BS EN 62430:2009

BSI British Standards

Environmentally conscious design for electrical and electronic products

raising standards worldwide™

BSI British Standards

National foreword

This British Standard is the UK implementation of EN 62430:2009. It is identical to IEC 62430:2009.

The UK participation in its preparation was entrusted to Technical Committee GEL/111, Electrotechnical environment committee.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 57459 7

ICS 13.020.01; 29.020; 31.020; 43.040.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2009

Amendments issued since publication

Amd. No.	Date	Text affected

BS EN 62430:2009

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62430

June 2009

ICS 13.020; 43.040.10

English version

Environmentally conscious design for electrical and electronic products
(IEC 62430:2009)

Eco-conception pour les produits électriques et électroniques
(CEI 62430:2009)

Umweltbewusstes Gestalten von elektrischen und elektronischen Produkten
(IEC 62430:2009)

This European Standard was approved by CENELEC on 2009-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 62430:2009 E

Foreword

The text of document 111/104/CDV, future edition 1 of IEC 62430, prepared by IEC TC 111, Environmental standardization for electrical and electronic products and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62430 on 2009-05-01.

The following dates were fixed:

– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2010-02-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-05-01

Endorsement notice

The text of the International Standard IEC 62430:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

ISO 9000	NOTE	Harmonized as EN ISO 9000:2005 (not modified).
ISO 9001	NOTE	Harmonized as EN ISO 9001:2008 (not modified).
ISO 14001	NOTE	Harmonized as EN ISO 14001:2004 (not modified).
ISO 14040	NOTE	Harmonized as EN ISO 14040:2006 (not modified).

CONTENTS

INTRODUCTION

Every product has an effect on the environment, which may occur at any or all stages of its life cycle – raw-material acquisition, manufacture, distribution, use, maintenance, re-use and end of life. These effects may range from slight to significant; they may be short-term or long-term; and they may occur at the local, national, regional or global level (or a combination thereof).

The widespread use of electrical and electronic products has drawn increased awareness to their environmental impacts. As a result, legislation, as well as market-driven requirements for environmentally conscious design, are emerging.

The goal of environmentally conscious design is the reduction of adverse environmental impacts of a product throughout its entire life cycle. This can involve balancing the environmental aspects of the product with other factors, such as its intended use, performance, cost, marketability and quality, and choosing methods to meet legal and regulatory requirements in the most environmentally friendly way. In striving for this goal, multiple benefits can be achieved for the organization, its customers and other stakeholders. Environmentally conscious design is not a separate design activity; rather, it is an integral part of the existing design process. The "design" in this context includes the activities associated with the processes of product planning, development and decision-making as well as the creation of policies within the organization.

The impetus to create an International Standard was triggered by common circumstances impacting many industries in the global marketplace, since the compositional elements of a product (such as materials, components and services) are provided across national borders. The existence of an International Standard provides for a consistent approach to life cycle management.

This International Standard is intended for use by all those involved in the design and development of electrical and electronic products. This includes all parties in the supply chain regardless of organization type, size, location and complexity. It is applicable for all types of products, new as well as modified. Sector-specific documents may be developed to address needs not covered in this standard. The use of this standard as a base reference is encouraged so as to ensure consistency throughout the electrotechnical sector.

This International Standard provides a set of requirements for the process of environmentally conscious design reflecting the contents of IEC Guide 114 and ISO/TR 14062.

ENVIRONMENTALLY CONSCIOUS DESIGN FOR ELECTRICAL AND ELECTRONIC PRODUCTS

1 Scope

This International Standard specifies requirements and procedures to integrate environmental aspects into design and development processes of electrical and electronic products, including combination of products, and the materials and components of which they are composed (hereafter referred to as products).

NOTE The existence of this standard does not preclude particular sectors from generating their own, more specific, standards or guidelines. Where such documents are produced it is recommended that they use this standard as the reference in order to ensure consistency throughout the electrotechnical sector.

2 Normative references

No normative references are cited. Informative references are noted in the bibliography.

NOTE This clause is included in order to retain typical clause numbering.

3 Terms and definitions

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

3.1
design and development
activities that take an idea or requirement and transform these into a product

NOTE The process of design and development usually follows a series of defined steps starting with an initial idea, transforming that into a formal specification, and resulting in the creation of a working prototype and whatever documentation is required to support production of the goods or provision of the service.

3.2
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation

NOTE Surroundings in this context extend from within an organization to the global system.

[ISO 14001: 2004, definition 3.5]

3.3
environmental aspect
element of an organization's activities or products that can interact with the environment

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

[ISO 14001:2004, definition 3.6, modified]

3.4
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partly resulting from an organization's environmental aspects

[ISO 14001:2004, definition 3.7]

3.5
environmental parameter
quantifiable attribute of an environmental aspect

EXAMPLE Environmental parameters include the type and quantity of materials used (weight, volume), power consumption, emissions, rate of recyclability, etc.

3.6
environmentally conscious design
ECD
systematic approach which takes into account environmental aspects in the design and development process with the aim to reduce adverse environmental impacts

3.7
environmentally conscious design tool
formalized method which facilitates qualitative or quantitative analysis, comparison and/or solution finding during the ECD process

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

[ISO 14040:2006, definition 3.1]

3.9
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[ISO 14040:2006, definition 3.2]

3.10
life cycle stage
element of a life cycle

NOTE 1 The phrase 'life cycle phase' is sometimes used interchangeably with 'life cycle stage'.

NOTE 2 Examples of life cycle stages are: raw material acquisition and production; manufacturing; packaging and distribution; installation and use, maintenance and upgrading and end of life.

3.11
life cycle thinking
LCT
consideration of all relevant environmental aspects during the entire life cycle of products

[IEC Guide 109:2003, modified]

3.12
organization
group of people and facilities with an arrangement of responsibilities, authorities and relationships

[ISO 9000:2005, definition 3.3.1,modified]

3.13
process
set of interrelated or interacting activities which transform inputs into outputs

NOTE 1 Inputs to a process are generally outputs of other processes.

NOTE 2 Processes in an organization are generally planned and carried out under controlled conditions to add value.

[ISO 9000:2005, definition 3.4.1, modified]

3.14
product
any goods or service

NOTE This includes interconnected and/or interrelated goods or services.

