# SLOVENSKI STANDARD
# oSIST prEN 18120-12:2024

**01-oktober-2024**

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**Embalaža - Načrtovanje, ki omogoča recikliranje plastične embalaže - 12. del: Postopek za ocenjevanje možnosti recikliranja plastične embalaže - Protokoli za togo plastično embalažo iz polietilena (PE) in polipropilena (PP)**

Packaging - Design for recycling for plastic packaging - Part 12: Recyclability evaluation process for plastic packaging - Protocols for PE and PP rigid packaging

Verpackung - Recyclingorientierte Gestaltung von Kunststoffverpackungsprodukten - Teil 12 - Verfahren zur Bewertung der Recyclingfähigkeit von Kunststoffverpackungen - Protokolle für starre Verpackungen aus PE und PP



**Ta slovenski standard je istoveten z:** **prEN 18120-12**



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**ICS:**

| | | |
|---|---|---|
| 13.030.50 | Recikliranje | Recycling |
| 55.020 | Pakiranje in distribucija blaga na splošno | Packaging and distribution of goods in general |
| 83.080.20 | Plastomeri | Thermoplastic materials |

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# prEN 18120-12

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English Version

# Packaging - Design for recycling for plastic packaging - Part 12: Recyclability evaluation process for plastic packaging - Protocols for PE and PP rigid packaging

Verpackung - Recyclingorientierte Gestaltung von Kunststoffverpackungsprodukten - Teil 12 - Verfahren zur Bewertung der Recyclingfähigkeit von Kunststoffverpackungen - Protokolle für starre Verpackungen aus PE und PP

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## European foreword

This document (prEN 18120-12:2024) has been prepared by Technical Committee CEN/TC 261 “Packaging”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

# Introduction

EN 18120 consisting of 15 parts aims via a series of guidelines and protocols to establish consistency and improvement for the Design for Recycling of household, industrial and commercial plastic packaging.

— Part 1: Definitions and principles for design-for-recycling of plastic packaging

— Part 2: Process and governance to evaluate the recyclability of plastic packaging

— Part 3: Sortability evaluation process for plastic packaging

— Part 4: Guideline for PET bottles

— Part 5: Guideline for PET rigid packaging (except bottle)

— Part 6: Guideline for PE and PP rigid packaging

— Part 7: Guideline and protocols for PE and PP flexible packaging

— Part 8: Guideline for PS and XPS packaging

— Part 9: Guideline for EPS packaging

— Part 10: Recyclability evaluation process for plastic packaging – Protocols for PET bottles

— Part 11: Recyclability evaluation process for plastic packaging – Protocols for PET other rigid packaging

— Part 12: Recyclability evaluation process for plastic packaging – Protocols for PE and PP rigid packaging

— Part 13: Recyclability evaluation process for plastic packaging – Protocols for PE and PP flexible packaging

— Part 14: Recyclability evaluation process for plastic packaging – Protocols for PS and XPS packaging

— Part 15: Recyclability evaluation process for plastic packaging – Protocols for EPS packaging



Design for recycling guidelines are a common way of describing compatibility with plastic packaging collection, sorting and recycling into high quality recycled plastic into state-of-the-art facilities. They provide guidance on the level compatibility, defined as:

— green: Packaging constituents with full compatibility with recycling;

— yellow: Packaging constituents with limited compatibility with recycling;

— red: Packaging constituents which are not compatible with recycling.

Recyclability guidelines will require regular review and improvement to reflect innovations in design, collection, sorting and recycling.

The Design for recycling guidelines provided in this series of standards are representative of the state of the art in Europe and cover all steps from design for recycling, packaging waste collection, sorting, recycling into recycled plastic and to use in a new application.

Packaging recyclability is the combination of five parameters: packaging designed for recycling, packaging waste collection, sorting when necessary, recycling and use of recycled plastic in a new application. This series of standards covers one parameter: the design for recycling.

# 1 Scope

This document covers the design of PE and PP rigid with respect to compatibility of the design with recycling processes.

Packaging constituents and packaging components made of other materials than PE and PP are also covered by this document as they need to be evaluated on compatibility with polymer recycling.

# 2 Normative references

The following documents are referred to in the text in such a way that their content constitutes requirements 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.

prEN 18120-1, *Packaging — Design for recycling of plastic packaging — Part 1: Definitions and principles for design-for-recycling of plastic packaging*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178)*

EN ISO 527-1:2019, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1:2019)*

EN ISO 527 series, *Plastics — Determination of tensile properties*

ISO 1133-1, *Plastics — Determination of the melt mass-flow rate (MFR) and melt volume-flow rate (MVR) of thermoplastics — Part 1: Standard method (ISO 1133-1)*

EN ISO 18314-1, *Analytical colourimetry — Part 1: Practical colour measurement (ISO 18314-1)*

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

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

ISO 11357-1, *Plastics — Differential scanning calorimetry (DSC) — Part 1: General principles*

ISO 11357-3, *Plastics — Differential scanning calorimetry (DSC) — Part 3: Determination of temperature and enthalpy of melting and crystallization*

ISO 11358-1, *Plastics — Thermogravimetry (TG) of polymers — Part 1: General principles*

EN ISO 15512:2019, *Plastics — Determination of water content (ISO 15512:2019)*

# 3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 18120-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

# 4 Recyclability evaluation process

## 4.1 Principle

This standard provides a method of evaluating the *technical recyclability* of a rigid PE or PP packaging sample in *mechanical recycling* processes as they are implemented in Europe. The results characterize both the *processability* of the sample as well as the *quality of the recycled plastic*.

