INTERNATIONAL STANDARD

GUIDE 109

Second edition
2003-06

Environmental aspects – Inclusion in electrotechnical product standards

Aspects liés à l'environnement – Prise en compte dans les normes électrotechniques de produits

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ENVIRONMENTAL ASPECTS – INCLUSION IN ELECTROTECHNICAL PRODUCT STANDARDS

FOREWORD

This second edition of IEC Guide 109 has been prepared, in accordance with the procedure given in Annex A of Part 1 of the ISO/IEC directives, by the IEC Advisory Committee on Environmental Aspects (ACEA).

The text of this Guide is based on the following documents:

Approval document	Report on voting
C/1289/DV	C/1304A/RV

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

IEC Environmental Policy

"IEC recognizes the growing importance of preserving the environment and the role electrotechnical standardization has to play to foster sustainable development. Therefore it is the responsibility of IEC staff and technical committees, members and experts, to contribute actively to the evolving standards framework for the benefit of the environment. For this purpose, the IEC cooperates with ISO and regional standards development organizations such as CENELEC. With respect to product-related standards, IEC technical committees must assess and continuously improve new and existing standards in view of reducing adverse environmental impacts over the whole life cycle of products. The IEC will monitor and annually report progress according to this policy."

The IEC Environmental Policy has been approved by the IEC Council Board. IEC Guide 109 helps to fulfil this policy by illustrating how environmental aspects can be included in electrotechnical product standards.

INTRODUCTION

This Guide aims to give advice to standards writers on the way the environment should be considered among all the aspects relevant to standards.

Finding an appropriate solution for the product is the task of product designers; this solution will be a trade-off along various dimensions (safety, environment, cost, technology, function and so on). This Guide is intended for standards writers, not for product designers; it aims at encouraging standards which preserve the natural environment while allowing designers to reach the best practical compromise among the constraints.

The need to reduce the adverse impacts on the natural environment of a product* during all phases of its life – from acquiring materials to manufacturing, distribution, use, and end-of-life treatment (i.e. re-use, recycling (recovery and disposal)) – is recognized in most countries around the world. The choices made at the design stage largely determine what those impacts will be during each phase of the life of that product. There are, however, considerable obstacles that make the task of selecting the best environmental options very complex. For example, selecting design options to reduce adverse environmental impacts can involve difficult trade-offs such as less recyclability for more energy efficiency.

Requirements for products may influence significantly the extent of environmental effects. Standards should promote the selection of design options in order to reduce adverse impacts. Furthermore, standards must not prohibit innovation in any sense. Standards writers should encourage the protection of the environment, for instance, by specifying requirements which do not rule out the appropriate use of recycled material and the re-use of components, subsystems and systems.

The continual introduction of new products and materials can make evaluation increasingly complex, since additional data must be gathered to assess the life-cycle impacts of such new products and materials. Moreover, there is currently very little data available on the environmental impacts of some existing materials. However, the data which exists can be used as a basis for improvement of the products with respect to environmental impacts. Life-Cycle Assessment (LCA) and Design For Environment (DFE) – or rather Environmentally Conscious Design (ECD)** – principles provide additional instruments that may be useful in this respect. ISO/TR 14062 gives all those involved information on how to integrate ECD principles into product design and development. Standards writers are not expected to perform Life-Cycle Assessment (LCA) but to encourage ECD.

Until more data are available, manufacturers can document more extensively the specific design choices and the reasons behind them. Besides generating requirements for environment-specific standardization, doing this expands the knowledge based on such options and choices, and it may also assist recycling and disposal at the End of Life of the product (EOL).

In this context, it should be noted that a standards writer should also give careful consideration to their impacts on the environment when specifying test methods.

Standards writers need comparative environmental data on materials and substances. However, they should handle information derived from LCA studies with great care when making choices needed for a standard. This may require consultation with advisory committees on environmental aspects within national, regional and international standards bodies.

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* Although the term product has been used throughout this Guide, the concept also embraces processes and services as appropriate.

** For the process of integrating environmental aspects into product design and development, various terms are used such as Design For Environment (DFE), eco-design, Environmentally Conscious Design (ECD), etc. ECD will be used in this document to represent the various terms.

ENVIRONMENTAL ASPECTS — INCLUSION IN ELECTROTECHNICAL PRODUCT STANDARDS

1 Scope

IEC Guide 109 is intended for standards writers and gives guidance on how to consider aspects relating to the impact on the environment of electrotechnical products when preparing standards for such products.

