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Sustainable management of waste electrical and electronic equipment (e-waste)

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Sustainable management of waste electrical and electronic equipment (e-waste)

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The text of this International Standard is based on the following documents:

Draft	Report on voting
111/864/FDIS	111/894/RVD

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 International Standard 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.

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– reconfirmed,
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– revised.

INTRODUCTION

Electrical and electronic equipment has become a defining and ubiquitous feature of modern life, which has raised living standards in most of the countries worldwide.

Globally, the slow adoption of sustainable practices for the management of waste electrical and electronic equipment (e-waste) means that environmental impacts due to, for example, resource consumption, greenhouse gas emissions, and hazardous substance releases continue unabated.

As a result, many countries face challenges related to considerable environmental and human health risks caused by inadequately managed e-waste.

This is all the more critical as collection and recovery activities are failing to keep up with total e-waste generation. According to the Global E-waste Monitor 2024, less than a quarter of e-waste generated was officially documented as collected and recycled. Electronic waste generation is rising five times faster than documented e-waste recycling.

This document sets out requirements for the sustainable management of e-waste, thereby contributing to the following objectives:

– protecting human health and safety and the environment;
– maximizing resource circularity through the recovery of e-waste products, components and materials;
– optimizing the quality of recovered products, components and materials;
– minimizing the quantity of e-waste being disposed of;
– preventing unsustainable and unsafe e-waste recovery and disposal practices;
– preventing or minimizing, or both, pollution and emissions;
– providing a framework for assuring the environmental sustainability of output of product, component and material recovery operations;
– preventing shipments of e-waste to operators whose activities do not conform with this document or a comparable set of requirements.

1 Scope

This document specifies requirements and provides guidance for the sustainable management of waste electrical and electronic equipment (e-waste) for all process steps, from collection to returning recovered products, components, materials or energy to the value chain. It includes traceability, monitoring and evaluation of the e-waste flow, recovery rate and recovery quality.

This document is intended for use by an organization involved in e-waste management seeking to manage its responsibilities in a systematic manner.

The requirements set by this document will help an organization to achieve sustainability outcomes within the context of e-waste management, including:

– enhancement of organizations' performance in relation to quality, environment and occupational health and safety;

– fulfilment of compliance obligations.

This document is applicable to any organization, regardless of its size, type and nature.

This document applies to the environmental, health and safety, and quality aspects of e-waste management activities that the organization determines it can either control or influence, from a lifecycle perspective.

NOTE 1 Social aspects – e.g. employment creation, conflict minerals, employment conditions – are not addressed directly but indirectly through the benefits of sustainable management of e-waste.

NOTE 2 Additional local requirements or regulations can apply.

This document is a basic environment horizontal publication focusing on essential requirements and is primarily intended for use by committees in the preparation of publications within the area of environment in accordance with the principles laid down in IEC Guide 123. Wherever applicable, it is the responsibility of committees to make use of environment basic publications in the preparation of their environment group and product publications. Committees can apply this document directly to products when they do not develop a product publication in the area of environment.

2 Normative references

There are no normative references in this document.

3 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
e-waste
WEEE
waste electrical or electronic equipment
electrical or electronic equipment that the holder discards or is required to discard

Note 1 to entry: All components, sub-assemblies and consumables which are part of the equipment at the time the equipment is discarded, even if not attached to the product when discarded, are also considered as e-waste.

[SOURCE: IEC FDIS 60050-193:2026, 193-04-02, modified – Note 1 to entry has been added.]

3.2
hazardous material
material containing one or more hazardous substances

3.3
hazardous substance
substance which can adversely affect human health or the environment with immediate or retarded effect, either by itself or through interaction with other factors

Note 1 to entry: Hazardous substances are typically identified by international or national regulations.

3.4
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to sole trader, company, corporation, firm, enterprise, authority, partnership, charity, or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE ISO 9000:2015, 3.2.1, modified – In Note 1 to entry, the term "association" has been deleted; Note 2 to entry has been deleted.]

3.5
compliance obligation
legal requirement that an organization must comply with and other requirements that an organization must or chooses to comply with

Note 1 to entry: Compliance obligations can arise from mandatory requirements, such as applicable laws and regulations, or voluntary commitments, such as organizational and industry standards, contractual relationships, codes of practice and agreements with community groups or non-governmental organizations.

[SOURCE: ISO 14001:2015, 3.2.9, modified – The plural form of the term has been changed to its singular form, the admitted term has been deleted, verbal form "has to" has been changed to "must", Note 1 to entry has been deleted.]

3.6
record
document stating results achieved or providing evidence of activities performed

Note 1 to entry: Records can be used, for example, to formalize traceability and to provide evidence of verification, preventive action, and corrective action.

Note 2 to entry: Generally, records need not be under revision control.

[SOURCE: ISO 9000:2015, 3.8.10]

3.7
documented information
information required to be controlled and maintained by an organization and the medium on which it is contained

Note 1 to entry: Documented information can be in any format and media, and from any source.

