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Information technology — Print cartridge characterization —

Part 3: Environment

Technologies de l'information — Caractérisation de cartouche d'impression —

Partie 3: Environnement

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 29142-3 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

ISO/IEC 29142 consists of the following parts, under the general title *Information technology — Print cartridge characterization*:

— *Part 3: Environment*

The following parts are under preparation:

— Part 1: General: terms, symbols, notations and cartridge characterization framework

— Part 2: Cartridge Characterization Data Reporting

Introduction

The purpose of this part of ISO/IEC 29142 is to establish principles and framework for environmental product standards, environmental labels, and green procurement criteria specific to ink and toner cartridges used in printing devices that have a digital input printing path, including multi-function devices. This standard includes terminology definitions for such cartridges and their environmental interactions, cartridge environmental attributes, and test methods for inclusion in cartridge environmental standards, environmental labels, and green procurement criteria.

Printing systems use consumables and because of this, environmental responsibility is important to be considered during the phases of design, manufacturing, printer operation and end-of-life.

The terms, definitions, attributes, and test methods established in this standard are generally applicable to all cartridges and are intended for use in the development of environmental standards, environmental labels, and green procurement guidelines. The defined attributes and methods form a framework to standardize the treatment and definition of cartridge environmental issues.

The foundation provided in this standard supports the following objectives:

1. Minimization of product environmental impact throughout the cartridge life-cycle
2. Minimization of product environmental impact associated with end-of-life

In an attempt to harmonize with existing environmental labels, standards, declarations, and green procurement criteria, environmental provisions and measurement methods already well established will be referenced wherever possible. This includes consideration of legal requirements and customer expectations associated with material use, manufacturing operations, and packaging, and/or management during end-of-life.

This part of ISO/IEC 29142 provides the following:

1. Terms and definitions related to cartridge environmental attributes.
2. Cartridge environmental attributes for inclusion in environmental labels, standards and green procurement criteria.
3. Test methods that manufacturers, test labs, etc., use to determine values for the defined cartridge environmental attributes.
4. Methods for determination of declared values from the test results.
5. Methods for declaration of conformance to provisions that don’t require measurement.

This International Standard is intended for office equipment environments.

Information technology — Print cartridge characterization —

Part 3: Environment

1 Scope

This part of ISO/IEC 29142 describes the principles and framework for environmental assessment of ink and toner cartridges used in printing devices that have a digital input printing path, including multi-function devices, including:

a) the goals and definitions related to environmental responsibility;

b) guidance to determine the relative benefits of reuse, recycling, recovery, and reduction techniques;

c) identification and prioritization of environmental attributes according to each phase of the cartridge life-cycle;

d) criteria for establishing environmentally sustainable practices.

This part of ISO/IEC 29142 establishes foundational terms, definitions, attributes, and test methods for cartridge environmental standards, environmental labels, and green procurement criteria.

This part of ISO/IEC 29142 standardizes treatment of environmental interactions and impacts throughout the cartridge life-cycle, and promotes harmonization of environmental standards, environmental labels, and green procurement criteria pertaining to ink and toner cartridges, thereby reducing impact on the environment and informing and benefiting the cartridge customer.

This part of ISO/IEC 29142 establishes environmental terms, definitions, attributes and test methods in accordance with the terms, symbols, notations and framework of ISO/IEC 29142-1 and ISO Guide 64.

2 Normative references

The following referenced documents are indispensable for the application 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.

ISO 1043 (all parts), *Plastics — Symbols and abbreviated terms*

ISO 11014, *Safety data sheet for chemical products — Content and order of sections*

ISO 11469, *Plastics — Generic identification and marking of plastic products*

ISO 14020, *Environmental labels and declarations — General principles*

ISO 14021, *Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling)*

ISO 14024, *Environmental labels and declarations — Type I environmental labelling — Principles and procedures*

ISO 17025, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC 28360, *Information Technology — Office Equipment — Determination of chemical emission rates from electronic equipment*

ISO/IEC 29142-1, *Information technology — Cartridge Characterization — Part 1: General: terms, symbols, notations and cartridge characterization framework*

ISO/IEC 29142-2, *Information technology — Cartridge Characterization — Part 2: Cartridge characterization data reporting*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 29142-1 and the following apply.

