



SLOVENSKI STANDARD
oSIST prEN 45552:2019
01-januar-2019

Splošna metoda za oceno trajnosti izdelkov, povezanih z energijo

General method for the assessment of the durability of energy-related products

Allgemeines Verfahren zur Bewertung der Lebensdauer energieverbrauchsrelevanter Produkte

Méthode générale pour l'évaluation de la durabilité des produits liés à l'énergie

Ta slovenski standard je istoveten z: prEN 45552

ICS:

13.020.20	Okoljska ekonomija. Trajnostnost	Environmental economics. Sustainability
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oSIST prEN 45552:2019

en,fr,de

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 45552

October 2018

ICS 13.020.20

English version

General method for the assessment of the durability of energy-related products

Méthode générale pour l'évaluation de la durabilité
des produits liés à l'énergie

Allgemeines Verfahren zur Bewertung der
Lebensdauer energieverbrauchsrelevanter Produkte

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/CLC/JTC 10.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation. Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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prEN 45552:2018 (E)**42 European foreword**

43 This document (prEN 45552:2018) has been prepared by Technical Committee CEN/CLC/JTC 10
44 “Energy-related products - Material Efficiency Aspects for Ecodesign”, the secretariat of which is held by
45 NEN/NEC.

46 This document is currently submitted to the CEN Enquiry.

47 The dual logo CEN-CENELEC standardization deliverables, in the numerical range of 45550 – 45559,
48 have been developed under standardization request M/543 of the European Commission and are
49 intended to potentially apply to any product within the scope of the Energy-related Products (ErP)
50 Directive (2009/125/EC).

51 Topics covered in the above standardization request are linked to the following material efficiency
52 aspects:

53 a) Extending product lifetime;

54 b) Ability to re-use components or recycle materials from products at end-of-life;

55 c) Use of re-used components and/or recycled materials in products

56 These standards are general in nature and describe or define fundamental principles, concepts,
57 terminology or technical characteristics. They can be cited together with other product-specific or
58 product group standards, e.g. developed by product technical committees.

59 The present standard is intended to be used by product technical committees when producing product
60 specific or product group standards.

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61 Introduction

62 As Energy-related Products (ErP) can often not be completely recycled and the benefits associated with
63 material recovery cannot fully compensate the energy (and material) demand of the whole production
64 chain, each disposed ErP also means losses in energy and materials. Therefore, increasing durability of
65 ErPs can contribute to reduce the material and energy demand and related environmental impacts.

66 When considering durability, the trade-off between longer lifetime (reducing impacts related to the
67 manufacturing and disposal of the product) and reduced environmental impacts of new products
68 compared to worse and/or decreasing energy efficiency of older products needs to be considered.
69 Considerations such as these are addressed in the preparatory studies commissioned under Directive
70 2009/125/EC. Whilst such aspects establish a relevant context for this standard, they are not addressed
71 in this document.

72 This standard covers a general method for the assessment of the durability of ErPs. To cover the whole
73 lifetime of a product, the generic standards on “Ability to repair, reuse and upgrade –
74 CLC/prEN 45554:2019”, “Ability to re-manufacture – CLC/prEN 45553:2019”, (both currently under
75 preparation) or similar standards can be taken into consideration.

76 This document describes general assessment approaches that can be adapted for application at a
77 product-specific level. In order to assess the durability of ErP, Reliability is an element of durability,
78 representing the assessment of the time from first use to first failure or in-between failures, whilst
79 durability is the whole assessment from production to end of life.

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prEN 45552:2018 (E)**1 Scope**

This document defines parameters and methods as a framework in order to assess the durability of ErP. It is intended to be used in preparation of product-specific standardization deliverables on durability assessment.

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 12973:2000, *Value management*

CLC/prEN 45559, *Methods for providing information relating to material efficiency aspects of energy-related products*

EN 62308:2006, *Equipment reliability - Reliability assessment methods*

EN 62506:2013, *Methods for product accelerated testing*

EN 60812, *Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)*

3 Terms and definitions

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

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

Note 1 to entry: See CLC/prTR 45550 for additional definitions.

3.1 durability
durability <of a part or a product>
ability to function as required, under defined conditions of use, maintenance and repair, until a final limiting state is reached

Note 1 to entry: The degree to which maintenance and repair are within scope of durability will vary by product or product group.

Note 2 to entry: The final limiting state has to be defined by the user of this document. For more information see Figure D.1.

3.2 limiting event
event which results in a primary or secondary function no longer being delivered

Note 1 to entry: Examples of limiting events are failure, wear-out failure or deviation of any analogue signal.