Its purpose is

a) to raise awareness that provisions in product standards can affect the environment in both negative and positive ways;
b) to outline the relationship between product standards and the environment;
c) to help avoid provisions in product standards that may lead to adverse environmental impacts;
d) to emphasize that addressing environmental aspects during the development of product standards is a complex process and requires balancing competing priorities;
e) to recommend the use of life-cycle thinking when addressing environmental aspects in the context of product standardization.

This Guide converges as far as possible with ISO Guide 64.

2 Reference documents

ISO 14001:1996, *Environmental management systems – Specification with guidance for use*

ISO/TR 14062:2002, *Environmental management – Integrating environmental aspects into product design and development*

ISO 11469:2000, *Plastics – Generic identification and marking of plastics products*

ISO 14040:1997, *Environmental management – Life cycle assessment – Principles and framework*

ISO 17422:2002, *Plastics – Environmental aspects – General guidelines for their inclusion in standards*

ISO Guide 64:1997, *Guide for the inclusion of environmental aspects in product standards*

ISO/IEC Guide 2:1996, *Standardization and related activities – General vocabulary*

3 Definitions

For the purposes of this Guide, the following definitions apply.

3.1
End of Life (EOL)
state of a product when it is finally removed from its intended use or original purpose

3.2
energy recovery
use of combustible waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat

3.3
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation

[ISO 14001]

NOTE 1 "Organization" in this Guide includes the products produced by the organization.

NOTE 2 "Environment" in this Guide does not refer to the surrounding atmosphere influencing an electrotechnical product (such as humidity or temperature), nor to the business environment. It is used as a synonym of "ecological environment".

3.4
environmental aspect
element of an organization's activities, products or services that can interact with the environment

NOTE A significant environmental aspect is an environmental aspect that has or can have a significant environmental impact.

[ISO 14001]

NOTE For example, energy consumption is, in many cases, the major environmental aspect of electrical or electronic products.

3.5
environmental impact
change to the environment, whether adverse or beneficial, wholly or partly resulting from an organization's activities, products or services

[ISO 14001]

NOTE For example, energy consumption of a product has several environmental impacts through the energy production process, such as contributions to the greenhouse effect or to acidification of the environment.

3.6
hazardous substance
substance which can adversely affect human health or the environment with immediate or retarded effect

NOTE The risk of adverse effects on the environment caused by a hazardous substance is not only determined by the hazardousness of the substance, but also by the quantity and the probability of its release. The risk has, therefore, to be assessed taking all these factors and the entire product life cycle into account.

3.7
input
material or energy which enters a product system at any stage, from raw material acquisition to final disposal

3.8
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation of natural resources to the final disposal

[ISO 14040]

3.9
Life Cycle Assessment (LCA)
systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and associated environmental impacts directly attributable to the functioning of a product system throughout its life cycle

[ISO 14040]

3.10
Life-Cycle Thinking (LCT)
consideration of all relevant environmental aspects (of a product) during the entire (product) life cycle

3.11
output
material or energy which leaves a product system at any stage, from raw material acquisition to final disposal

3.12
pollution
all adverse effects on the environment caused by the release of organic or inorganic materials, hazardous substances, radiation or noise

3.13
prevention of pollution
use of processes, practices, materials or products that avoid, reduce or control pollution, which may include recycling, treatment, process changes, control mechanisms, efficient use of materials and material substitution

NOTE The potential benefits of prevention of pollution include the reduction of environmental impacts, improved efficiency and reduced costs.

[ISO 14001]

3.14
product standard
standard that specifies requirements to be fulfilled by a product or group of products, to establish its fitness for purpose

NOTE 1 A product standard may include, in addition to the fitness-for-purpose requirements, directly or by reference, aspects such as terminology, sampling, testing, packaging and labelling and, sometimes, processing requirements.

NOTE 2 A product standard can either be complete or not, according to whether it specifies all or only a part of the necessary requirements. In this respect, one may differentiate between standards such as dimensional, material and technical delivery standards.

[ISO/IEC Guide 2]

3.15
recyclability
property of a substance or a material and parts/products made thereof that makes it possible for them to be recycled

NOTE The recyclability of a product is not only determined by the recyclability of the materials it contains. Product structure and logistics are also very important factors.