[ISO 14040:2006, definition 3.9, modified]

3.15
product category
group of technologically or functionally similar products where the environmental aspects can reasonably be expected to be similar

3.16
stakeholder
individual, group or organization that has an interest in an organization or activity

NOTE Usually a stakeholder can affect or is affected by the organization or the activity.

[ISO 14050, definition 3.5, modified]

4 Fundamentals of environmentally conscious design (ECD)

NOTE More detailed information relating to Clause 4 is provided in Annex A.

4.1 General

Clause 4 describes the fundamental requirements of ECD to be implemented by the organization. Clause 5 describes the ECD process to be implemented on an operational basis.

4.2 Life cycle thinking

Environmentally conscious design shall be based on the concept of life cycle thinking (LCT), which requires consideration during the design and development process of the significant environmental aspects of a product in all life cycle stages.

Key elements of life cycle thinking are as follows:

a) having an objective to minimize the overall adverse environmental impact of the product;
b) identifying, qualifying and where feasible, quantifying the significant environmental aspects of the product;
c) considering the trade-offs between environmental aspects and life cycle stages.

The above shall be initiated as early as possible in the design and development process, when most opportunities exist to make changes and improvements to the product affecting its overall environmental performance throughout its life cycle.

NOTE 1 As a first step in LCT, the intended function of the product should be determined. In subsequent design and development stages the influence of any applied business model should be recognized.

NOTE 2 The life cycle stages of any product under control of the organization usually include the processing of materials, manufacturing, distribution, use, maintenance and end-of-life management (including reuse, recycling, recovery and final disposal).

NOTE 3 When a product is part of a system, the environmental performance of one product during one or more life cycle stages can be altered by other products in that system.

NOTE 4 ECD requires collaboration and contributions of all stakeholders along the supply chain.

4.3 Regulatory and stakeholders' requirements

Environmentally conscious design is performed within the boundaries set by regulatory and stakeholders' requirements. Such requirements shall be regularly reviewed so that relevant changes are understood by the organization undertaking the ECD.

Regulatory and stakeholders' requirements may include:

a) restrictions and obligations resulting from national and international regulations;

b) technical standards and voluntary agreements;

c) market or customers' needs, trends and expectations;

d) societal and investors' expectations, e.g. advances in technology.

4.4 Integration into management system

Environmentally conscious design and its objective of minimizing the overall adverse impact of the product shall be reflected in the policies and strategies of the organization. If an organization has a management system which includes the product design and development function, the ECD process shall be an integral part of that documented system.

Environmental considerations could be one element of the overall risk management process of the organization.

NOTE 1 "Risk management" is defined in ISO/IEC Guide 73.

In line with the procedures of the management system of the organization, the ECD process shall be reviewed when required and at planned intervals to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the ECD process and the related policies and strategies of the organization.

NOTE 2 The iterative process of continual improvement in product design and development can also be described by the PDCA (Plan, Do, Check, Act) cycle. This approach also provides means for managing the changing legal, technological, organizational, economic and environmental requirements.

NOTE 3 Communication regarding the ECD process and its objectives is performed within an organization so that the affected departments understand the rationale for the initiative, leading to their cooperation and collaboration.

NOTE 4 Management systems are described, for example, in ISO 9001 and ISO 14001.

5 Environmentally conscious design process (ECD process)

NOTE More detailed information relating to Clause 5 is provided in Annex B.

5.1 General

Organizations performing environmentally conscious design (ECD) shall establish, document, implement and maintain an ECD process as an integral part of the product design and development process. This ECD process includes the following steps, which are further described in 5.2 to 5.5:

a) analysis of the regulatory and stakeholders' environmental requirements;

b) identification and evaluation of environmental aspects and corresponding impacts;

c) design and development;

d) review and continual improvement.

The organization shall, while following the above steps, document the relevant results and the subsequent conclusions and responsibilities assigned.

NOTE The above process a) to d) corresponds to the PDCA cycle as follows:

– steps a) and b) correspond to Plan,

– step c) corresponds to Do, and

– step d) corresponds to Check and Act.

5.2 Analysis of regulatory and stakeholders' environmental requirements

As an initial step of ECD, to be carried out in conjunction with the identification of environmental aspects (see 5.3), the organization shall understand the relevant regulatory and stakeholders' requirements, both at horizontal and sector specific level. These requirements set the basic framework within which a product is developed.

The organization shall ensure, as appropriate, that:

a) relevant environmental requirements from applicable regulatory authorities and stakeholders are identified, covering
   – relevant product functions,
   – relevant life cycle stages,
   – relevant environmental aspects of the product,
   – geographical scope of the intended market, and
   – related activities of the organization;
b) both current and new requirements are regularly reviewed and identified;
c) a systematic analysis of these requirements is performed and documented, identifying the affected product function(s) and life cycle stage(s), related activities of and responsibilities in the organization, and resulting action(s) to be taken;
d) new or changed requirements, which appear during the design phase are evaluated as to their effect on the product and necessary modifications are made.

NOTE 1 Horizontal requirements are generally applicable to electrotechnical and electronic products.

NOTE 2 Sector specific requirements address a certain product group.

5.3 Identification and evaluation of environmental aspects and corresponding impacts

The organization shall establish a procedure to identify environmental aspects and corresponding impacts. It shall comprise the following steps:

a) Identification of relevant environmental aspects and corresponding impacts.

   For each relevant life cycle stage, identify inputs such as materials, energy and other resources used, as well as outputs (examples are provided in Figure B.3), all of which cause environmental impacts. Examples of outputs include the product itself, semi-finished products, rejects, production wastes, and emissions.

   It is permitted to use qualitative or quantitative environmental information associated with the identified processes, materials, parts or components. Where feasible, the quantitative approach is encouraged.

NOTE Identification of environmental aspects can also be made for a product category.

b) Evaluation of environmental impacts related to the identified relevant environmental aspects.

c) Determination of significant environmental aspects.

   After all relevant environmental aspects have been identified, significant environmental aspects are determined by evaluation and prioritization, based on their contribution to overall environmental impact. The organization should then address, in the subsequent ECD process steps, these significant environmental aspects identified for a product or product category. An arbitrary emphasis on a single environmental aspect or a single life cycle stage should be avoided.

It is permitted to use qualitative or quantitative evaluation and prioritization of the environmental aspects. Where feasible, the quantitative approach is encouraged.

