



IEEE Standard for Environmental Assessment of Imaging Equipment

STANDARDS

IEEE Computer Society

Developed by the
Environmental Assessment Standards Committee

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(Revision of IEEE Std 1680.2-2012)



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Developed by

Environmental Assessment Standards Committee
of the
IEEE Computer Society

Approved 21 March 2024

IEEE SA Standards Board

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Abstract: A clear and consistent set of environmental performance criteria for the design of imaging equipment products is established, providing an opportunity to secure market recognition for efforts to reduce the environmental impact of electronic products. This standard is also intended to provide a tool for government, institutional, corporate, and consumer purchasers to identify products that demonstrate environmental leadership. The intent is that the standard will be updated and revised periodically to continue to set a higher performance standard for leadership products.

Keywords: amendment, cartridges, consumables, copiers, digital duplicators, electronic product, electronic product design, end-of-life, environment, environmental impact, environmental leadership, environmental performance, facsimile machines, fax machines, IEEE 1680.2™, imaging equipment, mailing machines multifunction devices, printers, scanners, toner

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¹Available at: <https://ieeexplore.ieee.org/browse/standards/collection/ieee>.

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Introduction

This introduction is not part of IEEE Std 1680.2-2024, IEEE Standard for Environmental Assessment of Imaging Equipment.

IEEE Std 1680.2 was developed due to a growing demand by purchasers for an easy-to-use evaluation tool that allows the comparison and selection of electronic products based on environmental performance.

This standard is intended to be used by government, institutional, corporate, and consumer purchasers in the selection of electronics products based on environmental performance, and by product designers and manufacturers that wish to sell products that meet environmental performance standards.

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1. Overview

1.1 Scope

This standard defines environmental performance standards for imaging equipment (as defined by the U.S. ENERGY STAR® Imaging Equipment Specification^{4 1}) including copiers, digital duplicators, facsimile machines, multifunction devices, printers, mailing machines, and scanners, relating to [the](#) reduction or elimination of environmentally sensitive materials, materials selection, design for end-of-life, life-cycle extension, energy conservation, end-of-life management, corporate performance, packaging, consumables, and indoor air quality.

^{4 1} ENERGY STAR is a registered trademark of U.S. Environmental Protection Agency.

1.2 Purpose

This standard for imaging equipment is part of the IEEE 1680™ family of standards that provides a clear and consistent set of performance criteria for the design of electronic products^{5,2}; and provides an opportunity to secure market recognition for efforts to reduce the environmental impact of electronic products. This *imaging equipment standard* is intended to provide a tool for government, institutional, corporate, and consumer purchasers. Product manufacturers may use this tool to earn recognition in these markets, recognizing that certain criteria may not be applicable to all types of purchasers.

The environmental performance criteria of this standard are intended to define a measure of environmental leadership in the design and manufacture of imaging equipment, the delivery of specified services that are associated with the sale of the product, and in associated corporate performance characteristics. This standard is defined with the intention that the criteria are technically feasible to achieve, but that only products demonstrating the leading environmental performance currently available in the marketplace would meet them at the time of their adoption. As the environmental performance of products that are available in the marketplace improves, it is intended that the criteria will be updated and revised to set a higher performance standard for leadership products.

1.3 Application

The environmental performance criteria in Clause 4 apply to imaging equipment (as defined by the ENERGY STAR Imaging Equipment Specification) including copiers, digital duplicators, facsimile machines, multifunction devices, printers, mailing machines, and scanners.^{5,2} Within this standard, consumables are not considered part of the product and are addressed in a separate performance category within the standard. The principles and procedures identified in the base standard (IEEE Std 1680) apply to imaging equipment.

^{5,2} Information on references can be found in Clause 2.

The manufacturer shall declare if its product is an *institutional product* as defined in 3.2.

1.4 Word usage

The word *shall* indicates mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals *is required to*).^{6,7}

The word *should* indicates that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required (*should* equals *is recommended that*).

The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted to*).

The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

1.5 Conformance with this standard

The environmental and social responsibility performance criteria in this standard are of two types, as follows:

- Required criteria that all products shall meet in order to be considered conformant to this standard.
- Optional criteria that products may meet in order to gain additional points so as to be rated at a higher level of environmental and social responsibility performance.

⁶The use of the word *must* is deprecated and cannot be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.

⁷The use of *will* is deprecated and cannot be used when stating mandatory requirements; *will* is only used in statements of fact.

All criteria, including the optional criteria, use the “shall” construct since the defined criterion shall be met if the manufacturer wishes to receive the optional point(s). Optional criteria are worth one point each unless the criterion states a higher point value. Optional criteria may also be tiered; for example, one point is awarded for achieving a specified threshold, and additional points are awarded for attaining higher thresholds.