3.1
Ames test
internationally recognized test which uses a biological assay to assess the mutagenic potential of chemical compounds

3.2
cartridge collector
any party providing a cartridge take-back or collection program such as a business entity designated to collect cartridges

3.3
cartridge supplier
cartridge marketer, manufacturer, remanufacturer, refiller, or distributor, being the party or parties responsible for marketing the cartridge and providing customer support for the cartridge

3.4
cartridge end-of-life
point in a cartridge life-cycle from which the cartridge is no longer used for its intended purpose without additional non-customer interaction

3.5
end-of-life
phase in a cartridge life-cycle when the cartridge can no longer be used for its intended purpose without additional non-customer interaction

3.6
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interaction

[ISO Guide 64]

3.7
environmental provision
any requirement, recommendation or statement in a standard that addresses environmental issues

[ISO Guide 64]

3.8
landfilled
waste disposal in a landfill or other non-reuse, -recycle, -remanufacture, -waste to energy, or -incineration depository, excluding the residuals from waste to energy and incineration

3.9
incineration
disposal method that involves combustion of waste material converting it into heat, gas, steam and ash but not including smelting

3.10
life-cycle
consecutive and interlinked stages of a product system, from raw material to acquisition or generation from natural resources to final disposition

[ISO 14040:2006, definition 3.1]

3.11
life-cycle assessment
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life-cycle

3.12
material safety data sheet
MSDS
form containing safety information about the ink or toner contained in cartridges designed for use in printing applications; and which includes physical, chemical, and toxicological properties, regulatory information, and recommendation to ensure safe handling

3.13
safety data sheet
SDS
form containing safety information about the ink or toner contained in cartridges designed for use in printing applications; and which includes physical, chemical, and toxicological properties, regulatory information, and recommendation to ensure safe handling

3.14
non-original cartridge
cartridge that is marketed by a company other than the company that markets the printing system for which the cartridge is intended

3.15
original cartridge
cartridge that is marketed by the company that markets the printing system for which the cartridge is intended

3.16
prevent
indicates a condition of zero allowance of an intentionally added substance

3.17
product environmental aspect
element of a product that, during its lifecycle, can interact with the environment

[ISO 14001]

3.18
product environmental criteria
environmental requirements that the product shall meet in order to be awarded an environmental label

[ISO 14024]

3.19
product environmental impact
any change to the environment, wholly or partly resulting from a product environmental aspect [ISO 14001]

3.20
recovery
process to divert cartridges and/or cartridge materials from the solid waste stream and into productive uses

3.21
recyclable
product that can be collected, separated, or otherwise recovered from the solid waste stream for reuse, or in the manufacture or assembly of another package or product, through an established recycling program

3.22
recycle
reuse, remanufacture or otherwise divert from a solid waste stream

3.23
recycled content
percent, by mass, of recycled material in a product or packaging

3.24
recycled material
materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process or after consumer use

3.25
recycling
activities where components or materials that have been recovered or otherwise diverted from the solid waste stream are put into productive use as a material or component

3.26
refill
operation to replace ink or toner in a customer's cartridge that does not involve the replacement or refurbishing of worn cartridge components

3.27
refiller
cartridge supplier that refills customer's cartridges

3.28
remanufacture
operation to replace or clean components and add ink or toner using cartridges from cartridge take-back or collection programs

3.29
remanufacturer
cartridge supplier that produces or markets remanufactured cartridges

3.30
restrict
indicates a condition of specifically constrained or limited allowance

3.31
reuse
operation in which a whole or a component part of a cartridge is incorporated in the manufacture or remanufacture of a cartridge, such that the whole or component part is intended to be put into service for the same purpose for which it was conceived

3.32
take-back
programs sponsored by cartridge suppliers and conducted by cartridge collectors for the purpose of obtaining cartridges after cartridge end-of-life

3.33
waste to energy
form of recovery in which the energy generated from incineration is captured and used as energy

4 Abbreviated terms

EMS – Environmental Management System

OEM – Original Equipment Manufacturer

5 Relationship with ISO 14020 Series

In addition to the requirements of this International Standard, the objectives, principles, and requirements set out in ISO 14020, ISO 14021, and ISO 14024 shall be followed as applicable to cartridge environmental labels, standards, and green procurement criteria.

6 Company environmental responsibility

Cartridge suppliers have the ability to reduce environmental impact associated with the cartridges they manufacture or market. This may be aided through the development of an environmental policy and implementation of an EMS which covers manufacturing operations and products according to ISO 14001 or an equivalent framework. It is recommended that cartridge environmental standards, environmental labels, green procurement criteria include a environmental provision requiring companies offering cartridges for sale to have a documented environmental policy and have implemented an EMS for cartridge manufacturing and for remanufacturing operations.

