A single batch is the quantity of PE recyclate that has homogeneous characteristics within the specified tolerances.

The characteristics of PE recyclates, which shall be determined for every batch (see ISO 3534-2) of recyclate, are given in Table 1, and are divided into two types:

- Required characteristics, needed to define PE recyclates in general, and required for all recyclates.
- Optional characteristics, needed to define PE recyclates according to customer specifications and applications.

NOTE 1 Polyethylene plastics waste originate from different types or grades of PE containing additives to modify characteristics. Polyethylene is generally classified as PE-HD (high density polyethylene), PE-LD (low density polyethylene), PE-LLD (linear low density polyethylene) and others of less common use. The properties and performance of recyclates derived from such wastes may depend on the type or relative proportions of blends of PE, but it is not in the scope of this Standard to investigate such relations.

These characteristics shall be assessed by using the test methods given in Table 1. Where possible the supplier should provide information on the original applications.

A certificate of analysis, giving the test results for each batch of recyclate shall be provided by the supplier to the purchaser upon request.

To secure the legal use of the recyclate, the supplier shall provide the necessary information about the material composition of the recyclate, as specified by the purchaser.

NOTE 2 In this European Standard, PE (R) is composed of:

- Polymeric matrix, consisting of polyethylene (PE content);
- Fillers, pigments and additives;
- Impurities or contamination in a quantity which do not compromise the workability characteristics of PE (R);
- Polymers compatible with the polymeric matrix.



Table 1 – Characterisation of PE recyclates

Characteristics	Unit	Tests method	Comments
<b>Required</b>			
Bulk density	kg/m <sup>3</sup>	ANNEX B	Test may be used for powder or granulates ASTM D 1895-96 may be used for powder
Colour		Visual inspection	
Particle size	mm	ISO 22498 <sup>a</sup>	For powder used for rotomoulding (particle size distribution also required). For flakes or regrind the Annex A of EN 15348:2007 and Annex E of EN 15346:2007 draft standards may be used. ASTM D 1921-01 may also be used
Melt mass flow rate (MFR)	g/10 min	EN ISO 1133	190 °C-2,16 kg for density ≤ 0,945 kg/dm <sup>3</sup> 190 °C-5 kg for density > 0,945 kg/dm <sup>3</sup>
Shape		Visual inspection	Typical shape are pellets, flakes, regrind, powder and agglomerated
<b>Optional</b>			
Ash content	%	EN ISO 3451-1	With this method, any organic pigments are destroyed
Density	kg/m <sup>3</sup>	EN ISO 1183-1	Pycnometer, parties to agree on method A or B
Contaminants	Number	ANNEX A Method A, B or C	Parties to agree on which method
Filtration level	µm	Mesh size	Only finest filter. Alternatively dimension of net passage.
Izod impact strength or Charpy impact strength	kJ/m <sup>2</sup>	EN ISO 180 EN ISO 179-1	Temperature conditions agreed between the interested parties
Residual humidity	%	EN 12099 <sup>b</sup>	Weight loss, 105 °C
Tensile stress at yield	MPa	EN ISO 527-1 EN ISO 527-2	Test speed and at the temperature conditions agreed between the interested parties Test specimen 1 A
Tensile strain at break	%	EN ISO 527-1 EN ISO 527-2	Test speed and at the temperature conditions agreed between the interested parties Test specimen 1 A
X: required characteristics to be quantified.			
O: optional characteristics to be quantified.			
a Although ISO 22498 is specific to PVC, it is considered relevant to PP.			
b Although the scope of EN 12099 is limited, it is considered relevant.			

## 5 Quality assurance

In order that the purchaser of the recyclate may have confidence in the quality of the product, the supplier shall maintain records of the quality control carried out, including incoming materials, processes and finished products.