There shall be three levels of conformance to this standard—Bronze, Silver, and Gold:

- 1) To achieve the first level (Bronze), the product shall conform to all the required criteria.
- 2) To achieve the second level (Silver), the product shall conform to all the required criteria, plus at least 50% of the available optional points.
- 3) To achieve the third level (Gold), the product shall conform to all the required criteria, plus at least 75% of the available optional points.

If an optional criterion is “Not Applicable” to the product (for a product criterion) or the manufacturer (for a corporate criterion) as specified in the criterion, the point(s) associated with that criterion are removed from both the numerator and denominator when calculating the percent of optional points awarded (i.e., shall not be counted toward available optional points).

Each criterion in the standard is designated as either one of the following:

- Product criterion that applies to the specific product or its packaging.
- Corporate criterion that applies to a program or an offering of the manufacturer in general and are not exclusive to the specific product or its packaging.

The environmental and social responsibility performance criteria in Clause 4 are applicable to the product if the product or its packaging falls within the scope of products or packaging defined by the “applies to” section of the criterion. The criterion is satisfied if the product, or its packaging (as applicable) meets the requirements shown in the “product criterion” or if the manufacturer meets the “corporate criterion” section of the subclause. The “additional details” section of the subclause provides critical information that is valuable for interpreting the requirements of the criterion. The “verification requirements” section of the subclause specifies the data and information that a manufacturer shall supply to demonstrate conformance to each criterion.

Where a criterion includes a numerical threshold or calculation, conformance shall be evaluated using calculated values without any benefit from rounding.

See IEEE Std 1680.

~~1.5 Product Registration Entity and Market Surveillance Entity~~

See IEEE Std 1680.

~~In addition to provisions of IEEE Std 1680, a Product Registration Entity (PRE) may be authorized to qualify an Electronics Take Back Standard for use in conforming with applicable criteria in this standard if it determines that a particular standard meets all of the requirements listed in 4.6.2.1 of this standard. The PRE shall utilize the processes defined below in qualifying standards.~~

~~A Market Surveillance Entity (MSE) shall develop and operate a system by which PREs can be authorized to qualify electronics take back standards. Assessments for qualification of a standard shall be conducted by PREs that are independent of any business or financial relationships with electronics take back service providers and subscribers. Any Standard Assessors (SAs) who conduct the assessments and qualifications shall disclose any potential conflicts of interest and shall possess the requisite technical competency to perform these activities. Qualified standards shall be listed on an MSE Registry.~~

~~Authorized PREs shall maintain~~

- a) ~~A publicly available listing of Electronics Take Back Standard Assessors who have been trained and qualified to conduct such assessments.~~
- b) ~~A Qualification Panel consisting of experts who have been trained and qualified to qualify standards.~~

~~PREs shall establish and maintain a qualification process, defined as follows, by which entities can propose an Electronics Take Back Standard to be assessed for qualification for use in this end-of-life criterion:-~~

- ~~— The process is initiated when an authorized PRE is contacted by an interested party with a request to have a standard be qualified. The request shall specify the countries/regions in which the standard is applicable and shall be qualified for use.~~
- ~~— The applicant shall engage one or more SAs to assess the standard according to the requirements of 4.6.2.1, and for its applicability to be used in the countries/regions being requested. For qualification, all requirements in the Electronics Take Back Standard shall be fully implementable in the applicable countries/regions.~~
- ~~— The SA shall generate a recommendation for either qualification or rejection of the application, which is provided to the PRE.~~
- ~~— The PRE shall submit the recommendation to the Qualification Panel, which will make the final judgment regarding qualification of the standard and define the country(s)/region(s) in which the standard is applicable.~~
- ~~— The PRE shall provide information to an MSE on Qualified Standards for listing on an MSE Registry. All records of assessment and qualification shall be made publically available.~~
- ~~— Qualified Standards shall be listed on a Registry prior to any subscriber claiming they are being met when declaring to 4.6.2.1.~~

~~1.6 Verification of conformance with this standard~~

~~See IEEE Std 1680.~~

~~1.7 Qualified Verifier~~

~~See IEEE Std 1680.~~

2. Normative references

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used, so each referenced document is cited in text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

In the case of [European Union \(EU\)](#) Directives, which contain an adoption date in their title, when the EU repeals a directive and replaces it with a new directive, or otherwise edits and updates a directive, the new directive will apply as the referenced directive upon its enforcement date, unless otherwise explicitly stated in the normative reference.

ASTM D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics. ^{8.3}

ASTM D6400, Standard Specification for Labeling of Plastics Designed to be Aerobically Composted in Municipal or Industrial Facilities.