Note 2 to entry: Documented information can refer to:

– the environmental management system, including related processes;

– information created in order for the organization to operate (can be referred to as documentation);

– evidence of results achieved (can be referred to as records).

[SOURCE: ISO 14001:2015, 3.3.2]

3.8
traceability
<circular economy and material efficiency> ability to trace the origin, history, application, location or certain characteristics of a product

Note 1 to entry: The term "traceability" is also defined in the context of electrical and electronic measurements (IEV 311-01-15).

Note 2 to entry: When considering a product, traceability can be related to:

– the origin of materials and parts;

– the history of the processing;

– the distribution and localization of products, including their recovery pathways and final disposal of non-recoverable fractions.

[SOURCE: IEC FDIS 60050-193:2026, 193-01-09, modified – At the end of the definition, "or material" has been deleted, Note 2 to entry has been added.]

3.9
transboundary movement
movement of e-waste across a national border from one country to another

3.10
recovery pathway
type and sequence of processes applied to recover products, components and materials from e-waste collected

3.11
recovery potential
potential of e-waste to be recovered as products, components or materials

Note 1 to entry: Criteria used to determine the recovery potential include environmental, social and economic benefit; functionality, usability and repairability of the e-waste; legal compliance; available recovery technologies; available downstream recovery organizations or end markets.

3.12
product or component recovery
controlled process whereby functioning products or components are recovered from end-of-life products or waste and are brought back to use for the same or different purpose

Note 1 to entry: Processes for product recovery can include refurbishment, remanufacture and repurposing.

Note 2 to entry: Processes for component recovery can include disassembly, cleaning, and testing.

Note 3 to entry: Recovery of components for subsequent recovery of the materials contained in the components is considered as material recovery.

Note 4 to entry: Recovery is considered completed when the "criteria for completed recovery" in 6.6.2.2 are fulfilled.

[SOURCE: IEC FDIS 60050:193:2025, 193-04-05, modified – "parts" replaced with "components", Note 3 to entry and Note 4 to entry has been added]

3.13
material recovery
controlled processing of end-of-life products or waste to produce useful material

Note 1 to entry: Processes for material recovery can include dismantling, depollution, grinding, shredding, milling, concentration, homogenization, refining, etc. as well as chemical processes excluding chemical recycling of polymeric waste.

Note 2 to entry: The result of the material recovery is either alternate material or material that will be further processed in material recycling.

Note 3 to entry: Material recovery results in circular material, i.e. material that can be recovered again.

Note 4 to entry: Recovery of components for subsequent recovery of the materials contained in the components is considered as material recovery

[SOURCE: IEC 60050-193:2026, 193-04-07, modified – The Figure has been deleted, Note 1 to entry "as well as chemical processes excluding chemical recycling of polymeric waste" has been added, Note 4 to entry has been replaced with new Note 4 to entry]

3.14
energy recovery
production of useful energy through direct and controlled combustion or other processing of waste

EXAMPLE Producing hot water, steam and/or electricity are common means for energy recovery.

[SOURCE: IEC 60050-904:2014, 904-04-03, modified – Note 1 to entry was transformed into an example and "Waste incinerators" has been deleted]

3.15
input
product, material or energy flow that enters a process

Note 1 to entry: Products and materials include raw materials, intermediate products and co-products.

[SOURCE: ISO 14044:2006, 3.21, modified – In the definition, term "unit" has been deleted]

3.16
output
product, material or energy flow that leaves a process

Note 1 to entry: Products and materials include raw materials, intermediate products, co-products, and releases.

[SOURCE: ISO 14044:2006, 3.25, modified – In the definition, term "unit" has been deleted]

3.17
throughput
total quantity of a product, material or energy flow that passes through a process

Note 1 to entry: Products and materials include raw materials, intermediate products, co-products, and releases.

3.18
identification
process of recognizing the attributes that identify the object

[SOURCE: ISO 16678:2014, 2.1.7]

3.19
classification
attribute-based differentiation

Note 1 to entry: An attribute is defined by a list of enumerators.

[SOURCE: ISO 23150:2023, 3.3.3]

3.20
pollutant
substance which either alone or in combination with other substances or through its products of degradation or emissions can have a harmful effect on human health or the environment

[SOURCE: ISO 16000-32:2014, 3.7, modified – In the definition, "or can lead to a reduction in the value or restriction in the use of the building" has been deleted.]

3.21
disposal
final disposal

treatment that does not lead to the recovery of product, parts, materials or energy

[SOURCE: IEC FDIS 60050-193:2026, 193-04-28, modified – term "disposal" is used as preferred term, the figure has been deleted, the note to entry has been deleted.]

3.22
treatment
any process step that occurs after collection

3.23
life cycle perspective
consideration of the environmental, health and safety aspects relating to a product during its entire life cycle

Note 1 to entry: The life cycle is considered to be circular and to include the return of recovered products, components or materials to use or production.