3.16
recycling
reprocessing in a production process of the waste materials for the original purpose or for other purposes but excluding energy recovery

3.17
standards writer
person taking part in the preparation of standards

3.18
waste
substance or object which the holder disposes of, or is required to dispose of, pursuant to the provisions of national law in force

[EEC Directive 75/442]

4 General considerations on product standards and the environment

4.1 Introduction

Every product has some impact on the environment. These impacts may occur at any or all stages of the product's life cycle and can be local, regional or global, or a combination of all three.

A product's environmental impacts are largely determined by the inputs that are used and the outputs that are generated at all stages of the product's life cycle. Changing any single input or output may affect other inputs and outputs.

Anticipating or identifying a product's environmental impacts is complex, and agreement is occasionally lacking on environmental cause-and-effect relationships. Attempts to address a given environmental impact may have consequences at any or all of the stages of a product's life cycle.

Despite the difficulties involved, a product's environmental impacts should be considered when product standards are developed.

A product's environmental impacts should be balanced against other factors, such as product function, performance, safety and health, cost, marketability and quality; legal and regulatory requirements have to be met.

In this clause, some general considerations on product standards and the environment, and their relationship, are presented. In Clause 5, practical advice and specific recommendations for standards writers are given.

4.2 Product standards and the environment

Provisions in product standards are conceptually related to the environmental impacts associated with the product during its life cycle, as illustrated in Figure 1. As such, product standards can significantly contribute to the continual reduction of adverse environmental impacts of products.

This subclause aims at giving standards writers background information on issues which should be taken into account when considering the inclusion of environmental aspects in product standards.

In 4.2.1 some general considerations are presented regarding product standards. In 4.2.2 attention is paid to environmental impact. In both cases, some related strategies to be followed when including environmental aspects in product standards are highlighted.

