BS EN 50598-3:2015

BSI Standards Publication

Ecodesign for power drive systems, motor starters, power electronics and their driven applications

Part 3: Quantitative eco design approach through life cycle assessment including product category rules and the content of environmental declarations

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National foreword

This British Standard is the UK implementation of EN 50598-3:2015.

The UK participation in its preparation was entrusted to Technical Committee PEL/22, Power electronics.

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

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Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Part 3: Quantitative eco design approach through life cycle assessment including product category rules and the content of environmental declarations

Ecoconception des entraînements électriques de puissance, des démarreurs de moteur, de l'électronique de puissance et de leurs applications entraînées - Partie 3: Approche quantitative d'écoconception par l'évaluation du cycle de vie, comprenant les règles relatives aux catégories de produits et le contenu des déclarations environnementales

Ökodesign für Antriebssysteme, Motorstarter, Leistungselektronik und deren angetriebene Einrichtungen - Teil 3: Quantitativer Ökodesign-Ansatz mittels Ökobilanz einschließlich Produktkategorieregeln und des Inhaltes von Umweltdeklarationen

This European Standard was approved by CENELEC on 2015-01-05. 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 CEN-CENELEC Management Centre 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 CEN-CENELEC Management Centre has the same status as the official versions.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 50598-3:2015) has been prepared by CLC/TC 22X “Power electronics”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-01-05
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2018-01-05

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

CLC/TC 22X/WG 6 as the standardization Task Force dealing with Mandate M/476 from the European Commission for standardization in the field of variable speed drives and/or power drive system products has been setting a close collaboration with several other technical committees (i.e. CLC/TC 2; CLC/TC 17B) in order to provide a comprehensive standard for energy efficiency and ecodesign requirements.

Key points:

— requirements on how to implement an environmentally conscious design process;

— requirements for environmental declarations, including product category rules for the underlying life cycle assessment of PDS;

— requirements on how to use environmental declarations in the extended product approach.

Within CLC/TC 22X/WG 6 a Task Force (TF2) has been set up for dealing with the environmental aspects of ecodesign through harmonized methods of assessing a product’s environmental performance and providing an environmental declaration for components of a motor system.

Since currently no horizontal approach on environmental declarations and no underlying life cycle assessment, within the standard basic and motor system specific product category rules, as required by EN ISO 14025, have been defined. If the approach is standardized for electronic and electro technical equipment through a harmonized standard (e.g. by CLC/TC 111X), the basic category rules (Clause 7) will become obsolete; however, this standard to be issued applies instead. Furthermore, product specific requirements, e.g. defined in Annex C, still need to be followed.

It is the intention of the working group that this document, once finalized as a European standard, is further processed to an international consensus in IEC according to the UAP procedure agreement between CENELEC and IEC.

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

Introduction

Technical Committee CLC/TC 22X has circulated on 2010-03-31 for a short period of time the CLC/TC22X/Sec0100/DC document including Mandate M/476 from the European Commission for standardization in the field of variable speed drives and/or Power Drive System products.

As the PDS contains converter driven motors, the additional requirements for measuring of the energy efficiency of those motors with non-sinusoidal supply and the labelling for the whole PDS are also included. This covers the requirements coming from Mandate M/470.

The horizontal ecodesign mandate, M/495, has been accepted at the end of 2011 by CEN and CENELEC, and requires to provide harmonized methods for measuring a product's environmental performance with a life cycle assessment and to provide an environmental footprint.

The document is based on the CENELEC Technical board document referenced BT137/DG8058/INF also reproducing this EC-Mandate.

CLC/TC 22X Working Group 6 as the standardization Task Force dealing with this Mandate has anticipated that a close collaboration with several other technical committees (i.e. CLC/TC 2; CLC/TC 17B) should be set.

Therefore CLC/TC 22X Committee has taken its responsibility for this field and has started a standardization work to clarify all aspects in the field of energy efficiency and ecodesign requirements for Power electronics, Switchgear, Control gear, and Power drive systems and their industrial applications.

The sometimes controversial requirements in the field of these tasks are illustrated in Figure 1. The work has been agreed to provide the reasonable target as a best compromise in this field.