Depending on the choice of the sample, the method can either provide a technical recyclability determination *for a given packaging design or item*, or it can be employed to selectively study the *impact of individual design elements* in rigid PE and PP plastic packaging on technical recyclability. The latter approach may be employed to generate data for the updating of *design-for-recycling guidelines*.

The test method follows the steps (*unit operations*) that occur in a mechanical recycling process for rigid PE or PP packaging and seeks to simulate each operation on a laboratory scale. The relevant unit operations are shown in Table 1. Steps 1 and 2 describe the plastic recycling process itself whereas step 3 represents the conversion of the recycled plastic into products, either bottles or rigid products. As such, steps 1 and 2 provide information on the *processability* of the sample whereas step 3 provides information on the *quality of the recycled plastic* that can be obtained.

**Table 1 — List of unit operations in mechanical recycling of PE or PP rigid packaging**

| Step # | Unit operation | Description of operation |
|---|---|---|
| 1 | Pre-treatment | |
| 1.1 | Grinding | PE or PP based rigid packaging waste is ground into flakes |
| 1.2 | Washing | The flakes are washed to remove product residue and optionally components such as labels. Most European PE and PP rigid packaging recycling lines use cold washing conditions for coloured items. Hot wash can be used for packaging natural coloured. Hot wash is normally used for recyclates intended to be used to remove inks, and therefore increase the yield of natural or transparent material and prevent odour after extrusion. |
| 1.3 | Flotation | (Washed) flakes are separated from higher density materials in a float/sink tank. Flakes and other objects that sink are removed; flakes that float together with the PE or PP flakes are recycled with the floating PE or PP flakes |
| 1.4 | Drying | The flakes are dried to reduce their moisture to less than 0,5 % by mass |
| 1.5 | Air elutriation | Control and innovation PE or PP flakes are separately elutriated with air to remove light fraction |
| 2 | Extrusion | |
| 2.1 | Flakes blend preparation | The flakes of the tested samples are mixed with control samples with different shares. |
| 2.2 | Pellet production | The dried flakes are extruded into pellets, employing melt filtration with a mesh size of 150micron. Temperature range of the control material as specified in its datasheet should be used to prevent polymer degradation. |

| Step # | Unit operation | Description of operation |
|---|---|---|
| 3 | Converting | The driving criteria for selection of method should be provided application and/or application suitable with the final MFR |
| 3.1 | Pellet blend preparation | The recycled pellets are blended with other pellets, typically including virgin grades of the same polymer. |
| 3.2a | Blow moulding | PP or PE pellet blends are converted into bottles products by extrusion blow moulding. |
| 3.2b | Sheet extrusion | PP or PE pellet blends are converted into sheet products by sheet extrusion. |
| 3.2c | Injection moulding | Pellets have to be tested for injection moulding to evaluate tensile properties, colours and defects in a reliable way. Depending on the final MFR of the pellets, PP or PE pellet blends are converted into items products by injection moulding. |

NOTE 1 This document does not describe sorting steps that occur at material recovery facilities (MRF) or plastics recovery facilities (PRF). For the evaluation of such sorting operations, references is made to prEN 18120-3.

The flow of the test method (shown in Figure 1) that is specified in this document simulates the three main steps in the form of:

1) *Pre-treatment* of *test material* and characterization of its behaviour in these processes;

2) *Extrusion* pre-treated *test material flakes*, together with *control material flakes*, to obtain *pellet samples* and characterization of those pellets;

3) *Conversion* of *pellet samples,* together with *virgin resin,* into *bottles or sheet samples* or injection moulded packaging items depending on MFR and characterization of those samples



NOTE 2 This document describes two dilution steps. The first dilution step (creation of flake mixes from test material flakes and control material flakes at 25 wt% and 50 wt % of test material) represents the dilution of individual packaging structures in the overall PE/PP rigid packaging recycling stream and therefore in the sorted bales of waste that recyclers receive.

The second dilution step (creation of pellet mixes from pellet samples and virgin resin at 50 wt% of virgin resin) represents the commercial practice of using less than 100 % of recycled plastic in the production of bottles or rigid items for packaging applications. In this method, instead of creating a blend of pellets (compounding), the *pellet samples* and *virgin resin* pellets are only physically mixed (dry blend).

## 4.2 Sampling

### 4.2.1 Test material requirements

For the purposes of this standard, at least 15 kg amount of the packaging material to be evaluated (‘*test material’*) is required the quantity should be based on number or quantity of items instead of weight. The *test material* may be provided in form of finished rigid packaging.[1]

[1] Packaging structures that contain additional elements such as spouts, caps, zips, valves shall be tested only in form of finished packaging articles.