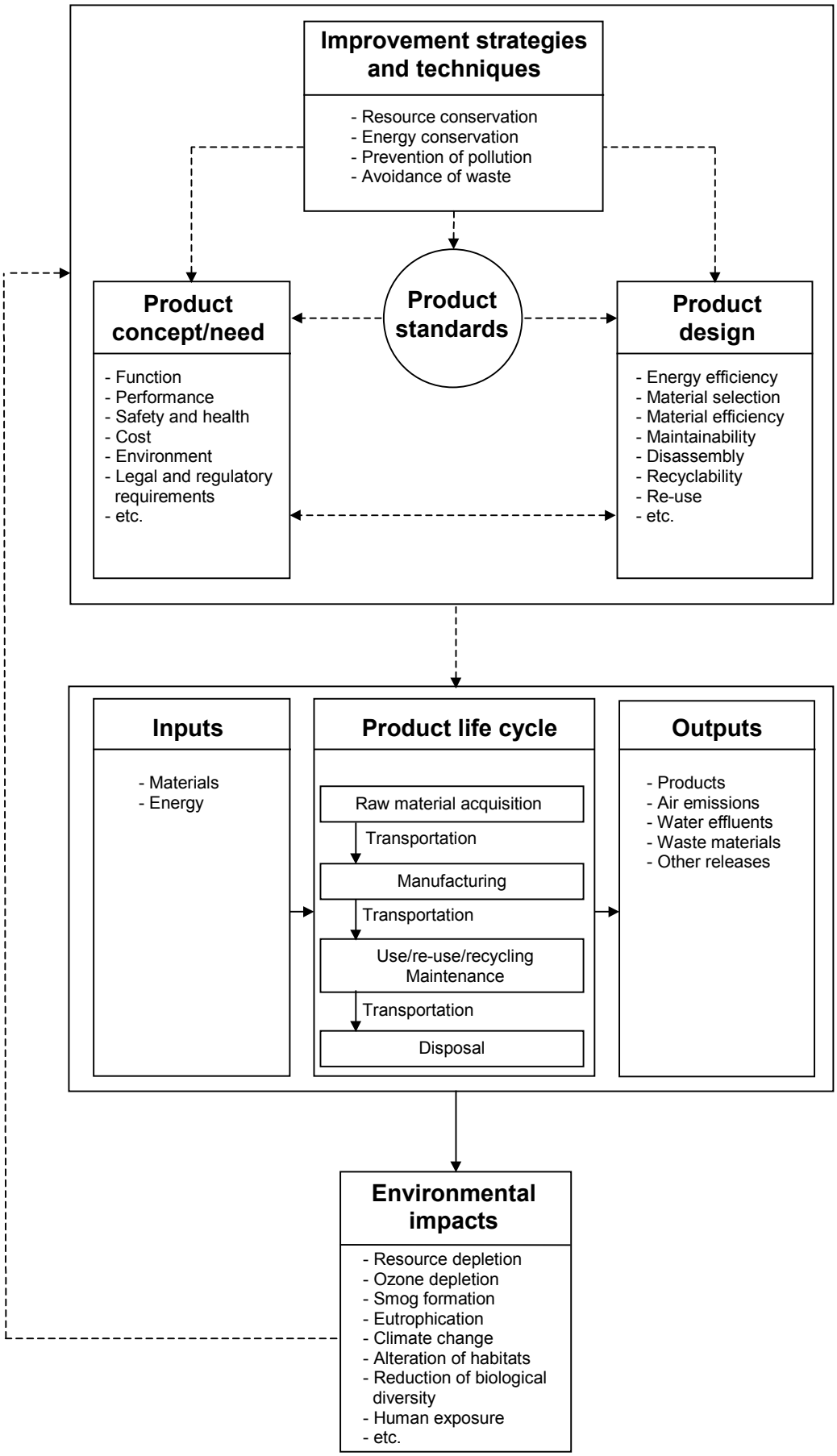

Figure 1 – Conceptual relationship between provisions in product standards and the environmental impacts associated with the product during its life cycle

4.2.1 General considerations

– Provisions in product standards may both facilitate and hamper environmental improvement. Unless necessary for important reasons (for example, health, safety or performance of the product), standards should, whenever possible, avoid specifying materials to be used in products. Specifying materials may preclude innovation and the development of new ways of reducing adverse environmental impacts through the use of alternative materials. For instance, provisions in product standards should not preclude the appropriate use of secondary or recycled materials. If materials are to be specified, consideration should be given as to how the use of the specified material will affect the environment at all stages of the product's life cycle. In general, provisions in product standards that are too restrictive may have the unintended effect of stifling innovation and environmental improvements.

– The rate of innovation is high. Therefore, review of product standards should be considered whenever the adverse environmental impacts might be significantly reduced by the application of new knowledge.

– The intended use and reasonably foreseeable misuse of a product determine the environmental impacts of a product to some extent. As such, both should be considered.

– Specifications in standards that have adverse environmental impacts should be avoided when suitable alternatives are available.

– Specification of performance requirements is better than specification of design requirements. For example, focus on functionality rather than on prescribed design.

– Opportunities to specify options that reduce adverse environmental impacts should be recognized and taken, for example, specifying requirements which do not rule out the appropriate use of recycled materials and encourage the re-use of parts and subassemblies.

4.2.2 Environmental impacts

When preparing product standards, strategies and techniques for environmental improvement may be represented by resource conservation, energy conservation, prevention of pollution and avoidance of waste.

Standards writers are advised to consider the following issues.

- Resource conservation

  Beside the environmental impacts associated with resource acquisition and use, resource depletion can be of great significance environmentally. Resource depletion refers to the process of diminishing stocks of natural resources. Usually, the less of a particular resource that is depleted, the better.

  Renewable resources can be replenished at significant rates. On the contrary, in the case of non-renewable resources, the likelihood of replenishment is low in comparison with human lifespan.

- Energy conservation

  Among considerations associated with the conservation of energy are the environmental impacts of various sources of energy, the conversion efficiency of a selected source, and the efficient use of energy. Substantial environmental trade-offs may exist between energy sources.

  Energy management might be dealt with, for example, in the following cases:

  – production of raw materials;

  – manufacturing of components and parts from materials;

  – assembling of components and parts to form a product;

  – making the product function and perform in a safe and satisfactory way;

  NOTE Options to automatically switch off the product or revert to "stand-by active, passive" when not in use should be considered.

  - packaging and transportation of components and products;
  - disposal or recycling of components and products;
  - energy efficiency of a product during use.

- Prevention of pollution

  Human and industrial activities result in releases to air, land and/or water. There are several generally accepted means of reducing these releases, including source reduction, material substitution, in-process recycling, re-use, recycling, and treatments to reduce hazards and/or volume.

  There are various types of releases which may lead to environmental impacts about which there is currently no international consensus on characterization and evaluation. Such concerns include climate change, ozone depletion, habitat alteration, impacts on biological diversity and other long-term impacts. When addressing these issues, standards writers should consider sector-specific expertise.

- Avoidance of waste

  During all stages of the product life cycle, waste is produced. By appropriate design and process optimization, it may be possible to reduce or even completely avoid unnecessary use of resources. In production, this may be achieved by use of recycled materials instead of virgin ones, returnable packaging instead of one-way packaging, and the like. During use, it is mainly the exchanged parts that should allow for re-manufacturing or at least be safely disposable. This also holds for the product as a whole at the end of its useful life.