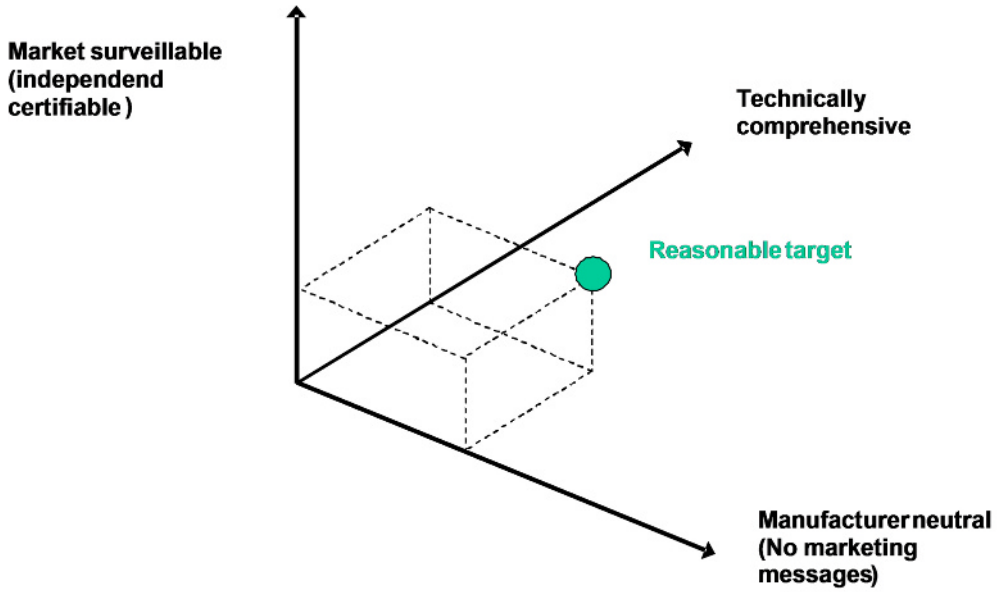


Figure 1 — Illustration of controversial requirements for the Energy related product (ErP) Standardization

EN 50598 is developed under the CENELEC projects number 24602 to 24604 for compliance with requirements from the horizontal mandate M/495. EN 50598 "*Ecodesign for power drive systems, motor starters, power electronics & their driven applications*" consists of the following parts:

Part 1: General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA), and semi analytic model (SAM);

Part 2: Energy efficiency indicators for power drive systems and motor starters;

Part 3: Quantitative ecodesign approach through life cycle assessment including product category rules and the content of environmental declarations.

The parts together will provide the appropriate set of standards also covering the individual mandates M/470, M/476, M/498, M/500 already in reference within Mandate M/495 and the upcoming mandates for standardization of other power driven applications.

Table 1 — Mandates of the European Commission given to CEN, CENELEC and ETSI and how they are solved by the individual parts of the standardization of CLC/TC 22X/WG 6

Mandates	Part 1	Part 2	Part 3
M/470 Motors		✓	✓
M/476 PDS		✓	✓
M/495 Horizontal all future Applications	✓	✓	✓
M/488 HVAC comfort fans	✓	✓	(✓)
M/498 Pumps	✓	✓	(✓)
M/500 Compressors	✓	✓	(✓)

NOTE Geared motors (motor plus gearbox) are treated for efficiency classes like a power drive system (converter plus motor). See EN 60034–30–1 for classification of the losses of a geared motor. The efficiency classes of gearboxes as individual components are under consideration.

1 Scope

This part of EN 50598 specifies the process and requirements to implement environmentally conscious product design principles, to evaluate ecodesign performance and to communicate potential environmental impacts for power electronics (e.g. complete drive modules, CDM), power drive systems and motor starters, all used for motor driven equipment in the power range of 0,12 kW up to 1 000 kW and low voltage (up to 1 000 V) applications over the whole life cycle.

It defines the content for 2 different environmental declarations based on EN ISO 14021:

— The basic version - which, in this context, will be referred to as an environmental declaration type II, with basic data and qualitative statements on ecodesign.

— The full version - which, in this context, will be referred to as an environmental declaration type II+, based upon a life cycle assessment and including quantitatively evaluated potential environmental impacts. For that the general principles of EN ISO 14025 are taken into account and product category rules [PCR] for motor system components are included to ensure a harmonized approach.

This part of EN 50598 is harmonized with the applicable generic and horizontal environmental standards and contains the additional details relevant in this context for the above mentioned products.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE As it is intended by the working group to process this document, once finalized, as an IEC Standard, some normative references are given even in case if no European harmonized document exists.

EN 50598-1, *Ecodesign for power drive systems, motor starters, power electronics & their driven applications - Part 1: General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA), and semi analytic model (SAM)*

EN 50598-2, *Ecodesign for power drive systems, motor starters, power electronics & their driven applications - Part 2: Energy efficiency indicators for power drive systems and motor starters*

EN ISO 14020, *Environmental labels and declarations — General principles (ISO 14020)*

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

EN ISO 14025, *Environmental labels and declarations — Type III environmental declarations - Principles and procedures (ISO 14025)*

EN ISO 14040, *Environmental management — Life cycle assessment — Principles and framework (ISO 14040)*

EN ISO 14044, *Environmental management — Life cycle assessment — Requirements and guidelines (ISO 14044)*

IEC 60050-161, *International Electrotechnical Vocabulary (IEV) — Chapter 161: Electromagnetic compatibility*

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

IEC/TR 62635, *Guidelines for end-of-life information provided by manufacturers and recyclers and for recyclability rate calculation of electrical and electronic equipment*

EN 62474, *Material declaration for products of and for the electrotechnical industry (IEC 62474)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 and the following apply.