5.4 Design and development

The choice of a design solution should achieve a balance between the various environmental aspects and other relevant considerations, such as function, technical requirements, quality, performance, business risks and economic aspects. Where certain attributes are required for compliance with regulations (e.g. health and safety, electromagnetic compatibility) these shall be met in a manner that is least damaging to the environment. These considerations also apply to research and development of new technologies.

The following steps shall be carried out during design and development:

a) specify the functions of the product;

b) define significant environmental parameters from the analysis of regulatory and stakeholder requirements and evaluation of the environmental aspects;

c) identify relevant environmental improvement strategies for these parameters;

d) develop environmental targets based on the improvement strategies;

e) develop a product specification addressing the environmental targets (environmental product specification); and

f) develop technical solutions to meet the environmental targets while taking into account other design considerations.

NOTE The use of ECD tools (described in Annex C) and other standards may be helpful.

5.5 Review and continual improvement

A procedure for review and continual improvement of the significant environmental aspects of products throughout the entire life cycle shall be established, implemented and maintained.

The organization shall conduct design reviews to evaluate that the product design has met the targets defined in the environmental product specification whenever significant environmental aspects are affected or a major design phase is completed. When the product environmental targets are not met, improvement actions shall be assigned and implemented for the current or future design.

NOTE The organization could conduct further product reviews after market launch to consider feedback from users and other stakeholders as well as additional environment-related knowledge. The results could then be incorporated into the ECD process supporting continual product improvement and the revision of policies and procedures of the organization setting the basis for product specifications for future product development.

Records of the design reviews, including the assigned actions arising from the review, shall be maintained and serve as a reference for future product development and continual improvement activities.

5.6 Information sharing for ECD

As part of the ECD process, organizations in the supply chain shall disclose information of their product or product category to organizations involved in design and development to enable them to achieve ECD objectives.

Examples of information to be exchanged include:

a) relevant resources used in the product, in the manufacturing processes and for the operation of the product;

EXAMPLE Resource usage includes water, energy and materials.

b) relevant emissions generated by the product;

c) guidance to improve environmental performance;

d) end-of-life treatment;

e) self-declaration indicating conformance with regulatory and customer requirements.

Annex A
(informative)

Fundamentals of environmentally conscious design

NOTE Annex A provides information relating to Clause 4 of this standard.

A.1 General (4.1)

ECD is based on life cycle thinking (LCT) and should be part of the organization's design and development processes (see 4.2). Figure A.1 illustrates how ECD could be incorporated into the (existing) management system of the organization (see 4.4).

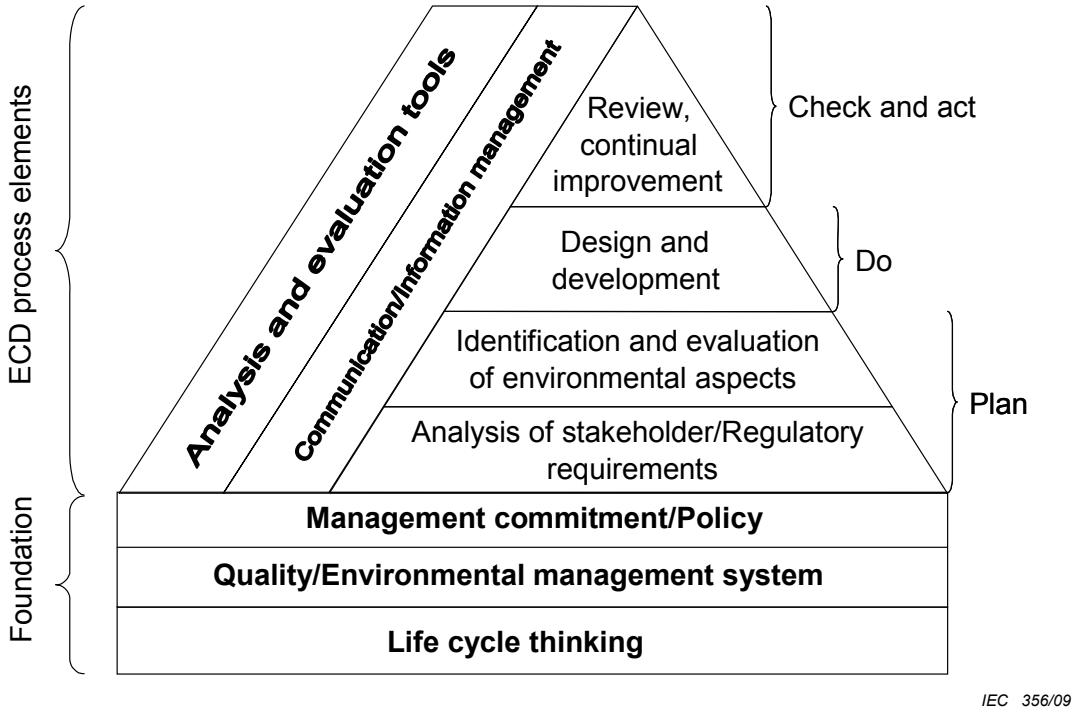

Figure A.1 – Overview of ECD process

As indicated in Figure A.1, the ECD process is consistent with the approach of Plan, Do, Check and Act.

A.2 Life cycle thinking (4.2)

Life cycle thinking is essential for performing ECD. The elements listed below can be included in life cycle thinking.

a) Comprehensive view: rather than arbitrarily focusing on one life cycle stage or aspect of the product, all such stages are considered during the design and development process from the environmental as well as from other business perspectives, maintaining the goal of overall improvement of the environmental performance.

b) Business strategy: when looking at ways to reduce environmental impact consider what changes can be made to the wider business model (product service systems, end-of-life options, etc.) rather than focusing solely on improvements to the product itself.

c) Consider end of life: when considering the life cycle it is necessary to include end-of-life aspects (e.g. life time, disposal reasons, collection rate and critical components to be disposed of) and (secondary) raw materials potentially to be recovered ('cradle to cradle').

d) Future developments: as far as feasible, take into account the effects of impending regulatory requirements, changes to related product families and advances in technology or the projected availability of devices with competing functionality (e.g. the replacement of cathode ray tubes (CRTs) by liquid crystal displays (LCDs).

e) Strategy for implementation: balance environmentally adverse effects with other relevant factors like health, safety, function, performance, marketability and cost. Define goals to be realised by ECD at the applicable life cycle stages (including maintenance, upgrading and management options at end of life).