7 Environmental attributes throughout the cartridge life-cycle

Environmental criteria for cartridges from conception through the period after cartridge end-of-life are intended to minimize environmental impacts of cartridges throughout the cartridge life-cycle. Performance criteria shall be established to address the specific environmental impacts in each cartridge life-cycle phase.

Persons responsible for the development of cartridge environmental standards, environmental labels, and green procurement criteria shall select environmental attributes which aim to minimize environmental impact in each phase of the cartridge life-cycle. For consideration of cartridge environmental impact, the life-cycle phases for cartridges include phases such as product design, manufacturing, product use, and end-of-life management.

Product environmental criteria should be set at attainable levels and give consideration to relative environmental impacts, measurement capability and accuracy. Environmental criteria shall be measurable, comparable, verifiable, and meaningful to the customer.

The development and selection of criteria shall be based on sound scientific and engineering principles. The criteria shall be derived from data that support the claim of minimizing environmental impact.

7.1.1 Cartridge supplier and cartridge collector identification

Cartridge environmental labels, standards and green procurement criteria shall include environmental provisions requiring cartridges and cartridge packaging to include cartridge supplier and cartridge collector identification information. If a cartridge has been remanufactured or refilled, labels and trademarks of another cartridge supplier and cartridge collector shall be unreadable or undiscoverable on the cartridge and accompanying packaging.

NOTE Cartridge supplier and cartridge collector identification encourages customer use of the cartridge take-back and program offered by the cartridge supplier.

7.1.2 Materials

Materials used to manufacture cartridges are significant in that they determine the cartridge's environmental impact, ensure it is safe and reliable, and affect the cartridge's ease of recycling after cartridge end-of-life. Cartridge manufacturers should aim to restrict or prevent the inclusion of regulated or restricted materials in their cartridges by requiring suppliers to provide information about their supply chain standards or supplier management processes.

Environmental standards, environmental labels, and green procurement criteria for materials shall be written to pertain to the companies offering cartridges for sale and shall not require disclosure of company confidential information.

7.1.3 Hazardous substances in ink or toner

Environmental standards, environmental labels, and green procurement criteria may restrict the use of components in concentrations that require the cartridge to be classified and labeled as hazardous or dangerous to human health or the environment in the countries where the cartridge is sold.

Environmental standards, environmental labels, and green procurement criteria shall include environmental provisions to prevent or restrict the intentional use of:

- Certain components which may be classified as carcinogenic, mutagenic, or reprotoxic according to one or more specified regionally applicable internationally recognized bodies.
- Certain compounds which may be classified as persistent, bioaccumulative, and toxic or very persistent and very bioaccumulative according to one or more specified internationally recognized bodies.
- Heavy metals such as cadmium, chromium VI, lead, nickel and mercury compounds.
- Short chained chloroparaffins limited to the range of chloroparaffins C_{10} to C_{13} containing chlorine at greater than equal to 50 % by weight.
- Azo colorants and dyes which may release one or more carcinogenic aromatic amines specified by an internationally recognized body.

Environmental standards, environmental labels, and green procurement criteria shall include environmental provisions for the evaluation of toner and ink for mutagenic and carcinogenic properties by using established classification methods that ensure ink or toner does not contain carcinogens, mutagens, or reproductive toxins or established test methods such as the Ames test.

7.1.4 Hazardous substances in cartridge parts

Environmental standards, environmental labels, and green procurement criteria shall include environmental provisions to restrict the intentional use of:

- Heavy metals such as cadmium, chromium VI, lead, mercury, and polybromobiphenols (PBBs) and polybromobiphenolethers (PBDEs) to internationally recognized threshold limits except in cases where exempted applications of these metals are allowed.

- Selenium, lead, mercury, or cadmium or any of their compounds in photoconductor drums of toner cartridges.

- Short chained chloroparaffins limited to the range of chloroparaffins C_{10} to C_{13} containing greater than equal to 50 % by weight chlorine.

- Short chained hydrocarbons as regulated under applicable regulations.

- Certain substances which are scientifically proven to be hazardous through recognized and published studies, restricted by internationally recognized laws, and a technically feasible alternative exists which has shown to be safe for use and has lesser impact on the environment throughout the cartridge life-cycle.

7.1.5 Design for ease of disassembly for recycling

Cartridges in end-of-life can be managed in a variety of environmentally responsible ways. Disassembly enables a cartridge to be taken apart at the end of its useful life so that components and parts to be reused, recycled, recovered for energy, or in some other way, are diverted from the waste stream. Cartridge recycling options include and are not limited to recovery of raw material for use in new cartridges or other products, reuse of parts in new cartridges, and reuse, refill or remanufacture of cartridges after cartridge end-of-life.