3.1
declared unit
referenced unit (device) in the environmental declaration

Note 1 to entry: The declared unit might differ from the functional unit in terms of the declaration. In the LCA the environmental impacts are broken down to the functional unit, this is then aggregated for the declaration for the declared unit.

3.2
end of life
EoL
life cycle stage of a product starting when it is removed from its intended use phase

[SOURCE: IEC/TR 62635]

3.3
end of life treatment
any operation after a waste has been handed over to a facility for product and product part reuse, material recycling, energy recovery and residue disposal

Note 1 to entry: This includes dismantling, material separation and disposal.

[SOURCE: IEC/TR 62635]

3.4
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation

Note 1 to entry: Surroundings in this context extend from within an organization to the global system.

[SOURCE: EN ISO 14001:2004, 3.5]

3.5
environmental aspect
element of an organization's activities or products that can interact with the environment

Note 1 to entry: A significant environmental aspect has or can have a significant environmental impact.

[SOURCE: EN ISO 14001:2004, 3.6, modified]

3.6
environmental claim
statement, symbol or graphic that indicates an environmental aspect of a product, a component or packaging

Note 1 to entry: An environmental claim may be made on product or packaging labels, through product literature, technical bulletins, advertising, publicity, telemarketing, as well as through digital or electronic media such as the Internet.

[SOURCE: EN ISO 14021:1999, 3.1.4]

3.7
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

[SOURCE: EN 62430:2009]

3.8
environmentally conscious design tool
formalized method which facilitates qualitative or quantitative analysis, comparison and/or solution finding during the ECD process

3.9
environmental declaration program
voluntary program for the development and use of type III environmental declarations based on a set of operating rules (program instructions)

[SOURCE: EN ISO 14025:2010]

3.10
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partly resulting from an organization's environmental aspects

[SOURCE: EN ISO 14001:2004, 3.7]

3.11
environmental label
environmental declaration
claim which indicates the environmental aspects of a product or service, for example a type I, a type II or a type III environmental declaration or a product environmental footprint

Note 1 to entry: An environmental label or declaration may take the form of a statement, symbol or graphic on a product or package label, in product literature, in technical bulletins, in advertising or in publicity, amongst other things.

[SOURCE: EN ISO 14020:2001, modified]

3.12
environmental declaration type II
environmental declaration providing self-declared environmental claims

[SOURCE: EN ISO 14021]

3.13
environmental declaration type II+
environmental declaration providing quantified environmental data using predetermined parameters (product category rules as a part of a product standard) and, where relevant, additional environmental information

Note 1 to entry: This kind of declaration is based on EN ISO 14021 but takes into account the basic principles of EN ISO 14025, such as the life cycle assessment basis, PCR and the verification. But in contrast to a type III environmental declaration, an internal declaration process verification is sufficient and no declaration program needs to be joined. The predetermined parameters (PCR) are based on the EN ISO 14040 series, which includes EN ISO 14040 and EN ISO 14044.

Note 2 to entry: The additional environmental information may be quantitative or qualitative.

3.14
environmental declaration type III
environmental declaration providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information

Note 1 to entry: For a type III declaration an environmental declaration program including program instructions and product category rules are necessary The predetermined parameters are based on the EN ISO 14040 series, which includes EN ISO 14040 and EN ISO 14044.

Note 2 to entry: The additional environmental information may be quantitative or qualitative.

[SOURCE: EN ISO 14025:2010, modified]

3.15
environmental declaration verification
process to verify the environmental declarations concerning the fulfilment of the requirements set out in the corresponding standards

Note 1 to entry: This is based upon the basic principles of EN ISO 14025 for type III environmental declarations, but type III environmental declarations require an environmental declaration program, setting out the stipulations for the verification in terms of the declaration program.

Note 2 to entry: A verification is also mandatory for environmental declarations in terms of this standard and takes place through internal process verification.

3.16
environmental management system
part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedure, processes, and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy

[SOURCE: EN ISO 14001:2004, 3.8, modified]

3.17
environmental parameter
quantifiable attribute of an environmental aspect

Note 1 to entry: Environmental parameters include the type and quantity of materials used (weight, volume), power consumption, emissions, rate of recyclability, etc.