A.3 Regulatory and stakeholders' requirements (4.3)

Environmentally conscious design is performed based on regulatory and stakeholder requirements, changes in technology, market trends as well as the policies and procedures of the organization.

These requirements may address parts of the supply chain not directly under control of the specifying organization but still affecting the product and should be considered.

The organization should regularly review the internal and external requirements and incorporate those that are relevant into the ECD process.

A.4 Integration into management system (4.4)

The decisions made by management determine the framework and targets of the ECD programme, the level of support the work will receive (including financial and human resources and time allocated for the tasks) and the degree of success at minimizing adverse environmental aspects the programme will achieve. Top management support addressed to all involved internal and external stakeholders is needed to achieve a significant effect on an organization's product design and development activities.

For effective implementation and use of ECD processes and procedures, it may be best to integrate ECD in an existing management system of the organization such as a quality or environmental management system. If an organization has a management system which includes the product design and development function, 4.4 requires that the ECD process be integral to that management system. Integration of the ECD process into a management system would:

– leverage the general elements of an existing management system (e.g. system review, communication);

– ensure consistency with the basic framework of the organization, including high-level policies and targets.

The success of integrating environmental aspects into product design and development in an organization is enhanced by involvement of all relevant disciplines and competencies rather than limiting the task to design and development. The aim should be to ensure that all relevant business functions contribute and commit to environmental improvement in the earliest stages of the design and development process and remain involved throughout the process, up to and including market launch and product review.

Risk assessment may be helpful to identify stages during a product's life cycle that can result in adverse environmental effects or in a potential non-conformity with specific regulatory or

stakeholder requirements. Such an input can also lead to improvements of the ECD process. An example of a risk assessment activity could be failure modes and effects analysis (FMEA) focusing on environmental aspects. Environmental risks that exceed a level defined by the organization would trigger action, which could typically either be a risk management assignment in the organization or a design improvement task.

Annex B
(informative)

Elaboration of environmentally conscious design process (ECD process)

NOTE Annex B provides information relating to Clause 5 of this standard.

B.1 Outline of ECD process (5.1)

B.1.1 Integrating environmental aspects into the design and development process

Table B.1 provides examples of general steps for integrating environmental aspects into the design and development process.

Table B.1 – Examples of procedures for ECD process

Phase	(a)- (d) in 5.1	General tasks	Leading questions	Examples of ECD tools (see Annex C)
1. Product planning	a)	Identify and list the various environmental parameters associated with each life cycle stage of the product	What are the significant environmental impacts across the relevant life cycle stages of the product?	
	a)	Identify the regulatory and market requirements, the needs of customers and other stakeholders and relate these to the environmental aspects to be achieved throughout the life cycle of the product	Who are the stakeholders and what do they expect from the environmental attributes of products?	ECD check-list
	a)	Benchmark against the competitor's or predecessor product(s)	What are the environmental strengths and weaknesses of these products?	ECD benchmarking Environmental QFD
	b)	Acquire information from the supply chain. In case of confidential information, organizations may agree on terms of confidentiality	What information on relevant life cycle stages and environmental aspects is needed (e.g. materials content and energy consumption of components)?	
	b)	Identify significant environmental aspects and relevant parameters. • Map out the product life cycle stages and what significant environmental aspects apply to each. • Analyse and evaluate the impacts on the environment, taking into account the foreseeable product life cycle Compile the result of the environ-mental analysis and stakeholders' requirements	What opportunities are there to improve environmental attributes of the product? How to translate customer's needs, benchmarking results and environmental assessment results into common improvement tasks?	ECD benchmarking Environmental QFD LCT assessment tools

Phase		(a)- (d) in 5.1	General tasks	Leading questions	Examples of ECD tools (see Annex C)
2. Product design	**Conceptual design** (identifying product's functions and the solutions)	c)	Establish the environmental targets (performance objectives) and requirements for the product in the design specification	What should be the target specifications for fulfilling the environmental performance objectives?	
		c)	Analysis of the product's intended functions so that these can be modified, if required, to achieve the environmental targets for the product	What are the core functions of the product? What are the possible new functions of the product?	
		c)	Assemble solutions (including new technologies) to achieve each required function within the designed product	How to generate product concept variants?	
		c)	Evaluate variants against criteria, such as economic, technical, social and environmental ones Select and evaluate a model solution against the environmental performance objectives	How to select the best product concept variant? Are the environmental performances objectives met?	Environmental QFD ECD check-lists LCT assessment tools
	Detailed design (Identifying product structure, components and materials)	c)	Detail and optimize the product's design so as to satisfy environmental and performance requirements		Design supporting tools
		c)	Optimize the product's design in detail by taking various life cycle processes into account (e.g. packaging and transportation)		
	Evaluation (Ensuring that the product satisfies environmental and other specifications)	d)	Conduct an assessment of environmental impacts over the entire product life cycle	Does the product satisfy the specified environmental performance objective?	ECD benchmarking ECD check-lists, Environmental QFD LCT assessment tools
		d)	Evaluate and test the prototype against criteria such as economic, technical, social, and environmental ones		
3. Release for production		d)	Prepare the product information for stakeholders to cover the entire life cycle, including end-of-life treatment	What accompanying documents and instructions will be prepared that are relevant for ECD? (Examples include user manuals, disassembly instructions and environmental product declarations). What are the relevant environmental data to include in accompanying documents?	
		d)	Review and check the results and feedback if necessary	Has the environmental target of the product been achieved?	

B.1.2 ECD process documentation – Knowledge management

Procedures and records used to ensure conformity of the product to specified requirements:

– identification of standards and guidelines applied, requirements of regulations;
– details of the significant design and development elements adopted to reduce adverse environmental impacts and of the procedures used to control variations in the production process;
– results of product assessment (assess environmental parameters) over the entire product life cycle, evaluating, testing and prototyping variants against criteria such as economic, technical, social, and environmental ones.

An organization may adapt its existing management system in order to establish a knowledge management system that is suitable to ensure the identification of the relevant regulatory and stakeholder requirements.

B.2 Analysis of regulatory and stakeholder requirements (5.2)

Examples of sources of external environmental requirements influencing the planning, design and development of products are as follows:

a) national and international regulations affecting products, processes or international trade;
b) national and international technical standards and voluntary agreements;
c) customer specifications;
d) benchmark reports of competing products;
e) eco-label and green procurement schemes;
f) technical documentations from suppliers;
g) market analysis and market trend reports; and
h) studies on societal, investor and media expectations.