ASTM D6868, Standard Specification for Labeling of End Items that Incorporate Plastics and Polymers as Coatings or Additives with Paper and Other Substrates Designed to be Aerobically Composted in Municipal or Industrial Facilities.

^{8.3}ASTM publications are available from the American Society for Testing and Materials (<http://www.astm.org/>).

[Commission Notice: The 'Blue Guide' on the implementation of EU products rules 2016.](#)⁹

[Blue Angel RAL-UZ 122, Office Equipment with Printing Function \(Printers, Copiers, Multifunction Devices\), May 2009.](#)⁴

EN 13432, Requirements for packaging recoverable through composting and biodegradation—Test scheme and evaluation criteria for the final acceptance of packaging.^{10 5}

ENERGY STAR Imaging Equipment Specification.^{11 6}

European Union, Eco-Management and Audit Scheme (EMAS).^{12 7}

European Union Directive [2014/35](#) ~~2006/95~~/EC of the European Parliament and of the Council of [26 February 2014](#) ~~12 December 2006~~ on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

European Union, European Commission Directive [2012/19](#) ~~2002/96~~/EC of the European Parliament and of the Council [of 4 July 2012](#) on waste electrical and electronic equipment (WEEE).^{13 8}

European Union, European Commission Directive 2006/66/EC of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC.

⁹Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2016.272.01.0001.01.ENG.

⁴ Available at http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=147.

^{10 5} Available at <https://www.en-standard.eu/>. ~~<http://www.en-standard.eu/>~~

^{11 6} ENERGY STAR publications are available from the ENERGY STAR Website at <https://www.energystar.gov>. ~~<http://www.energystar.gov>~~

^{12 7} EMAS publications of the European Union are available at https://ec.europa.eu/environment/emas/index_en.htm. ~~http://ec.europa.eu/environment/emas/index_en.htm~~

^{13 8} European Union Directives are available at <https://europa.eu>.

European Union, ~~European Council former~~ Directive ~~2002/95/EC as amended by 2005/618/EC and 2011/65/EC~~ ~~EU~~ of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).⁻

European Union, Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators.¹⁴

European Union Regulation (EC) No. 1907/2006, Registration, Evaluation, Authorization and Restriction of Chemicals (REACH).^{15 9}

Greenhouse Gas (GHG) Protocol, Product Life Cycle Accounting and Reporting Standard.^{16 10}

IEC 60950-1, Information technology equipment—Safety—Part 1: General requirements.^{17 11}

IEC 62301, Household electrical appliances—Measurement of standby power.

IEC 62474, Material declaration for products of and for the electrotechnical industry.

IEEE Std 1680™, IEEE Standard for Environmental Assessment of Electronic Products.^{18, 19 12, 13}

ISO 179, Plastics—Determination of Charpy impact properties.^{20 14}

¹⁴ EU Battery directive is available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006L0066-20180704>

^{15 9} REACH regulations and information are available from the European Union at http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm.

¹⁰ Available at <http://www.ghgprotocol.org/about-ghgp>.

^{17 11} IEC publications are available from the International Electrotechnical Commission (<https://www.iec.ch/>). (~~<http://www.iec.ch/>~~). IEC publications are also available in the United States from the American National Standards Institute (<https://www.ansi.org/>). (~~<http://www.ansi.org/>~~).

^{18 12} IEEE publications are available from The Institute of Electrical and Electronics Engineers (<https://standards.ieee.org/>). (~~<http://standards.ieee.org/>~~).

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^{20 14} ISO publications are available from the ISO Central Secretariat (<https://www.iso.org/>). (~~<http://www.iso.org/>~~). ISO publications are also available in the United States from the American National Standards Institute (<https://www.ansi.org/>). (~~<http://www.ansi.org/>~~).

ISO 180, Plastics—Determination of Izod impact strength.

ISO 1043, Plastics—Symbols and Abbreviated Terms.

ISO 11469, Plastics—Generic identification and marking of plastics products.

ISO 14001, Environmental management systems—Requirements with guidance for use.

ISO 14025, Environmental labels and declarations—Type III environmental declarations—Principles and procedures.-

ISO 14040, Environmental management—Life cycle assessment—Principles and framework.

ISO 14044, Environmental management—Life cycle assessment—Requirements and guidelines.

ISO 14064, Greenhouse gases—Specifications with guidance.

ISO 14065, Greenhouse gases—Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition.

ISO 14067, Carbon Footprint of Products—Requirements and Guidelines for Quantification and Communication.

ISO 17088, Specifications for Compostable Plastics.

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories. ²¹ ¹⁵

ISO/IEC 28360, Information technology—Office equipment—Determination of chemical emission rates from electronic equipment.-

²¹ [ISO/IEC publications are available from the ISO Central Secretariat \(https://www.iso.org/\)](https://www.iso.org/). ISO publications are also available in the United States from the American National Standards Institute (<https://www ansi.org/>).