The following environmental provisions should be considered in environmental standards, environmental labels, and green procurement criteria to promote ease of disassembly:

- All plastic parts heavier than 25 g and having greater than 200 mm^2 of flat surface area shall have material identification marking according to ISO 11469, ISO 1043, parts 1-4 or other internationally recognize marking for ease of recycling.

- Parts made of incompatible materials should be connected separately or via separation aids or should be separable via recycling processes used for those cartridges.

- Separable connections should be easily traceable.

- Coating of plastic parts should be limited to the minimum necessary.

- Parts specifically designed to prevent recycling shall not be attached to print cartridges.

- Recycled materials shall be permitted and encouraged in the manufacture of new cartridges.

Environmental standards, environmental labels, and green procurement criteria shall recommend or require that components of returned print cartridges which are not reused or recycled into new print cartridges are either sent to material recyclers for use in other products, or sent to facilities for waste to energy recovery.

7.1.6 Packaging

Environmental standards, environmental labels, and green procurement criteria shall recommend or require the cartridge suppliers offering cartridges for sale to minimize the environmental impact for cartridge packaging as follows:

- Cartridge design shall be encouraged to prevent toner dust or ink from escaping during storage and transport.

- User information shall be required to advise users of any user actions required to address safety in handling of toner and ink cartridges.

- Use of ozone depleting substances, such as those listed in the Montreal Protocol, shall be restricted to specified levels in packaging material.

- Chlorine content in plastic packaging material shall be restricted to specified levels.

- Heavy metals content in packaging material shall be restricted to specified levels.

- Use of recycled content in wood fiber packaging material and product documentation should be recommended based on availability of recycled material.

- Use of chlorine in user and product documentation sold with the cartridge shall be restricted to specified levels or processes.

- Plastic packaging material > 25 g and with greater than 200 mm^2 of flat surface area shall be required to be marked according to ISO 11469, ISO 1043, parts 1-4 or other internationally recognize marking for ease of recycling.

- Recyclable packaging material shall be recommended.

- Package and cartridge shall be required to be clearly labeled according to the requirements of ISO/IEC 29142-2.

7.1.7 Chemical emissions

Toner and ink contained within a cartridge may impact air emissions profiles of the printers in which the cartridge is intended to operate.

Environmental standards, environmental labels, and green procurement criteria should recommend that:

- When cartridges are tested for air emissions, the cartridges shall be tested in the printers for which cartridges are designed to ensure that air emissions derived from the combined cartridge and printer system do not exceed levels which pose a health risk to end-users.

- Air emissions testing shall be conducted in accordance with internationally recognized test protocol ISO/IEC 28360.

7.1.8 Chemical safety and environmental regulatory requirements

Environmental standards, environmental labels, and green procurement criteria may define preconditions for granting and maintaining certifications or labels. In such cases, all of the relevant chemical safety and environmental protection laws of the countries recognizing the certification or label shall be addressed in the defining environmental standard, environmental label, or green procurement criteria. When the certification or label is applied, compliance shall be required within each country recognizing the label or certification, in which the cartridge is manufactured and/or placed in the market.

Environmental standards, environmental labels, and green procurement criteria shall require that cartridge manufacturers offering cartridges for sale in a given country ensure that the cartridges are properly classified, labeled, and packaged according to the in-country regulatory requirements.

Environmental standards, environmental labels, and green procurement criteria shall require that manufacturers make available a Material Safety Data Sheet or Safety Data Sheet for the ink or toner

contained in the cartridge which complies with the regulations of the country where the cartridge is being offered for sale or follows an internationally recognized standard such as ISO 11014.

7.1.9 Considerations for after cartridge end-of-life

Requirements for recycling operations shall give equal consideration to various recycling solutions which provide environmental benefit, including: recovery of raw materials for use in new cartridges or other products, parts reuse, and cartridge remanufacture, reuse, or refill. These tactics help to alleviate the environmental impact of landfilled waste, natural resource depletion, and carbon emissions after cartridge end-of-life.

NOTE Material recycling is desirable from a sustainability perspective because it removes landfilled waste by recycling used cartridges into raw materials or recycled materials and thus helps alleviate depletion of virgin raw materials. The recycled materials are then used in new product production of either the same product or different products. Under controlled circumstances, the environmental benefits of returning the plastics, metals, and other materials from cartridges back into the industrial materials stream can outweigh the additional transportation and energy emissions involved in the cartridge recycling process.