Examples of factors that may be considered when establishing a procedure for the identification and analysis of environmental regulatory and stakeholders' requirements are as follows:

1) knowledge and expertise of staff;
2) extent of requirements to be covered (e.g. technical and geographic scope);
3) product categories in the organization's product portfolio triggering specific investigations;
4) frequency of changes and the resulting monitoring task;
5) manufacturing strategy and structure of the organization;
6) internal and external resources, availability of suitable specialized services;
7) cooperation with suppliers or within trade associations, and their capabilities; and
8) financial and human resources available for the task.

The organization may determine the necessary actions to appropriately respond to the identified requirements based on available expertise and experience, and by risk assessment.

B.3 Identification and evaluation of environmental aspects and corresponding impacts (5.3)

B.3.1 Examples of environmental impacts associated with a product’s life cycle

Products can have a range of environmental aspects (e.g. resources consumed, emissions generated) that result in environmental impacts (e.g. pollution of air, water and soil; climate change).

A product's environmental impacts are largely linked to the inputs that are used and consumed, the processes employed and the outputs that are generated at all stages of the product's life cycle. Environmental aspects when the product is a service may include transportation resources, use of spare parts or use of energy during service. Environmental impacts can be greatly influenced by the actions of organizations and individuals using the product. Figure B.1 shows some environmental impacts that can be associated with the product’s life cycle.

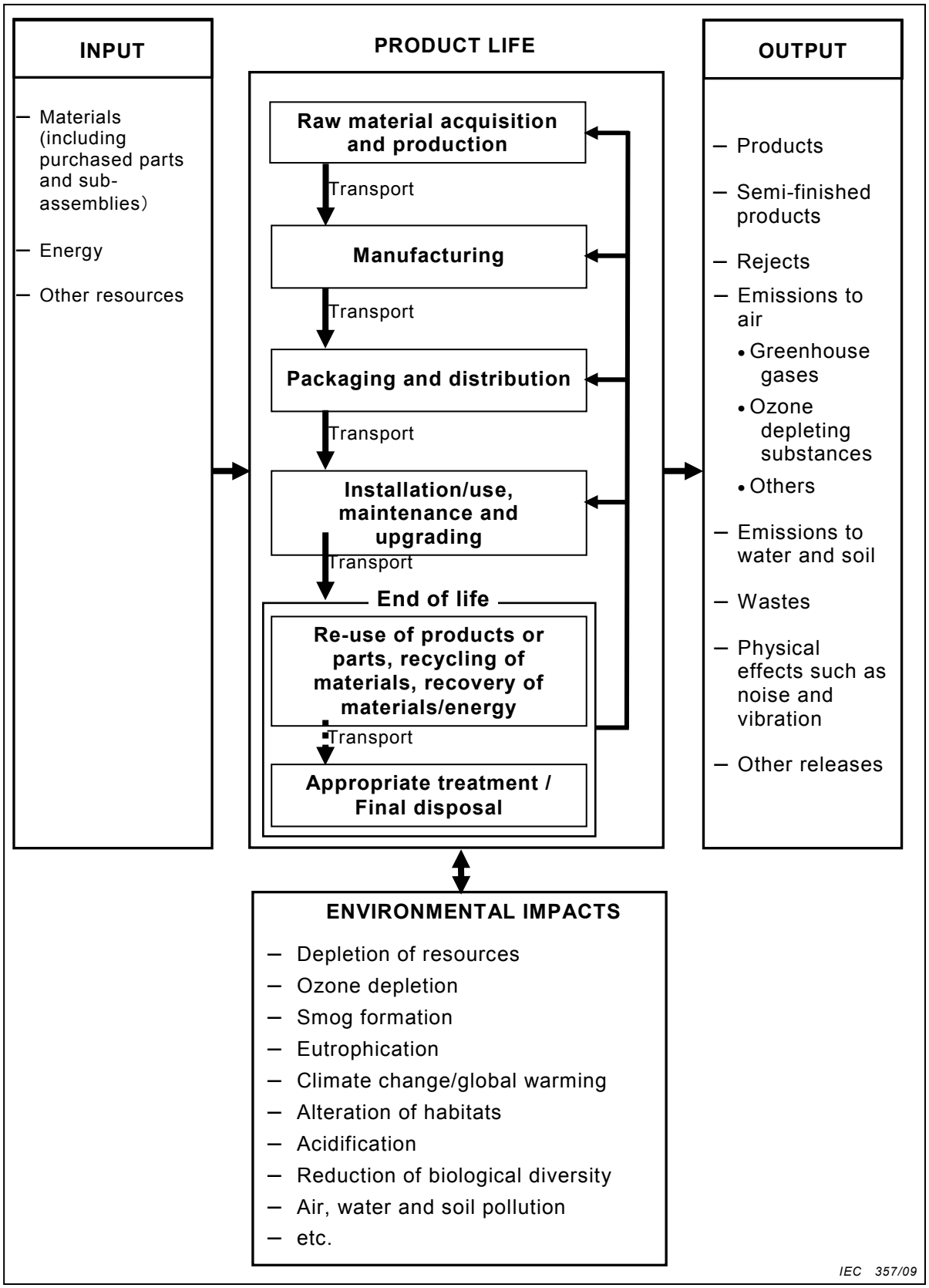

Figure B.1 – Examples of environmental impacts associated with a product's inputs, outputs and life cycle stages

B.3.2 Life cycle tools for identification of significant environmental aspects and impacts

A commonly used tool for the assessment of environmental aspects and impacts of a product based on LCT could be life cycle assessment (LCA), which generates quantitative information. There are also tools to generate qualitative information which yields results based on pre-set parameters for the analysis and allows organizations to evaluate those parameters qualitatively.

Table B.2 shows an example of the LCT approach that identifies significant life cycle stages and environmental aspects of a product.

Identification of significant environmental aspects is not necessarily a task that each organization needs to do by itself; for instance, such information could be available on a product category basis through industry bodies or other trusted sources.