- 114 **3.3**
115 **limiting state**
116 condition after one or more limiting event
- 117 **3.4**
118 **maintenance**
119 action carried out to retain a product in a condition where it is able to function as required
- 120 Note 1 to entry: Examples of such actions include inspection, adjustments, cleaning, lubrication, testing, and
121 replacement of wear-out part. Such actions could be performed by users in accordance with instructions provided
122 with the equipment (e.g. replacement or recharging of batteries); or the actions could be performed by service
123 personnel in order to ensure that parts with a known time to failure are replaced in order to keep the product
124 functioning.
- 125 **3.5**
126 **reliability**
127 probability that a product functions as required under given conditions, including maintenance, for a
128 given duration without failure
- 129 Note 1 to entry: The intended function(s) and given conditions are described in the user instructions provided
130 with the product.
- 131 Note 2 to entry: Duration can be expressed in units appropriate to the part or product concerned, e.g. calendar
132 time, operating cycles, distance run, etc., and the units should always be clearly stated
- 133 **3.6**
134 **primary function**
135 function fulfilling the intended use
- 136 Note 1 to entry: There can be more than one primary function.
<https://standards.iteh.ai/catalog/standards/sist/0701dc5f-3540-4023-abb8-02aad5c842ac/sist-en-45552-2020>
- 137 **3.7**
138 **secondary function**
139 function that enables, supplements or enhances the primary function(s)
- 140 [SOURCE: EN 62542:2017; 5.14,]
- 141 **3.8**
142 **tertiary function**
143 function other than a primary or a secondary function
- 144 [SOURCE: EN 62542:2017; 5.16, modified examples deleted]
- 145 **3.9**
146 **functional analysis**
147 process that describes the functions of a product and their relationships, which are systematically
148 characterised, classified and evaluated
- 149 **3.10**
150 **normal environmental conditions**
151 characteristics of the environment in the immediate vicinity of the product during transport, storage,
152 use, maintenance and repair life phases, which may affect its performance during normal use
- 153 Note 1 to entry: Examples of environmental conditions are pressure, temperature, humidity, radiation,
154 vibration.

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155 Note 2 to entry: Given normal environmental conditions and defined environmental conditions of transport,
156 storage, use, maintenance and repair, refer to a specified subset of normal environmental conditions which are
157 used for the assessments.

3.11**normal use**

160 use of a product, including its transport and storage, or a process, in accordance with the provided
161 information for use or, in the absence of such, in accordance with generally understood patterns of
162 usage

163 Note 1 to entry: Normal use should not be confused with intended use. While both include the concept of use as
164 intended by the manufacturer, intended use focuses on the purpose while normal use incorporates not only the
165 purpose, but transport and storage as well

166 [SOURCE: IEC 871-04-22]

3.12**normal operating conditions**

169 characteristic in operation which may affect performance of the product during intended use

170 Note 1 to entry: Examples of operating conditions are, modified environmental conditions when the product
171 operates (Self-heating, condensation), characteristics of the power supply, duty cycle, load factor, vibration due to
172 operation.

173 Note 2 to entry: Given normal operating conditions and defined operating conditions of use, maintenance and
174 repair, refer to a specified subset of normal operating conditions which are used for the assessments.

3.13**intended use**

177 use in accordance with information provided with a product or system, or, in absence of such
178 information, by generally understood patterns of usage

179 Note 1 to entry: Intended use should not be confused with normal use. While both include the concept of use as
180 intended by the manufacturer, intended use focuses on the purpose while normal use incorporates not only the
181 purpose, but transport and storage as well.

182 [SOURCE: ISO/IEC Guide 51:2014; 3.6, modified Note 1 to entry added]

3.14**wear-out failure**

185 failure due to cumulative deterioration caused by the stresses imposed in use

186 Note 1 to entry: The probability of occurrence of a wear-out failure typically increases with the accumulated
187 operating time, number of operations, and/or stress applications.

188 Note 2 to entry: In some instances, it may be difficult to distinguish between wear-out and ageing phenomena.

189 [SOURCE: IEC 192-03-15]

3.15**repair**

192 process of returning a faulty product to a condition where it can fulfil its intended use (3.13)

193 **3.16**
 194 **part**
 195 hardware or software constituent of a product

196 [SOURCE: CLC/prEN 45554; 3.2]

197 **4 Concept and process overview**

198 **4.1 Concept**

199 There are some key concepts to consider when addressing durability. The durability can be limited by
 200 fatigue/ageing of a part, which can cause a limiting event. A limiting event occurs when a primary or
 201 secondary function is no longer delivered. This results in the product being in a limiting state. The
 202 durability assessment can take into account a number of maintenance and repair actions. The
 203 maintenance and repair actions shall be included in the given normal environmental and operating
 204 conditions. Durability is usually expressed as time, number of cycles or distance.

205 The reliability of a product is directly related to its probability of failure or its failure rate (examples are
 206 available in EN 61703:2016) under given normal environmental and operating conditions. When
 207 carrying out a reliability assessment, the statistical distribution of limiting events is considered.

208 The time at which a certain percentage of products have reached a limiting state (e.g. time by which
 209 10 % will fail) is used to assess and compare the time to a limiting event. However, other reliability
 210 assessments such as mean time to failure (MTTF), mean time to first failure (MTTFF) and mean time
 211 between failures (MTBF) are also used. The reliability assessment between the first use of the product
 212 and the first limiting event does not take repair into account. However, the reliability assessment
 213 between two consecutive limiting events takes into account the effects of a previous repair.