3.18
extended product
EP
driven equipment with its included motor system (e.g. a PDS, a motor starter), see Figure 2

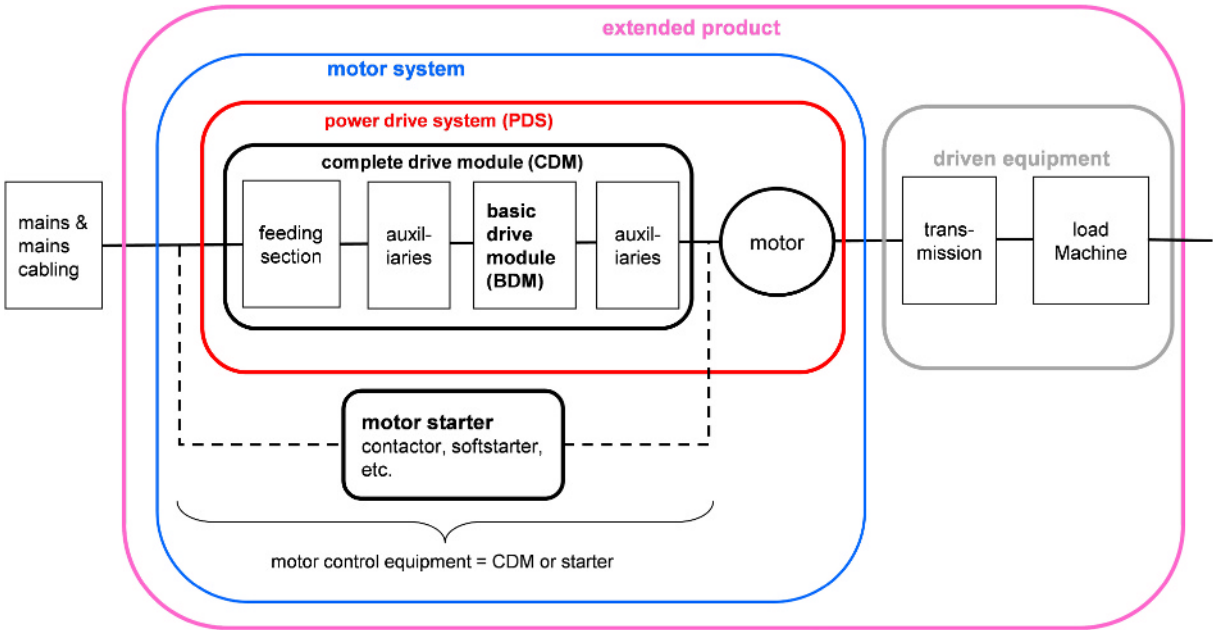


Figure 2 — Illustration of the extended product including a motor system

[SOURCE: EN 50598-1]

3.19
functional unit
quantified performance of a product system for use as a reference unit

Note 1 to entry: For example one product providing a certain function like power in kW.

[SOURCE: EN ISO 14040:2006]

3.20
hazardous substances and preparations
substance or preparation that can adversely impact the environment with immediate or retarded effect

[SOURCE: IEC Guide 109:2003, modified]

3.21
homogenous product family
subgroup of a product family where the environmental aspects can reasonably be expected to be similar and therefore scalable over the group through a function of certain parameter, e.g. power or weight

3.22
LCA report
accompanying document to the life cycle assessment as a basis to the environmental declaration giving further detailed information about the inputs, outputs, used LCI-data and the made assumptions in regards to this standard

Note 1 to entry: This LCA report is not meant for external communication but has to be kept for justification proposes in terms of environmental declaration verification or market surveillance.

3.23
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to the final disposal

[SOURCE: EN ISO 14040:2006]

3.24
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[SOURCE: EN ISO 14040:2006]

3.25
life cycle inventory
LCI
inventory of flows from and to nature for a product system

Note 1 to entry: Inventory flows include inputs of water, energy, and raw materials, and releases to air, land, and water.

3.26
life cycle stage
element of a life cycle

Note 1 to entry: The phrase 'life cycle phase' is sometimes used interchangeably with 'life cycle stage'.

Note 2 to entry: 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.

3.27
life cycle thinking
LCT
consideration of all relevant environmental aspects during the entire life cycle of products

[SOURCE: IEC Guide 109:2003, modified]

3.28
material
substance or mixture within a product or product part

[SOURCE: IEC 62674]

3.29
motor system
motor system is part of the extended product (3.18) as defined in EN 50598-2 and consists of motor starter devices (contactor, soft starters) and/or a complete drive module and motor

3.30
organization
group of people and facilities with an arrangement of responsibilities, authorities and relationships

[SOURCE: EN ISO 9000:2005, 3.3.1, modified]

3.31
packaging
material that is used to protect or contain a product during transportation, storage, marketing or use

Note 1 to entry: For the purposes of this International Standard, the term “packaging” also includes any item that is physically attached to, or included with, a product or its container for the purpose of marketing the product or communicating information about the product.