¹⁵ ~~ISO/IEC publications are available from the ISO Central Secretariat (<http://www.iso.org/>). ISO publications are also available in the United States from the American National Standards Institute (<http://www ansi.org/>).~~

~~Joint Industry Guide 101 (JIG 101 Ed. 4.0), Material Composition Declaration for Electrotechnical Products.¹⁶~~

PAS 2050:2011, Specification for the assessment of the life cycle greenhouse gas emissions of goods and services. ²² ¹⁷

UL 60950-1, Information Technology Equipment—Safety—Part 1: General Requirements. ²³ ¹⁸

United Nations Protocol on Pollutant Release and Transfer Registers (PRTR). ²⁴ ¹⁹

United States Environmental Protection Agency (U.S. EPA) Toxics Release Inventory. ²⁵ ²⁰

3. Definitions, special terms, acronyms, and abbreviations

3.1 Definitions

For the purposes of this document, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this clause. ²⁶ ²¹

²² Available at <http://www.bsigroup.com/upload/Standards%20&%20Publications/Energy/PAS2050.pdf>.

²³ UL standards are available from Global Engineering Documents (<http://www.global.ihs.com/>)

²⁴ Available at http://www.unece.org/env/pp/prtr/Protocol%20texts/PRTR_Protocol_e.pdf.

²⁵ Available at <http://www.epa.gov/TRI/>.

¹⁶ Available at http://www.ecaus.org/engineering/JIG_101_Ed_4%200.pdf.

¹⁷ Available at <http://www.bsigroup.com/upload/Standards%20&%20Publications/Energy/PAS2050.pdf>.

¹⁸ UL standards are available from Global Engineering Documents (<http://www.global.ihs.com/>)

¹⁹ Available at http://www.unece.org/env/pp/prtr/Protocol%20texts/PRTR_Protocol_e.pdf.

²⁰ Available at <http://www.epa.gov/TRI/>.

²⁶ ²¹ *IEEE Standards Dictionary Online* subscription is available at http://www.ieee.org/portal/innovate/products/standard/standards_dictionary.html.

automatic duplexing: The capability of a copier, fax machine, multifunction device (MFD), or printer to automatically place images on both sides of an output sheet, without manual manipulation of output as an intermediate step.

biobased: A material that is composed of biological materials, including renewable agricultural (plant, animal, and/or marine) and/or forestry materials.

biobased plastic material content: A percentage calculated by dividing the weight of biobased plastic material by the full weight of the plastic material in the part or product.

cartridge: A customer-replaceable module with printing-related functionality that includes integrated components or moving parts integral to the imaging product's function beyond holding the toner/ink and fitting onto/into the product.

NOTE—Examples of cartridges are toner, drum, and print-head cartridges. Moving parts in a toner cartridge may include, e.g., transport roller, charging unit, or photoconductor drum.^{27 22}

chassis: A rigid framework onto which electronic and/or mechanical components may be mounted. The framework may also support the product case.

chlorine-free paper: Paper that is classified as either “totally chlorine-free” (TCF) or “elementally chlorine-free” (ECF) for non-recycled paper or “processed-chlorine-free” (PCF) for paper with recycled content. TCF paper is produced with pulp that has been bleached without any type of chlorine, or that has not been bleached at all. ECF papers are produced from pulp that has been bleached with a chlorine derivative such as chlorine dioxide (ClO₂), but without elemental chlorine (Cl). PCF papers are produced with no chlorine or chlorine derivatives, but papers that were originally bleached with chlorine or chlorine derivatives may have been used as feedstock for recycled content.

NOTE—Source: CalRecycle.^{28 23}

^{27 22} Notes in text, tables, and figures of a standard are given for information only and do not contain requirements needed to implement this standard.

^{28 23} Available at <http://www.calrecycle.ca.gov/paper/chlorinefree/default.htm>.

commodity materials: Materials derived from primary resources (mined or extracted from virgin raw materials) or from secondary raw materials that need no further processing (such as smelting), cleaning, separation, or recycling in order to be either sold directly on the retail market as new consumer products, or used as a direct feedstock in primary manufacturing processes.

connectors: An electrical or mechanical coupling device employed to connect one element with those of another element.

consumable: A product integral to the functioning of the imaging equipment product with the intent, when depleted or worn, to be replaced or replenished by the user during the normal usage and life span of the imaging equipment product.