214 NOTE Reliability and durability are defined in the standardization framework and are relevant methods to
 215 estimate the technical lifetime of a product. Whilst "Minimum Lifetime" can be specified this requires a wider
 216 consideration than reliability and durability assessment, as it could include additional aspects such as economic,
 217 social or regulatory requirements.

218 **4.2 Process overview and guidance**

219 The users of this document shall specify the product group in terms of functions and, if applicable, in
 220 accordance with relevant product group standards (see subclause 5.1).

221 The users of this document shall use the results of the functional analysis (see subclause 5.1),
 222 environmental and operating conditions (see subclause 5.2) and additional input data (see subclause
 223 subclause 5.3) in order to conduct a product group specific reliability analysis developed for a product
 224 group (see subclause 6.2). The result is a rank-ordered list of functions and parts providing the
 225 functions linked to

226 — failure modes,

227 — failure sites, and

228 — failure frequencies.

229 Consecutively, the reliability of the functions/parts should be validated by either existing methods or
 230 methods which have to be developed (see subclause 6.3). In succession, the reliability of the product
 231 should be validated (see subclause 6.4). These can then be used for conformity assessment of individual
 232 products in the respective product group.

233 NOTE 1 Product group, as used in this document, refers as an umbrella term to a group of products with similar
 234 properties and main function(s).

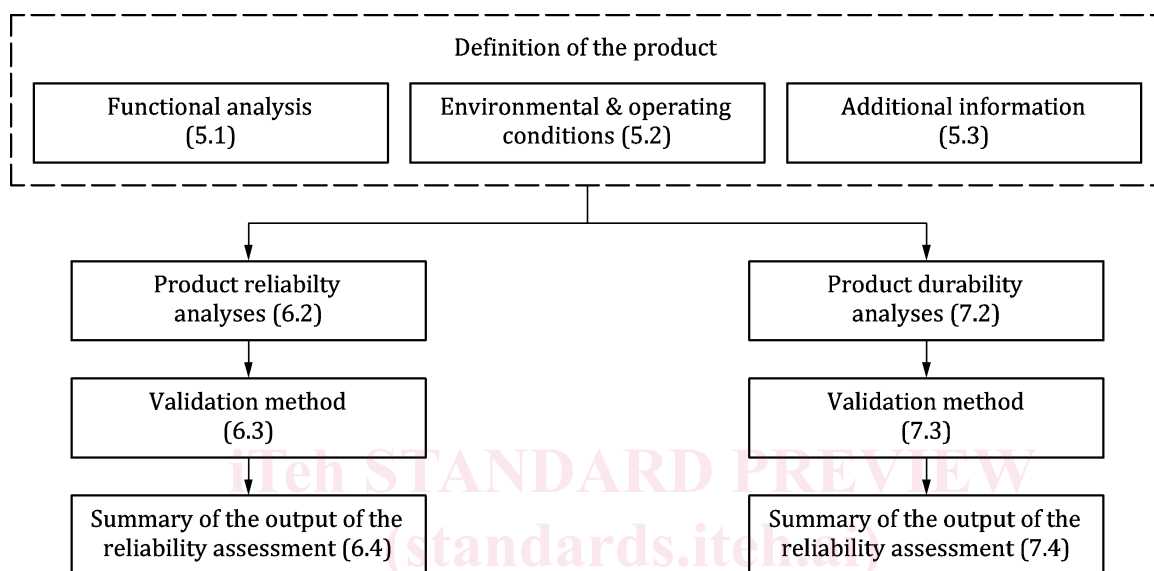
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235 NOTE 2 Software and/or firmware are also considered as part.

236 For the durability analysis of a product group (see subclause 7.3), the user of this document shall take
237 into account among others, repair considerations, special environmental conditions and misuse (see
238 subclause 7.2). Consecutively, the durability of the product should be validated (see subclause 7.4).

239 Results of the reliability and durability analysis may be reported according to Clause 8.

240 Figure 1 illustrates the key stages and the information required for an assessment of the reliability and
241 durability. The user of this document shall use the standard in accordance to it.



242

243

Figure 1 — General reliability and durability assessment procedure

244 5 Definition of the Product

245 5.1 Functional analysis

246 The product group being addressed shall be defined in terms of functions. Functional analysis is a
247 process that results in a comprehensive description of the functions and their relationships, which are
248 systematically characterized and classified. Any complete functional analysis enables a detailed
249 understanding regarding the product characteristics, how the functionality can be achieved embedding
250 constraints coming from regulatory framework (such as EMC). Functional analysis in accordance with
251 EN 12973:2000 A.1.2 or equivalent should be applied to determine all functions of the product group
252 during its lifecycle. Functional analysis is a restricted data in accordance with CLC/prEN 45559.

253 NOTE However focusing to the assessment method of durability the scope of the functional analysis might
254 cover only transportation, storage, use, maintenance and repair phases. As example of functional analysis, the
255 FAST methodology could be applied (EN 12973:2000; A.1.2.2.3.c) to assess an existing product or to design a
256 product.

257 There are three types of functions:

- 258 — primary function(s);
- 259 — secondary function(s);
- 260 — tertiary function(s).