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colour inside

Guidance on material circulation considerations in environmentally conscious design

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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GUIDANCE ON MATERIAL CIRCULATION CONSIDERATIONS IN ENVIRONMENTALLY CONSCIOUS DESIGN

FOREWORD

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IEC TS 63428 has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
111/759/DTS	111/772/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

The circular economy can be described as a systemic approach to the design of processes, products (including services) and business models, that tackles global challenges like climate change, resource depletion, biodiversity loss, waste, and pollution. It is based on the principles driven by design: eliminate waste and pollution, decreasing the use of resources, circulate products and materials (at their highest value), and regenerate nature. As such it focuses on managing resources more effectively and increasingly closing material flows. Changing from the traditional linear economy to a circular economy represents a paradigm shift in the way that society and natural capital are interrelated.

Different geographies have already introduced or are expected to introduce soon, the concept of circular economy into their legal systems. Standards can assist the effective adoption of legislation. It is important that the international community speed up addressing this topic, for example, CEN and CENELEC are already doing this in Europe on the assessment of the different aspects of material efficiency such as durability, ability to repair, reuse and upgrade, recyclability and recoverability, proportion of reused components, proportion of recycled content, and the ability of a product to be remanufactured.

Current IEC standards deal with functional approaches and dependability topics. Both can support material circularity optimization during the design phase across the different life cycle stages. Material circularity for a product can be supported by a systematic design approach taking all life stages of the product into consideration.

The design for material circularity means a design contributing to circular economy. This covers several interrelated efficiencies such as material efficiency, energy efficiency, and environmental footprint efficiency. Safety and health as functional priorities are covered by other standards.

Whereas ISO 14009 provides guidance and requirements for management systems to support incorporating material circulation in design and development, this document focuses on integrating the material circularity aspects in the design and development processes.

The design for material circularity supports innovation and technology managers, product designers and engineers by analysing the consequences of their ideas and decisions to the different life cycle stages of a product. Facilitating circulation of materials by closing the flow will assist organizations in fulfilling the objectives of circular economy, which is increasingly becoming an important objective in many parts of the world.

Environmentally conscious design (ECD) is the overarching concept applying life cycle thinking (LCT), which includes material circularity. This document, focusing on material circularity, aims at minimizing material losses and closing the material flow of the product's entire life.

This document is intended to become a horizontal document in a future edition, for example, if it becomes an International Standard.

GUIDANCE ON MATERIAL CIRCULATION CONSIDERATIONS IN ENVIRONMENTALLY CONSCIOUS DESIGN

1 Scope

This document describes principles and provides guidance on how to embed material circularity aspects into the design and development of products.

This includes making efficient use of materials and closing material flows in design and production, extending the lifetime of products through increased durability and enabling parts and materials to be reused or recycled at end-of-life.

- Closing the material flows includes the use of recycled content and reused parts.
- Durability extensions include such measures as to improve reliability and maintenance, enable and facilitate repair, provide updates and upgrades, refurbish and reuse.
- Improvements in material recyclability, parts reuse, and remanufacturing are possible through measures such as design for disassembly, separability of materials, choice of materials, traceability of materials, and durability of parts.

This document builds on the jointly published (ISO and IEC) document, IEC 62430:2019 for requirements for environmentally conscious design (ECD) processes, and it supplements ECD by adding more specific guidance on the aspects of material circularity and material efficiency.

This document only deals with material circularity of products. Economic, social and energy aspects are excluded from the scope of this document.

This document is applicable to all electrotechnical products including goods and services.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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

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

3.1.1
circular economy
economic system that uses a systemic approach to the sustainable development by optimizing the use of natural resources, aiming to eliminate losses and emissions, circulate products and materials at their highest value for as long as possible

Note 1 to entry: Circular economy is driven by design aiming at enhancing value by increasing the satisfaction of the needs and expectations of users, in relation to the resources used.

Note 2 to entry: Circular economy supports natural systems regeneration.

Note 3 to entry: A concept diagram of a circular economy is given in Figure 1.