NOTE—Consumables may include: toner, toner containers, toner bottles, toner cartridges, waste toner cartridges, ink cartridges, ink heads, ink sticks, ribbon ink, thermal paper, copy paper, imaging units, transfer belts, transfer roller, fusers, drum maintenance units, and other associated items. Items not intended to be replaced or replenished by the user would ~~be~~ not be considered consumable supplies, but rather “spare parts.”-

container: A customer-replaceable module that holds toner or ink and that fits ~~fit~~ onto/into or emptied into the imaging product.

NOTE—Containers may be constructed of plastic or recycled plastic composite and do not contain integrated components or moving parts integral to the imaging product’s function. Examples of such containers are toner cylinders, toner containers, toner bottles, ink tanks, and solid ink modules.

disposal: Final disposition (not including reuse or recycling) that includes incineration (with and without energy recovery), landfill, and any other placement of electronic equipment, components, or materials into or on land, water, and air.

disposal facility: Facilities that are licensed and permitted to provide final disposal for the specific wastes they accept, including incineration (with and without energy recovery) and landfill.

electronic components: An individual part or combination of parts that, when together, perform a design function(s) and are typically directly attached to a printed circuit board.

NOTE—Examples include cables, connectors, sockets, discrete printed circuit board components, and integrated circuits.

electronic products: Products that are dependent on electric currents or electromagnetic fields in order to work properly.

electromagnetic interference (EMI) components: Components designed to mitigate or manage the effects of conducted or radiated electromagnetic energy that may interfere, interrupt, obstruct, or otherwise degrade or limit the performance of telecommunication or other electrical and electronic products.

electrostatic discharge (ESD) components: Components designed to mitigate or manage the effects of electrical discharges of static electricity that may build up on personnel or equipment, generated by interaction of dissimilar materials.

environmental management system: Part of an organization's management system used to develop and implement its environmental policy and manage its environmental aspects.

external enclosure: The external housing that protects the internal parts from environmental effects and prevents the user from coming into contact with moving, radiating, or current-carrying components.

external plastic casings: Components of a product's external enclosure composed of plastic, exclusive of cabling.

final disposition: The last point in the recycling chain where materials have been converted into a commodity or properly treated in a disposal facility.

firmware: Software resident in the electronic product required for the product to operate as specified by the manufacturer.

general office paper: Uncoated, cut sheet paper intended for use in imaging equipment with a basis weight of 64 gsm to 100 gsm.

hazardous characteristics: The potential adverse environmental and health effects attributable to a specific environmental agent, the mechanisms by which agents exert their toxic effects, and the associated dose, route, duration, and timing of exposure.

imaging equipment: Includes the following products:

- *Copier*—A commercially available imaging product whose sole function is the production of hard copy duplicates from graphic hard copy originals. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as copiers or upgradeable digital copiers (UDCs).
- *Digital duplicator*—A commercially available imaging product that is sold in the market as a fully automated duplicator system through the method of stencil duplicating with digital reproduction functionality. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as digital duplicators.
- *Facsimile machine (fax machine)*—A commercially available imaging product whose primary functions are scanning hard copy originals for electronic transmission to remote units and receiving similar electronic transmissions to produce hard copy output. Electronic transmission is primarily over a public telephone system but also may be via a computer network or the Internet. The product also may be capable of producing hard copy duplicates. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as fax machines.
- *Mailing machine*—A commercially available imaging product that serves to print postage onto mail pieces. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as mailing machines.

- *Multifunction device (MFD)*—A commercially available imaging product, which is a physically integrated device or a combination of functionally integrated components, that performs two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single-sheet convenience copying offered by fax machines. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as MFDs or multifunction products (MFPs).
- *Printer*—A commercially available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g., digital cameras). The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as printers, including printers that can be upgraded into MFDs in the field.
- *Scanner*—A commercially available imaging product that functions as an electro-optical device for converting information into electronic images that can be stored, edited, converted, or transmitted, primarily in a personal computing environment. The unit is capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as scanners.

NOTE—*Imaging equipment* as defined by the ENERGY STAR Imaging Equipment Specification.

incineration: A disposal method that involves combustion of waste material converting it into heat, gas, steam, and ash, but not including smelting.-

labels: Piece of paper, plastic, metal, or other material affixed to a component or product, on which is printed specific information.

light source: A device to supply radiant energy capable of exciting a phototube or photocell.-

materials of concern: A generic term to encompass hazardous, toxic, and potentially hazardous materials that are defined by individual take-back standards, regardless of what the individual standard may refer to them as (e.g., *restricted materials*, *focus materials*, *hazardous wastes*, [toxins](#) ~~toxics~~ or *toxic materials*, *designated materials*).

non-manufacturer cartridge: A cartridge not sold by the registering manufacturer and that is remanufactured and/or refilled.

non-manufacturer container: A toner or ink container not sold by the registering manufacturer and that is remanufactured and/or refilled.

optical components: An individual part or combination of parts that are used in the creation, transmission, manipulation, or detection of light.