[SOURCE: EN ISO 14021]

3.32
process
set of interrelated or interacting activities which transform inputs into outputs

Note 1 to entry: Inputs to a process are generally outputs of other processes.

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

[SOURCE: EN ISO 9000:2005, 3.4.1, modified]

3.33
product
any goods or service

[SOURCE: EN ISO 14024:2000]

3.34
product category
group of products that can fulfil equivalent functions

[SOURCE: EN ISO 14025:2010]

3.35
product category rules
PCR
set of specific rules, requirements and guidelines for developing type II+/type III environmental declarations for one (product specific rules) or more (basic/core product category rules) product categories

[SOURCE: EN ISO 14025, modified]

3.36
product family
subgroup of a product category – technologically or functionally similar products

3.37
program operator
body or bodies that conduct a Type III environmental declaration program (3.18)

[SOURCE: EN ISO 14025:2010]

3.38
product specific rules
PSR
product specific set of rules and requirements, based upon basic product category rules for a type II+/type III environmental declaration and underlying life cycle assessment

3.39
use phase
life cycle stage of a product starting when it has been put into service and finishing at end of life

3.40
recycling
processing of waste materials for the original purpose or for other purposes, excluding energy recovery

[SOURCE: EN ISO 15270:2007, modified]

3.41
stakeholder
individual, group or organization that has an interest in an organization or activity

Note 1 to entry: Usually a stakeholder can affect or is affected by the organization or the activity.

[SOURCE: EN ISO 14050, 3.5, modified]

3.42
substance
chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the *substance* or changing its composition

Note 1 to entry: Definition taken from the United Nations' Globally harmonized System of Classification and Labelling (GHS).

3.43
raw material
primary or secondary material that is used to manufacture a product

Note 1 to entry: Secondary material includes recycled material.

[SOURCE: EN ISO 14040]

3.44
waste
substances or objects which the holder intends or is required to dispose of

Note 1 to entry: This definition is taken from the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal* (22 March 1989), but is not confined in this European Standard to hazardous waste.

4 Description of the elements of ecodesign and environmental declarations of a motor system

4.1 General

The process of declaring the potential environmental impact or stating environmental claims of the components of a motor system in an environmental declaration or footprint is the outcome of an environmentally conscious design (ECD) process. The components of a motor system, including amongst others, the auxiliaries, the motor starters, the complete drive module (CDM) and the motor, derived from its definition in EN 50598-1, is the scope of the standard.

In this context, it shall be mentioned that the basic principles of this standard shall be applied to all products in scope but further specifications, including an extended scope, can and shall be done in the corresponding technical committees (e.g. CLC/TC 17B, CLC/TC 2…)

Figure 3 now visualizes the defined product categories (green background) and families (red background) inside the motor system, including possible homogeneous product families, which shall be defined by the manufacturer, within the scope of the standard.

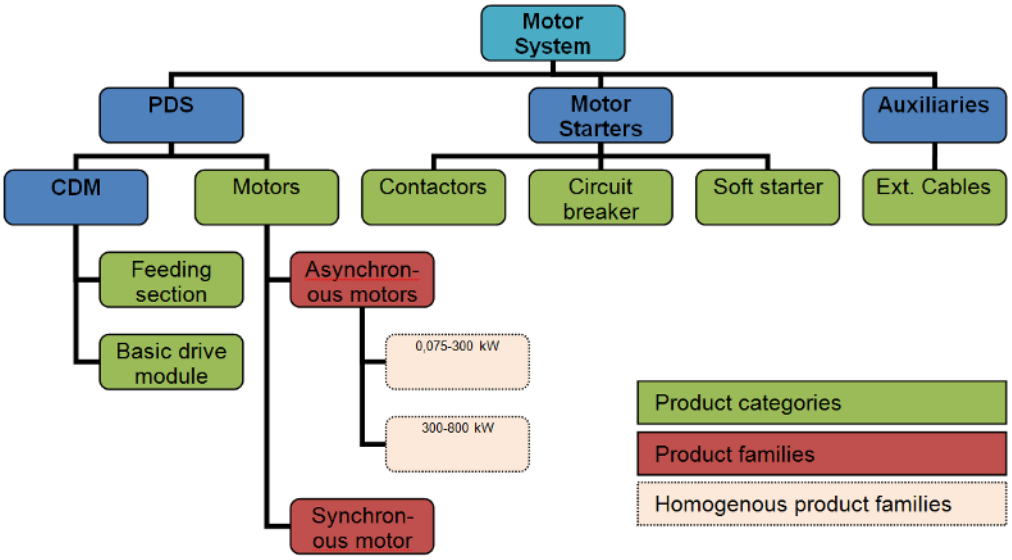


Figure 3 — Overview of the defined product categories and families of a motor system

Basically the purpose of the motor system is to transfer electrical to mechanical energy and vice versa. One of the main potential environmental impacts, for example the global warming potential, of these products results from the usage. Still other arising issues require a further implementation of life cycle thinking and an appropriate communication along the supply chain. For example the end of resources require further efficiency on raw material consumption and further efficiency in recycling processes.