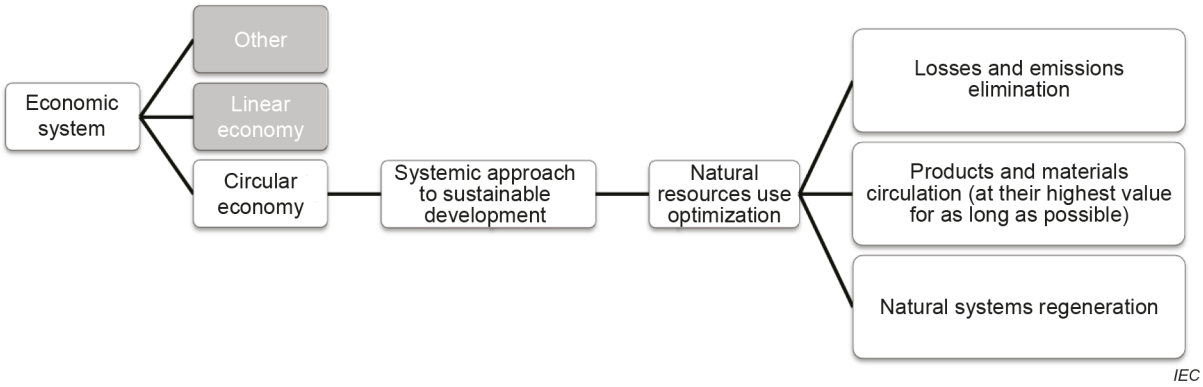

Figure 1 – Concept diagram of a circular economy

Note 4 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.2
corrective maintenance
maintenance carried out after fault detection to effect restoration

Note 1 to entry: Corrective maintenance of software invariably involves some modification.

[SOURCE: IEC 60050-192:2015, 192-06-06]

3.1.3
critical raw material
CRM
materials which, according to a defined classification methodology, are economically important, and have a high risk associated with their supply

[SOURCE: EN 45558:2019, 3.1.1, modified – The note has been deleted.]

3.1.4
durability
<of a part or a product> ability to function as required, under specified conditions of use, maintenance and repair, until the end-of-life is reached

Note 1 to entry: The criteria for transition from non-functional state to end-of-life should be specified. The criteria is based on predictable aspects (e.g. technical aspects) so that the durability can be estimated.

Note 2 to entry: Durability can be expressed in units appropriate to the part or product concerned, e.g. calendar time, operating cycles, distance run, etc.

Note 3 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.5
environmentally conscious design
ECD
systematic approach which considers environmental aspects in the design and development with the aim to reduce adverse environmental impacts throughout the life cycle of a product

Note 1 to entry: Other terminology used worldwide with the same meaning includes ecodesign, design for environment (DFE), green design and environmentally sustainable design.

[SOURCE: IEC 62430:2019, 3.1.1]

3.1.6
functional analysis
systematic investigation of the functions of a real or planned system

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.1685, modified – The second definition was deleted.]

3.1.7
maintenance
process to retain a product, or restore it to, a state in which it can perform as intended

[SOURCE: IEC 60050-192:2015, 192-06-01, modified –"combination of all technical and management actions intended" has been replaced with "process", "item" has been replaced with "product", "required" has been replaced with "intended", and the Note to entry has been deleted.]

3.1.8
material
(physical) matter composed by one or more substances

[SOURCE: IEC/ISO 82474-1:—, 3.1.7]

3.1.9
material circularity
capability for product, parts, and the materials they are composed of to be kept in value retention loops

Note 1 to entry: Value retention loops refer to the capability of products and parts to have their life maintained or extended through multiple uses and materials to be recovered at end-of-life.

Note 2 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.10
material efficiency
degree to which a system or product performs its designated functions with effective use of materials

Note 1 to entry: An effective use of materials can be achieved through balancing material use, product durability, and recovery.

3.1.11
product
good, service or combination hereof

Note 1 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.12
refurbishing
reconditioning
industrial process to return a used product or part to its original or predetermined design

Note 1 to entry: Original design include form, functionality, performance and safety aspects.

Note 2 to entry: Upgrade could take place simultaneously with refurbishment. The refurbished product remains within the limits of the original specifications.

Note 3 to entry: The identity of the product or part shall be maintained (e.g. serial or type number).

Note 4 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.13
reliability
<of a product> ability to perform as required, without failure, for a given time interval, under given conditions

Note 1 to entry: The time interval duration can be expressed in units appropriate to the item concerned, e.g. calendar time, operating cycles, distance run, etc., and the units should always be clearly stated.

Note 2 to entry: Given conditions include aspects that affect reliability, such as: mode of operation, stress levels, environmental conditions, and maintenance.

[SOURCE: IEC 60050-192:2015, 192-01-24, modified – The domain, "<of an item>" has been replaced with "<of a product>" and Note 3 to entry has been deleted.]

3.1.14
remanufacturing
industrial process to create a product by combining different parts from used products and including, where necessary, new parts

Note 1 to entry: Remanufacturing also occurs when at least one change is made which influences the safety or original performance of an existing product.

Note 2 to entry: The product shall be given a new identity (for example serial or type number) .

Note 3 to entry: This terminological entry is based on IEC 60050-193:—.

3.1.15
repair
direct action taken to effect restoration

Note 1 to entry: Repair includes fault localization (IEV 192-06-19), fault diagnosis (IEV 192-06-20), fault correction (IEV 192-06-21), and function checkout (IEV 192-06-22).

[SOURCE: IEC 60050-192:2015, 192-06-14]

3.1.16
reuse
operation by which a product or part having reached the end-of-use is used again

Note 1 to entry: Reused for another purpose is called repurpose.

Note 2 to entry: This terminological entry is based on IEC 60050-193:—.