NOTE—Examples include lasers, light sources, optoelectronics, fiber optics, lenses, polarizers, mirrors, beam splitters, windows, and prisms.

packaging: All goods made of any materials of any nature to be used for the containment, protection, handling, delivery, and presentation of products, from raw materials to processed goods, from the producer to the user or the consumer.

NOTE—For the purpose of this standard, *packaging* is limited to (a) sales packaging or primary packaging, i.e., packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase; (b) grouped packaging or secondary packaging, i.e., packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics.

packaging component: Any individual assembled part of a package such as, but not limited to, (a) any interior or exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, coatings, closures, inks and labels; (b) tin-plated steel that meets the American Society for Testing and Materials (ASTM) specification [A623](#); (c) ~~A-623; (b)~~ electro-galvanized coated steel and hot dipped coated galvanized steel that meets ASTM A525 and [ASTM](#) A879.

post-consumer: A material or finished product that has served its intended use and has been discarded for disposal or recovery, having completed its life as a consumer item; part of the broader category of “recovered” items.

printed circuit boards: A circuit board onto which the pattern of copper traces connecting the components has been etched or printed.

printing function: The ability of a product to generate hard copy images from either electric or hardcopy input. The following imaging equipment product types have a printing function by definition: copier, digital duplicator, facsimile machine, mailing machine, multifunction device (MFD), and printer.

product: A marketing model and chassis type including all its included peripherals or options but not including consumables.

recovered: Waste materials and byproducts that have been recovered or diverted from solid waste, but [do](#) ~~does~~ not include materials and byproducts generated from, and commonly reused within, an original manufacturing process.

recovered fiber: Post-consumer fiber such as paper, paperboard, and fibrous materials from retail stores, office buildings, homes, and so forth, after they have passed through their end-usage as a consumer item, including used corrugated boxes, old newspapers and magazines, mixed waste paper, tabulating cards, and used cordage; and all paper, paperboard, and fibrous materials that enter and are collected from municipal solid waste, and manufacturing wastes such as dry paper and paperboard waste generated after completion of the papermaking process (that is, those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including, envelope cuttings, bindery trimmings, and other paper and paperboard waste resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock; and repulped finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others. *Mill broke* means any paper waste generated in a paper mill prior to [the](#) completion of the papermaking process. It is usually returned directly to the pulping process. Mill broke is excluded from the definition of *recovered fiber*.

recyclable: Materials or components that can be removed or recovered from the whole product or package and put back into productive use as a material, not including energy recovery, using standard technologies, or as otherwise demonstrated.

recyclable plastic stream: A group of identifiable plastics that, mixed together, can be processed back into productive use as a material, not including energy recovery.

recycled content: A percentage calculated by dividing the weight of recycled material of the type of material being measured by the full weight of the material in the part or product.

recycling: A process by which materials or components are processed to be put back into productive use as a material or component, not including waste to energy.

refurbishment: The process by which electronic products or components are restored to a defined condition in function and form that is comparable to, or better than, a new unit. The unit's composition and design [are](#) ~~is~~ not changed significantly, as in *remanufacturing*.

remanufacturing: All actions necessary to build up as-new products using components taken from previously used electronic equipment as well as new components, if applicable. Depending on the components used, this process may significantly change the unit's composition and design.

renewable: Material considered to be an agricultural product, both fiber and animal, that takes 10 years or less to grow or raise and harvest.

repair: The process by which the faults in a unit preventing its specified operation are corrected. The unit's composition and design are ~~is~~ not changed significantly.

reusable: Components or systems of components that can be removed or recovered from the whole product or package and put back into productive use as a component or system of components, not including energy recovery, using standard technologies, or as otherwise demonstrated.

reuse: Using an object again, for its original purpose or as repurposed, without significantly altering the physical form of the object although the object may be cleaned, repaired, or refurbished between uses.

special handling needs materials: Materials with hazardous characteristics; components having an adverse impact on or posing a hazard to recycling workers' safety; or components that need to be removed before shredding due to hazardous characteristics.

standard size media: Media with widths between 210 mm and 406 mm.

subassembly: Two or more basic parts that form a portion of an assembly of a unit, replaceable as a whole, but having a part or parts that are individually replaceable.

take-back: Any collection service provided by or caused to be provided by the manufacturer, by which either the product, packaging, or designated items produced by or recommended by the manufacturer for use in or with the product, can be returned to the manufacturer or their collection service for reuse, repair, refurbishment, remanufacturing, and/or recycling. This collection occurs at the end of customer use or when the product or designated item is damaged beyond repair.

toxic chemical release/toxins ~~toxies~~ released: Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of any hazardous substance, pollutant, or contaminant.

waste to energy: The heat treatment of material in which the heat produced is used to produce electricity or steam or reduce the energy already required in a process.