4.2 Environmentally conscious design

As mention above ECD requires the identification, measurement and reporting of particular impacts. EN 62430 describes the basic principles of ECD with the goal of reducing the potential environmental impacts of products. A brief introduction is provided in Annex A. Additionally a life cycle assessment [LCA] provides the possibility to quantify the ECD approach. 5.1 defines the basic content of the ECD, where the output can be used for an environmental declaration type II. 6.1 defines the full content of the ECD including a LCA approach, where the output can be used for an environmental declaration type II+ (in compliance to this standard) and/or an environmental declaration type III if additionally an environmental declaration program is joined and the PCRs are consistent.

4.3 Environmental declaration

As mentioned above an environmental declaration is a statement from a manufacturer on environmental claims or potential impacts on (extended) product level. EN ISO 14020 defines the general principles that shall be followed.

The basic content for communication through an environmental declaration (type II according to EN ISO 14021) is listed in 5.2. The full content of an environmental declaration (type II+ based on EN ISO 14025, derived with a further quantified analysis through a LCA), is listed in 6.2. Clause 7 serves as a basic set of product category rules for the life cycle assessment (LCA) which is mandatory for the type III environmental declarations.

The maximum duration of validity of environmental declarations issued in compliance to this standard shall be 5 years. After that period a review shall be done by the issuer. A procedure for document control shall be applied to the declarations.

Table 2 gives an overview of the explained above structure of the standard, its content and the referenced clause.

Table 2 — Overview of the standards structure, the content and the corresponding clauses

Topic	Classification	Description	Clause	Reference
Environmentally Conscious Design	**Basic**	**Qualitative assessment**	**5.1** **Annex A**	EN 62430 EN ISO 14006
	Full	**Quantitative assessment**	**6.1**	EN ISO 14040 EN ISO 14044
Environmental Declaration	**Basic**	**Material declaration**	**5.2**	EN 62474
		Conformity to applicable legislation	**5.2**	EN 50581
		Statements concerning potential impacts of the products life cycle	**5.2**	EN ISO 14020
		Qualitative statements on potential environmental aspects	**5.2**	EN ISO 14021
	Full	**Material declaration**	**6.2**	EN 62474
		Conformity to applicable legislation	**6.2**	EN 50581
		Statements concerning potential impacts of the products life cycle	**6.2**	EN ISO 14020
		Quantitative Statements on environmental aspects	**6.2 + Clause 7 + Annex C**	EN ISO 14021 EN ISO 14025

NOTE The approaches leave the following choices: Basic ECD and basic environmental declaration, full ECD and basic environmental declaration or full ECD and full environmental declaration.

5 Basic environmentally conscious design and declaration requirements

5.1 Basic ecodesign requirements

To reduce the potential environmental impacts of a product the product development shall follow the principals of ECD which are described in EN 62430. This ECD process shall be documented as proposed inside the company's management system (e.g. EN ISO 14001 or EN ISO 9001). See EN ISO 14006 for further advice. If the company does not have a management system in place the ECD shall be documented and implemented accordingly in an adequate way, like for instance process instructions. Annex A gives a basic idea about the conceptual relationship between provisions in product standards and the environmental impacts associated with the product during its life cycle that should be considered.

NOTE Informative Annex A provides guidance with respect to situations under consideration and for which no specific requirements apply.

5.2 Basic content of an environmental declaration type II

5.2.1 General

The following sub clauses represent the content of an environmental declaration complying with this standard and EN ISO 14021 (type II environmental declaration).

5.2.2 Information about the manufacturer

The following information shall be declared by the manufacturer:

— environmental policy,

— the location of main manufacturing plant(s) of the final assembly,

— relevant available certifications e.g. EN ISO 9001, EN ISO 14001, OSHAS 18001.

5.2.3 Description of the product family, the reference product and its packaging

The following information shall be declared by the manufacturer:

— product family and its included products (e.g. through power range or identification numbers);

— referenced product type and its identification number (manufacturer's reference);

— basic technical data (name plate, e.g. electrical rating, mechanical power, mass);

— performance classification (e.g. IE classes (if defined));

— product packaging: dimensions, mass, material.

NOTE For further information, for instance about selecting key products for product families, refer to Annex B.

5.2.4 Constitutive materials and substances

Materials and declarable substances shall be provided by the manufacturer for the reference product and its packaging in the scope of the environmental declaration in accordance with EN 62474, e.g. Annex B, Table B.1, whereas additionally these rules apply:

— all substances / materials that are subject to legal regulations;

— comments regarding substances not regulated at the moment, for example halogens, should only be included if this is ensured accordingly and meaningful in this product group;

NOTE Once completed, Table B.1 facilitates compliance with laws and regulations applying to substances in the EU, e.g. RoHS and REACH.