5 Influence of provisions in product standards on the environment and the role of standards writers

5.1 Environmental relevance of provisions in product standards

When specifying requirements, such as descriptive requirements or performance requirements, provisions in product standards affect the choices made during the design and production of a new or upgraded product (see Figure 1). For example, during all stages of the product's life cycle these choices can influence

a) the inputs and outputs associated with manufacturing processes;

b) the inputs and outputs associated with packaging, transportation, distribution and use;

c) the options for re-use and recovery, including recycling or energy recovery of the product, as well as its ease of disassembly, repair and restoration;

d) the options for disposal of the product and associated waste.

The impacts these choices have on the environment will vary from product to product. All products will not necessarily affect the environment equally at all stages of their life cycle.

Because a product's environmental impacts are usually interrelated, an arbitrary emphasis on a single environmental impact may alter environmental impacts at other stages of the product's life cycle or in other aspects of the local, regional or global environment.

5.2 The role of standards writers in environmental considerations

Environmental stewardship in a business enterprise can embrace a multiplicity of activities including

– the establishment of policies, practices, and priorities;

– the education of citizens, employees, contractors and suppliers;

– the expenditure of resources for research, technology transfer, readiness in emergencies and operational compliance;

– and, above all, resources for the development of products that have no undue environmental impacts and are safe in their intended use, that are efficient in their consumption of energy and natural resources, and that can be re-used, recycled, or disposed of safely.

Advances in technology and the application of new design principles have fostered the development of such products. Standards writers should approach this issue from several perspectives:

a) resource conservation by a decrease of the material content;

b) energy conservation by improved energy efficiency;

c) pollution prevention by substitution of hazardous substances;

d) waste prevention, by re-use and refurbishing of subassemblies or components or by favouring maintainability, upgradability, disassembly and recyclability;

e) better management of materials:
   – safe application of hazardous substances,
   – marking plastics parts according to relevant standards (for example, ISO 11469),
   – specification of materials that are not detrimental to recycling,
   – specification of material combinations (joining technologies, surface coatings, etc.) which do not impede recyclability and maintenance.

6 Inputs and outputs to be considered in the development of product standards

6.1 Introduction

A product's environmental impacts are largely determined by the inputs that are used and the outputs that are generated at all stages of the product's life cycle. When developing product standards, significant inputs and outputs related to the product system under standardization should be identified and considered. Inputs and outputs are related to each other; changing any single input, either to alter the materials and energy used or to influence a single output, may affect other inputs and outputs (see Figure 1).

In connection with this clause, reference is made to the checklist in Annex A.

6.2 Inputs

Inputs fall into two broad categories: materials and energy.

6.2.1 Material inputs to the different phases of the product’s life cycle – from raw material acquisition, manufacturing, transportation (including packaging and storage), use/maintenance, re-use/recycling, to disposal of products – can produce a variety of environmental impacts. Material inputs used in product development should also be considered. These impacts can include depletion of renewable and non-renewable resources, detrimental land use, and environmental or human exposure to hazardous substances. Material inputs can also contribute to the generation of waste, emissions to air, effluents to water, and other releases.

6.2.2 Energy inputs are required at most stages of a product's life cycle, both direct but also indirect, for example energy used in material manufacturing. Energy sources include, for example, fossil fuels, nuclear, recovered waste, hydroelectric, geothermal, solar and wind energy. Each energy source has its own set of environmental impacts.

6.3 Outputs

Outputs generated during a product's life cycle comprise the product itself, intermediates and by-products, air emissions, water effluents, waste materials and other releases.

6.3.1 Air emissions comprise releases of gases or vapours or particulate matter to the air. Releases of toxic, corrosive, flammable, explosive, acidic, or odorous substances may adversely affect flora, fauna, human beings, buildings, etc., or contribute to other environmental impacts such as depletion of stratospheric ozone or formation of smog. Air emissions include releases from point as well as diffuse sources, treated as well as untreated releases, and releases from normal operation as well as accidental releases.

6.3.2 Emission to water, effluents, comprise the discharge of substances to a water course, either surface or ground water. The discharge of nutrients or toxic, corrosive, radioactive, persistent, accumulating or oxygen-depleting substances may give rise to adverse environmental impacts including various pollution effects on aquatic ecosystems and undesirable eutrophication of natural waters. Water effluents include discharges from point as well as diffuse sources, treated as well as untreated discharges, and discharges from normal operation as well as accidental discharges.