3.2 Special terms

commercial customers: Customers that purchase institutional products.

commonly available tools: Widely used, commercially available tools.

competent authority: A governmental authority designated by a country to be responsible for receiving notification of a transboundary movement of hazardous wastes or other wastes, and any information related to it, and for responding to such notification.

conformance assurance system: A process to ensure conformity to a design requirement where the key consideration is control of the supply chain of components, materials, packaging, and/or services, and can also include recyclers, test laboratories, and even internal designers. A conformance assurance system will include elements addressing the following elements: Plan (i.e., a description of the requirement to the supplier), Do (i.e., the collection of documents that show conformity), Check (i.e., demonstration of how conformance is assured), and Act (i.e., corrective action).

consumer: Individual and/or household purchasers of products.

consumer product: All products that are not declared as institutional products.

contractual agent: Repair/refurbishment operations with whom a manufacturer has contracted and closely controls to accomplish the repair or refurbishment of taken back products, under manufacturer specifications and policies, that are intended to be returned to a customer under a ~~an~~ manufacturer program, such as warranty, off-lease, or trade-in programs.

harnessed replaceable entities: A collection of one or more parts considered as a single part for the purpose of replacement and repair due to physical constraints of the unit under test.

homogeneous material: One material of uniform composition throughout or a material, consisting of a combination of materials, that cannot be disjointed or separated into different materials by mechanical actions such as unscrewing, cutting, crushing, grinding, and abrasive processes.

NOTE—Examples of *homogeneous* ~~materials~~ ~~material~~ are individual types of: plastics, ceramics, glass, metals, alloys, paper, board, resins, and coatings.

incidental presence: The presence of a substance as an unintended or undesired ingredient of the product or aspect of the product applicable to a criterion.

independent certification bodies: Organizations that conduct conformity assessments and third-party certification of organizations against designated management system standards in accordance with the requirements of ISO/IEC 17021, as confirmed and accredited by a national accreditation body, which is a member of the International Accreditation Forum (IAF).²⁹ ~~[B12]~~. Audits are impartial, and conducted by competent, professional auditors, meeting international guidelines for management systems auditing as specified in ISO 19011.-

initial service providers: Companies ~~that~~ ~~who~~ contract directly with manufacturers to provide one or more take-back services. Initial service providers perform recycling and/or refurbishment services for ~~products~~ ~~product~~/equipment/components.

institutional product: Products declared as institutional product are as follows:

- Only available through authorized dealers or resellers
- If sold directly, are marketed primarily as a product for “business” or “enterprise” or equivalent

²⁹ [Information available at http://www.iaf.nu/](http://www.iaf.nu/)

intentionally added: The act of deliberately utilizing a substance in the formation of a product, component, package, or packaging component where its continued presence is desired in the final product, component, package, or packaging component to provide a specific characteristic, appearance, or quality. The use of recycled material as feedstock in the manufacture of a product, component, or package, where some portion of the recycled material may contain residual amounts of a restricted substance, is not considered intentionally added, unless the restricted substance in the recycled material is used for the express purpose of imparting a specific characteristic, appearance, or quality to the final product.

key functions: All the essential functions an electronic product was designed to perform.

manufacturer's environmental packaging requirement: Specifications for packaging suppliers that denote the respective environmental attributes required in the packaging. Each manufacturer sets different requirements.-

nationwide: Across the entire nation or country, including those outside of major population centers.

on average: The term as used in this standard means that the desired material (e.g., recycled or biobased plastic) is present at the designated percentage in the total weight of like material (e.g., all plastic) within each unit for each product declared to the criterion.

region: Countries and territories whose independence is not recognized by all countries (e.g., Taiwan).

spare parts: A component of a product that is kept in reserve for possible use to replace a similar or identical component in the product.

take-back service providers: Companies ~~that~~ ~~who~~ provide one or more take-back services (e.g., recycling, reuse, repair, refurbishment, or remanufacturing).

technically required: A characteristic of a design element that is essential to the function of the product and for which an alternative that would meet the requirements of the standard is not available.

weighted average: An average that takes into account the proportional relevance of each component, rather than treating each component equally.

working properly: Electronic equipment or components are *working properly* when they are tested and proven capable of performing the key functions they were designed (or modified) to perform.

written management plan: A document that addresses the special treatments necessary to properly manage “materials of concern” (or equivalent term that describes toxic or hazardous materials) to protect human health and the environment.