— mass and type of batteries if incorporated (EU Batteries Directive, 2006/66/EC).

5.2.5 Use phase

The following information shall be declared by the motor system component manufacturer as environmental declaration issuer:

— Efficiency classes and related electrical power losses (see Figure 4) and if applicable related remarks on an optimized design of the motor system from EN 50598-2.

Line fed motors Efficiency	**Converter fed motors** Efficiency	**Converters (CDM)** losses related to rated power	**Power Drive systems (PDS)** losses related to rated power
IE0 – not used	IE0 – u.c.	**IE0** – more than 25% higher than reference value	**IES0** – more than 20% higher than reference value
IE1 – can be mostly technically achieved	IE1 – u.c.	**IE1 - reference value ±25%**	**IES1 - reference value ±20%**
IE2 – can be achieved by enhancement	IE2 – u.c.	**IE2** – more than 25% lower than reference value	**IES2** – more than 20% lower than reference value
IE3 – needs significant amount of techniques	IE3 – u.c.	IE3 – u.c.	IES3 – u.c.
IE4 – will require new techniques	IE4 – u.c.	IE4 – u.c	IES4 – u.c
IE5 – experimental new technologies	IE5 – u.c.	IE5 – u.c	IES5 – u.c
IE6 – not used	IE6 – u.c.	IE6 – u.c	IES6 – u.c
IE7 – not used	IE7 – u.c.	IE7 – u.c.	IES7 – u.c.
IE8 – not used	IE8 – u.c.	IE8 – u.c.	IES8 – u.c.
IE9 – not used	IE9 – u.c.	IE9 – u.c.	IES9 – u.c.

u.c. = under consideration

Figure 4 — Metrical relation of IE, IES classes from EN 50598-2:2014, 4.9

NOTE IE classes if available in the a.m. standard. Add a remark how to deal with devices without efficiency classes. Add standard concerning losses, energy consumption.

5.2.6 End of life

The manufacturer shall provide information to facilitate end of life treatment for the products in the scope of the environmental declaration, e.g. dismantling, disposing, and recycling instructions compliant to IEC/TR 62635. This information shall include a list of components and their location in the product in accordance with IEC/TR 62650, B.1 and if applicable necessary requirements concerning waste management (e.g. necessary competencies, technologies and type or level of security required for the treatment or landfill).

NOTE Once completed, Table C.1 facilitates compliance with laws and regulations for waste from electrical and electronic equipment, e.g. WEEE.

6 Full environmentally conscious design and declaration requirements

6.1 Full ecodesign requirements

The following sub-clauses represent the full quantitative ECD approach based on EN 62430 through a quantitative evaluation of environmental impacts through a life cycle assessment. This is mandatory for an environmental declaration type II+ described in 6.2. This ECD and environmental declaration processes shall be documented as proposed inside the company's management system (e.g. EN ISO 14001 or EN ISO 9001). See EN ISO 14006 for further advice. If the company does not have a management system in place the ECD and environmental declaration processes shall be documented and implemented accordingly in an adequate way, like for instance process instructions. Product life cycle assessment.

For estimating the environmental impacts caused by motor system components quantitatively the life cycle assessment" [LCA] methodology on the basis of EN ISO 14040 and EN ISO 14044 shall be used. The product category rules [PCR] described in Clause 7 and if applicable the product specific rules in the annex or other product standards, shall be taken into account. These rules define requirements regarding certain assumptions (e.g. cut-off criteria, transport and application) for certain product groups. Both, own measured values or generic data available in databases for material and energy - with regards to this standards data quality requirements (7.16) - can then be used with an established LCA tool to assess the potential environmental impact arising for the different life cycle phases (for example from the acquisition of raw materials).

In this case the term established means that the LCA tool shall ensure the compliance with the LCA principles set out in the corresponding standards EN ISO 14040 and EN ISO 14044 and the ILCD handbook (so called ILCD compliance). It shall provide the options to build the LCA model according to the requirements set out in this standard.

6.2 Content of an environmental declaration type II+

6.2.1 General

The following sub-clauses represent the content of an environmental declaration type II+ complying to this standard, and EN ISO 14021. It also takes into account the basic requirements set out in EN ISO 14025.

6.2.2 Information about the manufacturer

The following information shall be declared by the manufacturer:

– environmental policy;

– the location of main manufacturing plant(s) of the final assembly;

– relevant available certifications e.g. EN ISO 9001, EN ISO 14001, OSHAS 18001.

