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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

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

If this draft becomes a European Standard, CEN and CENELEC 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.

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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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European foreword

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

This document is currently submitted to the CEN Enquiry.

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

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

a) Extending product lifetime;

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

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

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

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

Introduction

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

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

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

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

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.

3.3
limiting state
condition after one or more limiting event

3.4
maintenance
action carried out to retain a product in a condition where it is able to function as required

Note 1 to entry: Examples of such actions include inspection, adjustments, cleaning, lubrication, testing, and replacement of wear-out part. Such actions could be performed by users in accordance with instructions provided with the equipment (e.g. replacement or recharging of batteries); or the actions could be performed by service personnel in order to ensure that parts with a known time to failure are replaced in order to keep the product functioning.

3.5
reliability
probability that a product functions as required under given conditions, including maintenance, for a given duration without failure

Note 1 to entry: The intended function(s) and given conditions are described in the user instructions provided with the product.

Note 2 to entry: Duration can be expressed in units appropriate to the part or product concerned, e.g. calendar time, operating cycles, distance run, etc., and the units should always be clearly stated

3.6
primary function
function fulfilling the intended use

Note 1 to entry: There can be more than one primary function.

3.7
secondary function
function that enables, supplements or enhances the primary function(s)

[SOURCE: EN 62542:2017; 5.14,]

3.8
tertiary function
function other than a primary or a secondary function

[SOURCE: EN 62542:2017; 5.16, modified examples deleted]

3.9
functional analysis
process that describes the functions of a product and their relationships, which are systematically characterised, classified and evaluated

3.10
normal environmental conditions
characteristics of the environment in the immediate vicinity of the product during transport, storage, use, maintenance and repair life phases, which may affect its performance during normal use

Note 1 to entry: Examples of environmental conditions are pressure, temperature, humidity, radiation, vibration.

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

3.11

normal use

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

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

[SOURCE: IEV 871-04-22]

3.12

normal operating conditions

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

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

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

3.13

intended use

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

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

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

3.14

wear-out failure

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

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

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

[SOURCE: IEV 192-03-15]

3.15

repair

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

3.16
part
hardware or software constituent of a product

[SOURCE: CLC/prEN 45554; 3.2]

4 Concept and process overview

4.1 Concept

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

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

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

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

4.2 Process overview and guidance

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

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

— failure modes,

— failure sites, and

— failure frequencies.

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

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