3.3 Acronyms and abbreviations

~~ASTM-~~	~~American Society of Testing and Materials~~
BFRs	brominated flame retardants
~~CAS-~~	~~Chemical Abstracts Service~~
CFRs	chlorinated flame retardants
~~DfE-~~	~~design for the environment~~
~~DIN-~~	~~Deutsches Institut für Normung (German Institute of Standardization)~~
ECHA	European Chemicals Agency
EMAS	Eco-Management and Audit Scheme
EMI	electromagnetic interference
EMS	environmental management system
ESD	electrostatic discharge
EU	European Union
F-GHG	fluorinated greenhouse gas

GHG	greenhouse gas
GRI	Global Reporting Initiative
GSCP	Global Social Compliance Program
gsm	grams per square meter
~~IEEE~~	~~Institute of Electrical and Electronics Engineers, Inc.~~
~~ISO~~	~~International Organization for Standardization~~
~~ISRI~~	~~Institute of Scrap Recycling Industries~~
~~JIG~~	~~Joint Industry Guide~~
LCA	life-cycle assessment
LCACP	Life Cycle Assessment Certified Professionals
~~LCD~~	~~liquid crystal display~~
LCI	life-cycle inventory
MSE	Market Surveillance Entity
~~OECD~~	~~Organisation for Economic Co-operation and Development~~
PRE	Product Registration Entity
PRTR	Pollutant Release and Transfer Register
PVC	polyvinyl chloride
REACH	<u>Registration, Evaluation, Authorization and Restriction of Chemicals</u> ~~European Union Regulation (EC) No 1907/2006~~

RoHS	Restriction of Hazardous Substances ~~European Union, European Council former Directive 2002/95/EC as amended by 2005/618/EC and 2011/65/EU~~
SVHC	substances of very high concern
TRI	Toxics Release Inventory
TVOC	total volatile organic compounds
~~U.S. EPA~~	~~United States Environmental Protection Agency~~
~~WBCSD~~	~~World Business Council for Sustainable Development~~
WEEE	waste electrical and electronic equipment
~~WRI~~	~~World Resources Institute~~

4. Environmental performance criteria for imaging equipment

4.1 Reduction/elimination of environmentally sensitive material

4.1.1 Reduction of use of hazardous substances

4.1.1.1 Required—Compliance with provisions of [the](#) European Union RoHS Directive

Product criterion: All products shall comply with the requirements of the European Union (EU) RoHS Directive in effect at the time of product registration.

Applies to: All covered products.

Verification requirements:

- a) Declaration from [the](#) manufacturer.

- b) Documentation of a conformance assurance system that demonstrates conformity to the EU RoHS requirements through effective control of the supply chain.

References and details: The EU RoHS [Directive 2011/65/EU](#) and its amendments, [Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment](#). ~~Directive, formerly known as Directive 2002/95/EC, stipulates maximum concentration values (MCVs) by weight for the presence of each substance within homogeneous materials.~~

Elements of a conformance assurance system are outlined in the [UK](#) ~~United Kingdom~~ (UK) RoHS Enforcement Guidance document [\[B35\]](#).³⁰ ~~[B27]~~.²⁴

4.1.2 Cadmium

4.1.2.1 Optional—Further reduction of the use of EU RoHS Directive hazardous substances (cadmium)

Product criterion: Products shall not use exempted cadmium applications; excluding those with a sunset date within one year, under the EU RoHS Directive in effect at the time of product registration.

Applies to: All covered products.

Verification requirements:-

- a) Declaration from [the](#) manufacturer.
- b) Documentation of a conformance assurance system that demonstrates conformity to this criterion through effective control of the supply chain.

References and details: The EU RoHS Directive [2011/65/EU](#), ~~formerly known as Directive 2002/95/EC~~, stipulates [maximum concentration values \(MCVs\) by weight](#) ~~allowable thresholds~~ for the presence of each ~~regulated~~ substance within homogeneous materials.

³⁰ ²⁴ The numbers in brackets correspond to those of the bibliography in Annex A.

4.1.3 Mercury

4.1.3.1 Required—Reporting on the amount of mercury content in light sources

Product criterion: The manufacturer shall report the number of mercury-containing light sources in the product and the mercury content per light source. Data may be reported in accordance with the ranges of the following list:

- 0 mg (less than lower limit of detection)
- > 0 mg to ≤ 5 mg
- > 5 mg to ≤ 10 mg
- > 10 mg to ≤ 50 mg
- > 50 mg to ≤ 100 mg
- > 100 mg to ≤ 1 g
- Greater than 1 g

For products that do not contain light sources, the manufacturer may declare “Not applicable” on the MSE Registry.

Applies to: All covered products.

Verification requirements:

- a) Declaration from the manufacturer.
- b) Documentation showing mercury content per light source or access to a representative aggregated mercury content report.