Table B.2 – Life cycle stages and examples of environmental aspects for the identification of the significant life cycle stages and environmental aspects

Environ-mental aspect	Raw material procurement	Manufacturing	Packaging, transport and distribution	Installation and maintenance	Use	End of life
Material / energy consumption	- What types of materials/ energy are needed? - How much is needed?	- Does it require ancillary materials/ energy to manufacture? - What types and how much?	- Does it require packaging to transport? - Which means of transport are used? - How long is the transport distance?	- Does it require materials/ energy to unpack, set up, clean or repair the product? - What types and how much?	- Does it require materials/ energy to operate? - What types and how much?	- Does it require materials/ energy during end of life? - What types and how much?
Emission	- Are there any emissions generated? - What types of emissions? - To where/how much is emitted?	- Are there any emissions generated during manufacturing? - What types of emissions? - To where/ how much is emitted?	- Are there any emissions generated during transport? - What types of emissions? - To where/ How much is emitted?	- Are there any emissions generated during installation and maintenance? - What types of emissions? - To where / How much is emitted?	- Are there any emissions generated during use? - What types of emissions? - To where /How much is emitted?	- Are there any emissions generated during end of life? - What types of emissions? - To where /How much is emitted?
Physical effect (e.g. noise, electro-magnetic or ionizing radiation)	- Are there any physical effects involved?	- Are there any physical effects involved during manufacturing?	- Are there any physical effects involved during transport?	- Are there any physical effects involved during installation/ maintenance?	- Are there any physical effects involved during use?	- Are there any physical effects involved during end of life?
Waste generation	- What types of waste are generated? - How much is generated?	- What types of waste are generated during manufacturing? - Are there any by-products? - How much is generated?	- What types of waste are generated during packaging, transport and distribution? - How much is generated?	- What types of waste are generated during installation/ maintenance? - How much is generated?	- What types of waste are generated during use? - How much is generated?	- What types of waste are generated during end of life? - How much of each type is generated?

Environ-mental aspect	Raw material procurement	Manufacturing	Packaging, transport and distribution	Installation and maintenance	Use	End of life
Possibility of reuse, recycling, or recovery	- Is it possible to recover material/ energy?	- Is it possible to reuse parts or components of rejected products? - Is it possible to recover materials/ energy during the manufacturing processes?	- Is it possible to reuse or recycle the packaging?	- Is it easily serviced? - Is it possible to reuse parts or components? - Is it possible to recover materials/ energy which have been used to set up or maintain the product?	- Is it possible to recover materials/ energy which have been used to operate the product?	- Is it easily dis-assembled? - Is it possible to reuse parts/ components or recycle the materials from the waste product? - Is it possible to recover the energy from the waste product?

For each life cycle stage and environmental aspect, identify the materials and/or processes of a product that can cause significant impact on the environment. The materials and/or processes identified as significant become significant environmental parameters. At the same time, the identification process highlights which life cycle stages are most significant.

B.4 Design and development (5.4)

The design and development process starts with the specification of the product's functions. The environmental parameters for the product design are then defined based on the prioritized significant environmental aspects that are identified.

The organization should evaluate various design and development approaches with the aim of reducing the adverse environmental impacts caused by the product over its entire life cycle. The following examples of possible design and development considerations may be helpful in this respect:

a) functionality: considering opportunities for multiple functions, modularity, automated control and optimization; comparing the environmental performance to that of products tailored for specific use;

b) materials efficiency: checking if environmental impact can be reduced e.g. by minimal use of materials, use of low impact material, and/or recovered materials;

c) energy efficiency: considering total energy use throughout the product's life cycle (including use phase), check if environmental impact can be reduced, e.g. reduction of energy use, use of low impact energy resources;

d) material composition: identifying substances contained in the product including purchased parts and materials, and considering the reduction or avoidance of the use of potentially hazardous substances in the product;

e) durability: considering the product's longevity, serviceability; considering environmental improvements emerging from new technologies;

f) cleaner production and use: using cleaner production techniques, avoiding use of hazardous consumables and auxiliary materials;

g) packaging: packaging material may be considered from the view point of efficient material use and information about the take-back system;

h) transport: consider transport distances during the production and distribution of the product including efficient determination of product volume and weight;

i) reuse, recovery and recycling: considering opportunities to reduce material complexity, to make resource recovery and material recycling easier and to reuse sub-assemblies and components;

j) end-of-life management: considering the value of resources recoverable from products taken back, waste treatment processes and requirements, and their economic impacts on the organization.

Based upon the above described design considerations, as well as upon business considerations, environmental strategies should be developed to improve the performance of the identified significant environmental parameters.

Environmental targets based on the environmental strategies, are then developed. Examples of these targets might include: reduce emissions by x %; improve energy efficiency by z %; reduce weight by y kg, etc.

The environmental targets, and other considerations such as functionality, are translated into the product specification which is the basis for the technical solutions.

Technical solutions to meet the product specification are identified in the next stage of the design and development process.

The impact of technical solutions on other product parameters, such as functionality, quality, costs and marketability, are examined and decisions on trade-offs are made with the aim to find optimum solutions. Where certain attributes are required for compliance with regulation (e.g. health and safety, electromagnetic compatibility) the objective should be to meet these requirements in a manner that is least damaging to the environment. This iterative procedure leads to increasingly detailed design solutions. The use of ECD tools and standards may be helpful in this stage.

An integrated perspective achieved by including environmental aspects in product design and development can help the organization in the consideration of the trade-offs which arise with most design decisions. Examples of trade-offs which might be encountered are given below.

1) Between different environmental aspects; for example, optimizing a product for weight reduction might negatively affect its recyclability. The comparison of potential environmental impacts associated with each option can help decision-makers find the best solution.
2) Between environmental, economic and social benefits. These can be tangible (for example, lower cost, waste reduction), intangible (for example, convenience) and emotional (for example, image). For example, making a product more robust increases the lifetime and, as a result, may benefit the environment by reducing long-term resources use and waste generated but may also increase initial costs. This may have social as well as economic effects.
3) Between environmental, technical and/or quality aspects; for example, design decisions related to use of a particular material might negatively affect the reliability and durability of a product, even though this produces environmental benefits.

The product design and development process varies depending on products and organizations. Figure B.2 shows a model of product design and development with its typical stages and possible actions to integrate environmental aspects into the process. There are various approaches to integrate environmental aspects into the design process, and many organizations employ a combination of approaches and tools.