6.3.3 Waste materials comprise solid or liquid materials or products which are disposed of. Waste materials may be produced at all stages of a product's life cycle. Waste materials are subject to recycling, treatment, recovery or disposal techniques associated with further inputs and outputs, which may contribute to adverse environmental impacts.

6.3.4 Other releases may include emissions to soil, noise and vibration, radiation and waste heat.

7 Tools for including environmental aspects in product design and development

Identification and assessment of how provisions in product standards influence the environmental impacts caused by a product is complex and needs careful consideration; it may also require consultation with experts. Certain tools and techniques are evolving to encourage the inclusion of environmental aspects in product design and development. These can assist in the development of key design items, decision-making, and integration with business and economic factors. Examples of such tools are

1) analysis of a product’s environmental aspects; for example, LCA (Life Cycle Assessment), and environmental benchmarking based on physical metrics (for example, weight, energy consumption, volume);
2) determination of a product’s environmental strategy: qualitative decision-making tools, for example, Eco-matrices, checklists, Pareto diagrams, SWOT analysis (Strengths, Weaknesses, Opportunities, Threats), spider’s-web diagrams, and portfolio diagrams;
3) transfer of environmental aspects into product properties; for example, QFD (Quality Function Deployment), and FMEA (Failure Mode and Effects Analysis) techniques.

When selecting which tools to use, it is helpful to consider the basic product-related concepts for integrating environmental aspects into product design and development.

Annex A

Checklist for the consideration of environmental aspects in product standards

The following list, based on the the preceding clauses of this Guide, is meant as a working aid for the TCs/SCs to screen existing standards as well as standards under development/ revision so as to find environmentally related aspects that may require consideration. The list addresses key factors which have an impact on the environment.

Determine whether the standard or draft under consideration considers

- material conservation;
- efficient use of energy and resources;
- reduction of emissions and waste;
- minimum material content of product (including packaging material);
- decreasing the number of different materials;
- substitution or reduction in the use of hazardous substances;
- re-use/refurbishing of subassemblies or components;
- possibility of technical upgrading;
- design for maintainability, disassembly and recyclability;
- surface coating or other material combinations impeding recyclability;
- marking;
- adequate environmental instructions/information for the user.

It should be checked that consideration of the above points always leads to reduction of the adverse environmental impact of the product throughout its life cycle.

Standards Survey

The IEC would like to offer you the best quality standards possible. To make sure that we continue to meet your needs, your feedback is essential. Would you please take a minute to answer the questions overleaf and fax them to us at +41 22 919 03 00 or mail them to the address below. Thank you!

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A Prioritaire

RÉPONSE PAYÉE

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Q1 Please report on **ONE STANDARD** and **ONE STANDARD ONLY**. Enter the exact number of the standard: *(e.g. 60601-1-1)*

.....

Q2 Please tell us in what capacity(ies) you bought the standard *(tick all that apply).* I am the/a:

purchasing agent ❑
librarian ❑
researcher ❑
design engineer ❑
safety engineer ❑
testing engineer ❑
marketing specialist ❑
other.....

Q3 I work for/in/as a: *(tick all that apply)*

manufacturing ❑
consultant ❑
government ❑
test/certification facility ❑
public utility ❑
education ❑
military ❑
other.....

Q4 This standard will be used for: *(tick all that apply)*

general reference ❑
product research ❑
product design/development ❑
specifications ❑
tenders ❑
quality assessment ❑
certification ❑
technical documentation ❑
thesis ❑
manufacturing ❑
other.....

Q5 This standard meets my needs: *(tick one)*

not at all ❑
nearly ❑
fairly well ❑
exactly ❑

Q6 If you ticked NOT AT ALL in Question 5 the reason is: *(tick all that apply)*

standard is out of date ❑
standard is incomplete ❑
standard is too academic ❑
standard is too superficial ❑
title is misleading ❑
I made the wrong choice ❑
other .....

Q7 Please assess the standard in the following categories, using the numbers:
(1) unacceptable,
(2) below average,
(3) average,
(4) above average,
(5) exceptional,
(6) not applicable

timeliness.....
quality of writing.....
technical contents.....
logic of arrangement of contents .....
tables, charts, graphs, figures.....
other .....

Q8 I read/use the: *(tick one)*

French text only ❑
English text only ❑
both English and French texts ❑

Q9 Please share any comment on any aspect of the IEC that you would like us to know:

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