
Polimerne cevi in fittingi - Uporaba recikliranih plastomerov - 2. del: Priporočila za ustrezne značilnosti

Plastics pipes and fittings - Utilisation of thermoplastics recyclates - Part 2:
Recommendations for relevant characteristics

Kunststoff-Rohrleitungen und -Formstücke - Verwendung von thermoplastischen
Rezyklaten - Teil 2: Empfehlungen für relevante Eigenschaften

Tubes et raccords en plastique - Utilisation de recyclats thermoplastiques - Partie 2 :
Recommandations pour les caractéristiques pertinentes

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**Plastics pipes and fittings - Utilisation of thermoplastics
recyclates - Part 2: Recommendations for relevant
characteristics**

Tubes et raccords en plastique - Utilisation de recyclats
thermoplastiques - Partie 2 : Recommandations pour
les caractéristiques pertinentes

Kunststoff-Rohrleitungen und -Formstücke -
Verwendung von thermoplastischen Rezyklaten - Teil
2: Empfehlungen für relevante Eigenschaften

This Technical Specification (CEN/TS) was approved by CEN on 13 March 2022 for provisional application.

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

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European foreword

This document (CEN/TS 14541-2:2022) has been prepared by Technical Committee CEN/TC 155 “Plastics piping systems and ducting systems”, the secretariat of which is held by NEN.

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

This document, together with Part 1 of the EN 14541 series, supersedes CEN/TS 14541:2013.

The EN 14541 series consists of the following parts under the general title *Plastics pipes and fittings - Utilisation of thermoplastics recyclates*:

- *Part 1: Vocabulary*;
- *Part 2: Recommendations for relevant characteristics* (this document).

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

The EN 14541 series is intended to give recommendations to the value chain of thermoplastics piping systems to stimulate the use of thermoplastics recyclates as defined in the European circular economy policy.

Part 1 of the EN 14541 series defines the relevant terms and definitions related to the use of thermoplastics recyclates in thermoplastics piping systems.

This document (part 2 of the EN 14541 series) is a CEN Technical Specification in which recommendations are given for product standards related to the relevant characteristics for defining (e.g. fingerprinting) commonly used thermoplastics recyclates intended to be used in thermoplastics piping systems.

This document is intended to support specification writers of product standards within CEN TC 155 in defining the relevant characteristics for thermoplastics recyclates (PVC-U, PVC-C, PE, PP, and ABS) to be specified in the relevant product standards for use in thermoplastics piping systems. The product standards should specify relevant characteristics and applicable tolerances to be included within the agreed specification. For a specific application, specification writers may specify additional characteristics.

This document introduces the Cracked Round Bar (CRB) test for slow crack growth resistance of recycled PE, PP and PVC-U material.

This document is extended, compared with the CEN/TS 14541:2013, and covers next to PE, PP and PVC-U also PVC-C and ABS.

This document is not intended as a standalone specification for use of recyclates in plastic piping systems.

Different CEN Technical Committees are dealing with recycled Plastics. In particular CEN/TC 249 "Plastics". CEN/TC 249 "Plastics" developed a series of CEN publications on 'Plastics Recycling' which consists of: EN 15343 [1], EN 15344 [2], EN 15345 [3], EN 15346 [4], CEN/TS 16010 [5] and CEN/TS 16011 [6].

Other documents touching recycling are e.g. ISO 15270 [7] and Waste Framework Directive [8].

1 Scope

This document provides guidance and information for drafting product standards to specify characteristics and test methods for the utilization of thermoplastics recyclates (PVC-U, PVC-C, PE, PP, ABS) in pipes, fittings and ancillaries for thermoplastics piping systems.

This document covers recyclates with an agreed specification from all sources.

NOTE 1 This document does not cover characteristics for reworked material.

NOTE 2 This document does not cover recycling processes (e.g. chemical or mechanical).

NOTE 3 This document does not define if recycled material can be used in a specific application. The possible use of recyclates will be defined in the applicable product standard.

This document provides guidance about the relevant characteristics to be included in the agreed specification for recyclates.

This document is applicable without prejudice to any existing legislation.

For the recycling process, the transport, the testing and the use of thermoplastics recyclates, National and/or European regulations (e.g. hygienic aspects) can apply.

NOTE 4 For example, threshold levels for substances of very high concern (SVHC) as defined in the REACH-legislation which can possibly be present in thermoplastic recyclates.

2 Normative references

The following documents are referred to in the text in such a way that some or all of 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.

EN 14541-1, *Plastics pipes and fittings - Utilisation of thermoplastics recyclates - Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 14541-1 apply.

ISO and IEC maintain terminological 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 Abbreviations

ABS	acrylonitrile butadiene styrene
CRB	cracked round bar
MFR	melt mass-flow rate
PE	polyethylene
PP	polypropylene
PVC-C	chlorinated poly(vinyl chloride)
PVC-U	unplasticized poly(vinyl chloride)
OIT	oxidation induction time

5 Guidance for agreed specification and quality plan of the supplier

5.1 General

The conditions for the use of recyclates should be defined in the applicable product standard.