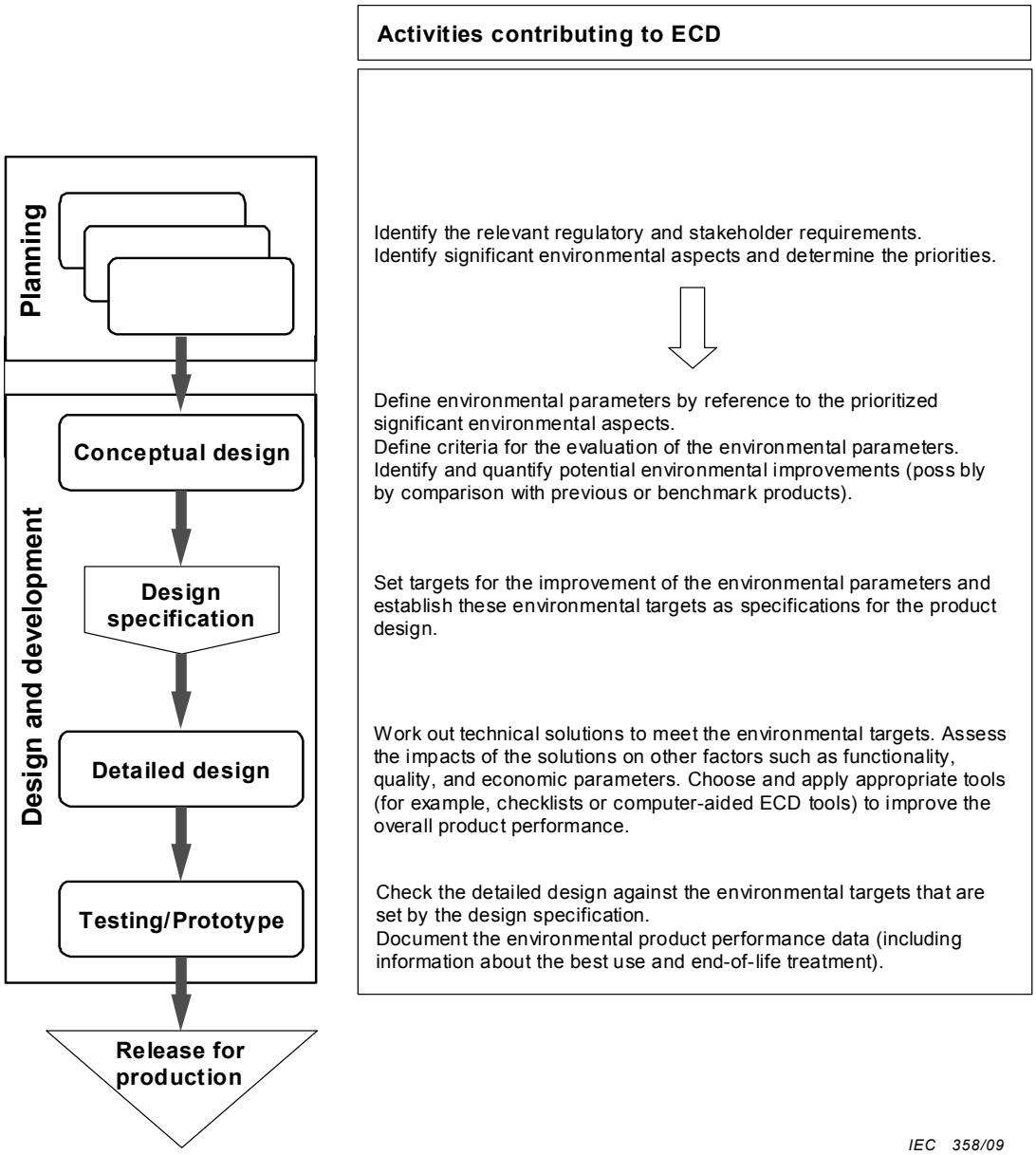

Figure B.2 – Example of integration of environmental aspects into the design and development process

B.5 Review and continual improvement (5.5)

Product designs, at the completion of major design stages, or when a significant environmental aspect is affected, may be subject to a review, e.g. as part of a continual improvement process. The review may assess performance, confirm and evaluate achievement of the targets and identify opportunities for improvement.

Evaluation and assessment against targets can be either qualitative or quantitative. Examples could include:

– prevention or reduction of adverse environmental impacts;

– improvement of environmental parameters as compared to a reference product or product category; and

– cost effectiveness and benefits.

It is recommended to record and maintain the results of design and development reviews and subsequent actions with a view to continually improve the environmental performance of the products.

B.6 Information sharing for ECD (5.6)

An internationally harmonized ECD process leads to a common understanding of ECD process information requirements. This supports collaboration among various stakeholders along the supply chain to share information for the analysis of relevant environmental aspects covering the entire life cycle. In addition, this information sharing facilitates the creation of solutions that only become evident when different organizations come together with one goal, that of minimizing the environmental impact (see Figure B.3).

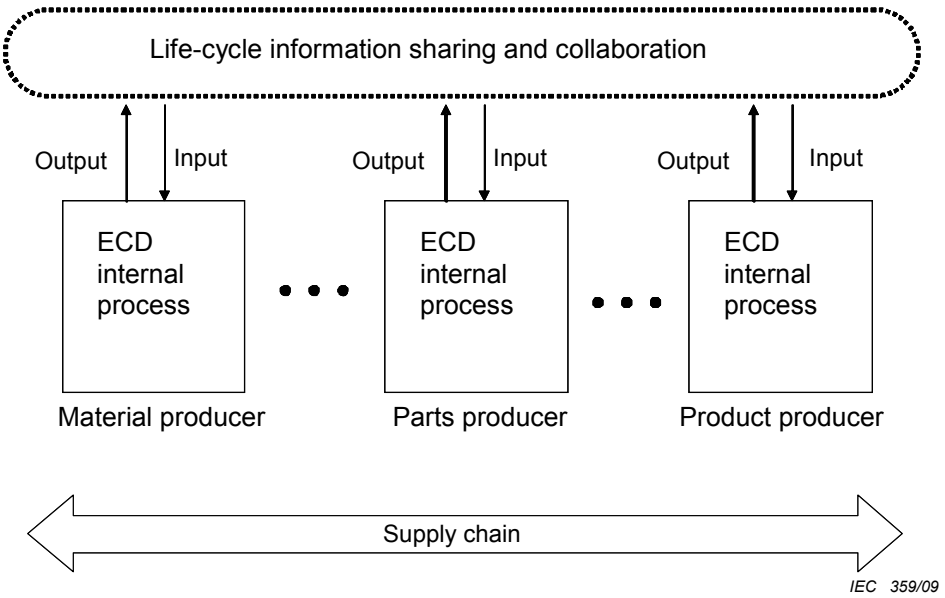

Figure B.3 – Information sharing and collaboration along the supply chain for ECD processes

Annex C
(informative)

Examples categories of tools

C.1 Overview

Many of the common product design and development tools can be utilized in the ECD process. Characteristics of certain tools are summarized in Table C.1 and further described in Clause C.2. This standard does not recommend which tool or tools should be used by an organization.