Reuse and remanufacturing *after cartridge end-of-life can under certain conditions minimize environmental impact. One condition for consideration is that a remanufacturing success* rate below a certain threshold can result in an environmental benefit to responsibly recycle cartridges rather than to remanufacture them. Another consideration is that, in contrast to material recycling, the reuse or remanufacture of a cartridge does not end the cartridge life-cycle. End-of-life of the remanufactured cartridge is a crucial factor in shaping environmental impact; not properly recycling a remanufactured cartridge at the end of its useful life can offset the benefits accrued through its prior reuse. Weighing these factors, in some cases material recycling rather than reuse and remanufacture can be the best environmental outcome for print cartridges.

To ensure recycling operations provide an environmental benefit, environmental standards, environmental labels, and green procurement criteria shall include the following requirements applied to each cartridge supplier offering cartridges for sale:

- A cartridge supplier placing a cartridge, new, reused, or remanufactured, for sale shall be required to participate in or have its own system for collection and recycling of cartridges that enables responsible management after cartridge end-of-life in the countries in which the cartridges are sold.

- A cartridge supplier placing a cartridge for sale shall be restricted with regard to using landfilled methods as a primary means of disposal, and should be required to use processes such as, but not limited to, reuse, recycling or energy recovery.

- Cartridges collected for remanufacture or reuse but not remanufactured or reused shall be channeled into a responsible recycling process that avoids landfilled methods.

- Waste to energy conversion may be exercised to avoid landfilled methods.

- The cartridge supplier placing the cartridge for sale shall be required to make available information about the cartridge collection and recycling system according to ISO/IEC 29142-2.

8 Verification methods

Environmental standards, environmental labels, and green procurement criteria shall require that cartridge environmental attributes be verified by the manufacturer. Verification methods may consist of self-declaration and test method when appropriate and shall follow the principles outlined in ISO 14021. Verification or test methods beyond a manufacturer declaration shall determine conformity to standards, environmental labels, and green procurement criteria based solely on factors within direct control of the manufacturer.

Self-declaration of environmental attributes shall be required to communicate verifiable, accurate information that is pertinent to environmental impact according to ISO 14021.

Whenever possible, environmental standards, environmental labels, and green procurement criteria shall rely on test methods defined in international standards for evaluation of cartridge attributes. When an international

standard is not available, environmental standards, environmental labels, and green procurement criteria shall refer to regional or national standards. Environmental standards, environmental labels, and green procurement criteria shall require test results be made available by the manufacturer upon request.

Lacking international or national or regional test method standard references, environmental standards, environmental labels, and green procurement criteria shall establish test methods using repeatable and reproducible methods which follow accepted principles of good laboratory practice according to ISO/IEC 17025. The test method should be developed in accordance with ISO 14021 and should be based on practice that is broadly recognized by industry.

9 Life-cycle assessment

Life-cycle assessment can be used to determine product aspects that have the most significant impacts on the environment across a product life-cycle. There are several aspects of printing systems (e.g., materials in the printing system and cartridges, energy used in printing, paper) and their usages that contribute to the product environmental impacts (e.g., resource depletion, carbon footprint) of printing. Print quality and reliability are not in themselves environmental aspects but are important considerations as they can impact materials and paper use. Environmental aspects of printing, print quality, and reliability should be considered when conducting life-cycle assessments for printing.

Life-cycle assessments of printing can be used to put potential cartridge improvements, cartridge quality, and reliability in the context of the overall life-cycle of the printing system to prioritize cartridge environmental attributes which have the most significant product environmental impact.

In the case in which an organization chooses to include life-cycle assessment or carbon footprint criteria in environmental standards, environmental labels, or green procurement guidelines, an internationally recognized and vetted standard such as ISO 14025, ISO 14040, ISO 14044 or ISO 14067 shall be utilized.

10 Certification and compliance

Environmental standards and environmental labels which award a label or certification shall establish general rules which guide the overall operation of the program. These rules shall control the general conditions governing awarding of the certificate and use of the label and shall be developed in accordance with ISO 14024.

11 Mutual recognition

Mutual recognition across environmental labels should be encouraged for tests, inspections, conformity assessment, and administrative procedures and where appropriate, cartridge environmental criteria.

Bibliography

[1] ISO Guide 64, *Guide for addressing environmental issues in product standards*

[2] ISO 14001, *Environmental management system — guide and specification for use*

[3] ISO 14025, *Environmental labels and declarations — Type III environmental declarations — Principles and procedures*

[4] ISO 14040, *Environmental management — Life cycle assessment — Principles and framework*

[5] ISO 14044, *Environmental management — Life cycle assessment — Requirements and guidelines*

[6] ISO 14067, *Carbon footprint of products*

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