[SOURCE: ISO 14050:2020, 3.6.33, modified – The preferred term "life cycle thinking" and the abbreviated term "LCT" have been deleted, in the definition, "health and safety aspects" has been added, Note 1 to entry has been added.]

3.24
repair
direct action taken to effect restoration

Note 1 to entry: Repair includes fault localization, fault diagnosis, fault correction and function checkout.

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

3.25
refurbishment
refurbishing
reconditioning
industrial process to restore or improve a used product or part within the limits of its original or predetermined design

Note 1 to entry: Original or predetermined design includes form, functionality, performance and safety aspects.

Note 2 to entry: Refurbishment can extend the remaining lifetime of the product.

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

3.26
remanufacture
remanufacturing
industrial process to create a product by combining different parts from used products and including, where necessary, new parts

Note 1 to entry: The product must be given a new identity (e.g. serial or type number).

[SOURCE: IEC 60050-193:2026, 193-06-04, modified – "remanufacturing" has been changed to preferred term, the reference to the figure has been deleted.]

4 Principles for sustainable e-waste management

4.1 Best environmental outcome

This principle aims to deliver the best environmental outcome from a lifecycle perspective, generally prioritising, waste prevention and extending product life (product and component recovery) over recycling (material recovery), energy recovery and disposal.

NOTE Resource conservation is integral to the Best environmental outcome.

4.2 Pollution prevention

This principle aims to promote the use of processes, practices, techniques, materials, products, services or energy that avoid, reduce or control (separately or in combination) the creation, emission or discharge of any type of pollutant or waste, in order to reduce adverse environmental impacts.

4.3 Systems approach

This principle aims to promote an approach that fosters understanding how an organization's activities impact the process flow within the e-waste recovery system and anticipating outcomes resulting from the behaviour of different organizations within the system.

4.4 Precautionary principle

This principle aims to promote preventive action against the use of practices or substances identified as potentially harmful in the absence of scientific evidence or certainty.

4.5 Lifecycle perspective

This principle aims to promote the systematic consideration of the environmental impacts of products over their lifecycle to inform decisions about the sustainable management of e-waste.

4.6 Collaboration and innovation

This principle aims to promote the development and implementation of networks and mechanisms for collaboration that facilitate innovative technologies and practices for the recovery of resources contained in e-waste.

4.7 Continual improvement

This principle aims to promote an approach to implement recurring activities to continually enhance organizations' sustainable e-waste management performance.

5 Overview e-waste management process flow

The conceptualization adopted in this document applies circular economy thinking and the best environmental outcome principle whereby waste prevention and extending product life (product and component recovery) are generally prioritised over recycling (material recovery), energy recovery and disposal. This document enables organisations to implement this approach in practice by using the Methodology for deciding the Recovery Pathway (see 8.3 and Annex B).

Figure 1 illustrates the e-waste management process flow as conceptualized in this document.

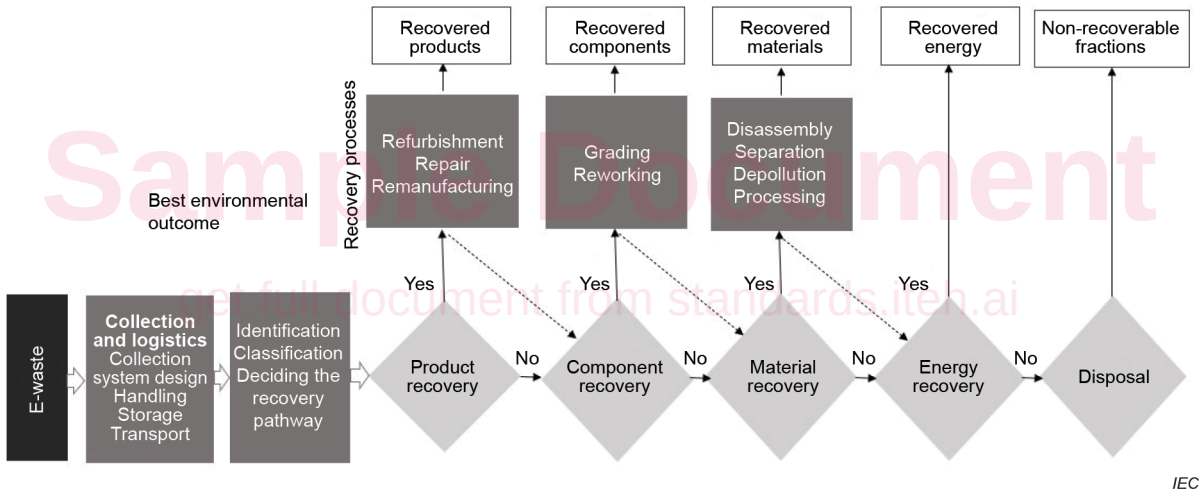

Figure 1 – E-waste management process flow chart

Different process steps are not necessarily undertaken at one single location or by one single organization. The applicable process steps depend on the activities and processes undertaken by the organization.

Table 1 below shows the range of different organizations that can be involved in the e-waste management process flow.