This document provides recommended characteristics (see Clauses 6.2, 6.3, 6.4, 6.5 and 6.6) to be considered for inclusion in the agreed specification(s) of a product standard. Additional characteristics may need to be considered depending on the application.

The product standard should define the documentation that should be used to cover all deliveries and to verify conformity with the agreed specification.

Depending on the application of the products, different requirements regarding the use and/or quality control of reworked material and recyclates may apply.

5.2 Agreed specification

A specification should be agreed, between the supplier of the recyclate and the manufacturer, for each grade of thermoplastic recyclates.

The following minimum information should be included in the agreed specification:

- the relevant characteristics as specified in the referring product standard;
- the values, units and tolerances for each characteristic;
- the defined batch size(s);
- the agreed sampling procedures, sample preparation methods, and testing frequencies.

NOTE Guidance on sampling procedures, sample preparation and testing can be found in CEN/TS 16010 [5] and CEN/TS 16011 [6].

When drafting an agreed specification, the following should be considered:

- the recycling process and sources of the material being mindful of risk of impurities;
- the processing of the material into the end product;
- the required characteristics of the end product;
- possible limitations of sources for the recyclable material;
- the intended dosage level of the material.

5.3 Quality plan of the supplier

It is recommended that the quality plan of the supplier of recyclates is not less stringent than the relevant requirements of EN ISO 9001 [9].

5.4 Reworked material

In EN 14541-1, reworked material is defined as “plastics material from rejected unused products or trimmings capable of being reclaimed within the same process that generated it”.

This is a general definition, where the responsible product standard writers should specify detailed conditions for the use of reworked material within the material clause of the Product standards.

The requirements for the use of reworked material in a product standard, will vary depending on the application area, which means there may be more options for use in non-pressure application area than in the pressure application area.

6 Characteristics of recyclates

6.1 General

Clauses 6.2 to 6.6 give guidance for characteristics and corresponding test methods suitable for an agreed specification between the supplier of recyclates and the product manufacturer. The certificate of analysis to demonstrate conformity with the agreed specification shall be made by either the supplier of recyclates or the product manufacturer as agreed between the parties.

6.2 PVC-U

Recommended characteristics for the agreed specification for PVC-U recyclates are shown in Table 1.

NOTE Other characteristics can be relevant depending on application.

Table 1 — Characteristics for PVC-U recyclates

Characteristic	Unit	Test method	Comment
Density	kg/m ³	EN ISO 1183-1 [18] or EN ISO 1183-2 [19]	--
Bulk density	kg/m ³	EN 15346:2014, Annex B [4]	Only applicable for micronized material or granules
PVC-content	--	EN ISO 1158 [25]	PVC content is calculated from chlorine content result of EN ISO 1158 [25] according to EN 1905 [11]
Filler content by ash rest	% by mass	EN ISO 3451-5 [22]	--
Particle size	mm	The applicable test method should be stated in the agreed specification	--
Source of the material	--	--	To be specified by the recycle supplier
Impurities (solid contaminants content)	--	The test method (such as EN 15346:2014, Annex C), evaluation of sheets or evaluation of micronized material, or mesh/melt filtering should be stated in the agreed specification	CEN/TS 17627:2021 [10] could also be considered.
Slow crack growth resistance	--	Annex A	If referred to in the product standard to gain experience, the Annex A should be used.
Vicat softening temperature	°C	EN ISO 2507-1 [20]	--
Impact strength	kJ/m ²	EN ISO 179-1 [14] or EN ISO 180 [16]	--
Tensile properties	--	EN ISO 527-2 [37]	Tensile modulus, tensile stress at yield, strain at yield etc. can all be derived from the test given.

6.3 PVC-C

Recommended characteristics for the agreed specification for PVC-C recyclates are shown in Table 2.

NOTE Other characteristics can be relevant depending on application.

Table 2 — Characteristics for PVC-C recyclates

Characteristic	Unit	Test method	Comment
Density	kg/m ³	EN ISO 1183-1 [18] or EN ISO 1183-2 [19]	--
Bulk density	kg/m ³	EN 15346:2014, Annex B [4]	Only applicable for micronized material or granules
Chlorine content	% by mass	EN ISO 1158 [25]	--
Particle size	mm	Sieve analysis	--
Impurities (solid contaminants content)	--	The test method (such as EN 15346:2014, Annex C), evaluation of sheets or evaluation of micronized material or mesh/melt filtering should be stated in the agreed specification	--
Source of the material	--	--	To be specified by the recyclate supplier
Vicat softening temperature	°C	EN ISO 2507-1 [20]	--
Impact strength	kJ/m ²	EN ISO 179-1 [14] or EN ISO 180 [16]	--
Tensile properties	--	EN ISO 527-2 [37]	Tensile modulus, tensile stress at yield, strain at yield etc. can all be derived from the test given.