The tools listed herein have been selected in accordance with the following criteria, they are:

a) widely available and commonly recognized;

b) intended to be used by organizations performing design and development;

c) understood and accepted globally (not just regionally); and

d) neither too narrow nor too general in terms of their applicability to the consideration of environmental aspects.

Table C.1 shows the relationship between categories of tools and the general phases of the ECD process. This represents an indicative but non-exhaustive overview of useful approaches.

Table C.1 – Overview of tools which can be used in ECD

Example of tools	Purpose				
	Analysis of regulatory and stakeholders' requirements 5.2	Identification and evaluation of environmental aspects and corresponding environmental impacts 5.3	Design and development 5.4	Review and continual improve-ment 5.5	Information sharing 5.6
1. ECD benchmarking	✓	✓		✓	✓
2. Environmental QFD	✓	✓		✓	
3. ECD check-lists	✓	✓	✓	✓	✓
4. LCT assessment tools		✓	✓	✓	✓
5. Design and development support tools			✓	✓	
✓ Denotes relevance of tool for a purpose.					

C.2 Examples of tools

C.2.1 ECD benchmarking

ECD benchmarking is often used to compare the environmental properties of one product against a similar product from a competitor or an industrial average.

A benchmarking tool can be used in various stages in the ECD process beginning with the analysis of regulatory and stakeholders' requirements, proceeding to the identification and evaluation of the environmental aspects and corresponding impacts, review and continual improvement, and information sharing along the supply chain. Common formats for presenting ECD benchmark results are tables, graphs and spider web diagrams.

C.2.2 Environmental quality function deployment

Environmental quality function deployment (QFD) is a tool used to systematically link stakeholders´ environmental requirements to environmental parameters of the product.

It can be used at various stages in the ECD process. For example, it could be used to transform customer environmental requirements into design parameters, and, the setting of target values for product environmental improvement over extended periods of time, and to help in the identification and evaluation of environmental aspects and corresponding impacts throughout the product's life cycle.

C.2.3 ECD check-lists

The ECD check-list is a simple tool to evaluate and record the environmental performance requirements or impact of a product, at each life cycle stage.

Different checklists can be used to, for example, focus on minimization of materials used; reduction of energy consumption; and greater application of reused/refurbished components or assemblies. Although check-lists can be used at any stage of the ECD process, they generally have the greatest effect in the earliest phases of the ECD process since this is when the various trade-offs can most readily be accommodated. ECD check-lists can also be used to verify that ECD process steps have been implemented for a project.

C.2.4 Life cycle thinking (LCT) assessment tools

C.2.4.1 Simplified method

The environmental impacts of products, at a preliminary level, can be estimated by using a simple LCT assessment tool. Only significant environmental aspects are used as measurement criteria in this evaluation process.

C.2.4.2 Full method

A full assessment of the environmental impacts caused by products is performed following the principles described in the ISO 14040 series of standards.

The results of performing an LCT assessment are, in practice, likely to be very different as they vary so much on the assumptions made and method of assessment employed. Therefore, if products are assessed by different persons or organizations, the comparison of findings should include and consider the assumptions made and the method of assessment or analysis chosen. At this time, the best way to facilitate consistency is to ensure that the various simplifications made and values used are clearly identified. The results of LCT assessment can be applied in the identification and evaluation of environmental aspects and corresponding impacts; in review and continual improvement and in information sharing along the supply chain.

C.2.5 Design and development support tools

Design and development support tools include those which facilitate the selection of materials and production processes, as well as those for the analysis of environmental impacts of different options.

C.2.5.1 Disassembly and recyclability assessment tools

Design and development of a product for ease of disassembly and recyclability could be one of the environmental targets resulting from the identification and evaluation of environmental aspects during the ECD process. In order to design the product for ease of recyclability, it is helpful to utilize the ‘recyclability evaluation method’. This tool quantitatively evaluates the ease or difficulty of recycling the product by estimating the disassembly time, recycling rate, recycling costs, etc. by using the information on materials, mass, disassembly operations and recycling operations. Various design and development options such as selection of materials and surface treatment and the possibility of reuse and recycling can be easily incorporated into the evaluation.

C.2.5.2 Material selection support tools

Material selection is a key step in environmental conscious design. The target of selecting environmentally compatible materials without either increasing costs or degrading the product functionality can be supported by the use of tools that evaluate the environmental impacts of materials as well as costs, resource efficiency and functional performance.

Bibliography

ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*

ISO 9001, *Quality management systems – Requirements*[1]

ISO 14001:2004, *Environmental management systems – Requirements with guidance for use*

ISO 14040:2006, *Environmental management – Life cycle assessment – Principles and framework*

ISO 14050, *Environmental management – Vocabulary*[2]

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

ISO 14063:2006, *Environmental management – Environmental communication – Guidelines and examples*

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

ISO/IEC Guide 73:2002, *Risk management – Vocabulary – Guidelines for use in standards*

IEC Guide 109: 2003, *Environmental aspects – Inclusion in electrotechnical product standards*

IEC Guide 114:2005, *Environmentally conscious design – Integrating environmental aspects into design and development of electrotechnical products*

BREZET, H., VAN HEMEL, C., *Ecodesign – A promising approach to sustainable production and consumption, United Nations Environmental Programme, Paris, 1997*

_____

1 The fourth edition is to be published shortly.

2 The third edition is to be published shortly.

This page deliberately left blank

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level.

It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.

Tel: +44 (0)20 8996 9000 Fax: +44 (0)20 8996 7400

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

You may also buy directly using a debit/credit card from the BSI Shop on the website **www.bsigroup.com/shop**

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library.

Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.

Tel: +44 (0)20 8996 7111
Fax: +44 (0)20 8996 7048 Email: info@bsigroup.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at **www.bsigroup.com/BSOL**

Further information about BSI is available on the BSI website at **www.bsigroup.com**

Copyright

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

raising standards worldwide™

British Standards