6.2.3 Description of the product family, the reference product and its packaging

The following information shall be declared by the manufacturer:

– product family and its included products (e.g. through power range or identification numbers);

– referenced product type and its identification number (manufacturer's reference);

– basic technical data (name plate, e.g. electrical rating, mechanical power, mass);

– performance classification (e.g. IE classes (if defined));

– product packaging: dimensions, mass, material.

NOTE For further information, refer to Annex B.

6.2.4 Constitutive materials and Substances

Materials and declarable substances shall be provided by the manufacturer for the reference product and its packaging in the scope of the environmental declaration in accordance with EN 62474, e.g. Annex B, Table B.1. Additionally, these rules apply:

– all substances / materials that are subject to legal regulations;

– comments regarding substances not regulated at the moment, for example halogens, should only be included if this is ensured accordingly and meaningful in this product group;

NOTE Once completed, Table B.1 facilitates compliance with laws and regulations applying to substances in the EU, e.g. RoHS and REACH.

– mass and type of batteries if incorporated (EU Batteries Directive, 2006/66/EC).

6.2.5 Information on life cycle stages and potential impacts

6.2.5.1 General

Additionally to the content described above in 6.2.2, 6.2.3 and 6.2.4, the environmental impacts in the context of their potential impact in the midpoint impact categories stated in Table 3 shall be included to the environmental declaration to be published as a type II+ declaration. The impact categories have been chosen based upon the recommendations in the ILCD handbook (International Life Cycle Data System, EUR 24571 EN – 2011, JRC's technical notes EUR 25167 EN - 2012) and taking into account the aspect of harmonization and standardization (e.g. EN 15804).

NOTE 1 This chosen impact categories and the underlying characterization methods and factors are constantly subject to research and development and might therefore be updated.

Type III environmental declaration programs or certification schemes may require the expression of additional environmental impacts and/or different characterization factors and units. These may be included in the full environmental declaration of the motor system but shall be indicated as additional and justified.

Applied LCA tools may not support the most recent developments in environmental impacts characterization methods. In this case the manufacturer may express the required impact category with a different characterization factor and a different unit but shall indicate and justify this fact accordingly

Table 3 — Overview of impact categories and indicators to be reported in the full environmental declaration, respective considered in the LCIA or the corresponding LCA

Impact Assessment Model, Source	Impact Category Name	Impact Category Abbreviation	Unit	Characterization factor name	Characterization factor abbreviation
Bern model over a 100 year time horizon (IPCC, 2007)	**Climate Change**	**CC**	**kg CO_2**	**Global warming potential**	**GWP**
EDIP model over an infinite time horizon (WMO, 1999)	**Ozone Depletion**	**OD**	**kg CFC-11**[5]	**Ozone Depletion Potential**	**ODP**
LOTO-EUROS model, Van Zelm et al., 2008, (implemented in ReCiPe)	**Photochemical Ozone Creation**	**POC**	**kg NMVOC**	**Photochemical Ozone Creation Potential**	**POCP**
Seppälä et al. 2006, Posch et al., 2008	**Acidification**	**A**	**mole H^+ eq**	**Accumulated Exceedance**	**AE**
Seppälä et al. 2006, Posch et al., 2008	**Eutrophication terrestrial**	**ET**	**mole N eq**	**Accumulated Exceedance**	**AE**
EUTREND model, Struijs et al., 2009 (implemented in ReCiPe)	**Eutrophication aquatic**	**EF**	**kg P eq**	**Accumulated Exceedance**	**AE**
USEtox model (Rosenbaum et al., 2008)	**Human Toxicity, cancer effects**	**HT**	**CTUh**	**Comparative Toxic Unit for Human Health**	**CTUh**
USEtox model (Rosenbaum et al., 2008)	**Human Toxicity, non cancer effects**	**HT**	**CTUh**	**Comparative Toxic Unit for Human Health**	**CTUh**
USEtox model (Rosenbaum et al., 2008)	**Ecotoxicity freshwater**	**ET**	**CTUe**	**Comparative Toxic Unit for ecosystems**	**CTUe**
RiskPoll model (Rabl and Spadaro, 2004; Greco et al., 2007)	**Particulate Matter**	**PM**	**kg PM2.5**	**Particulate matter with a diameter of 2,5 µm or less**	**PM2.5**
CML2002 model, van Oers et al., 2002	**Resource Depletion, mineral**	**MD**	**kg Sb**	**Abiotic Depletion Potential for non fossil resources**	**ADP-elements**
CML2002 model, van Oers et al., 2002	**Resource Depletion, fossil**	**FD**	MJ, net calorific value	**Abiotic Depeltion Potential for fossil resources**	**ADP-fossil fuels**

NOTE 2 Concerning the above mentioned scaling function for deriving potential environmental impacts through an environmental parameter, the behaviour can be different for these impacts. Therefore different scaling functions or even parameters with regards to Annex B for the different environmental impacts might be necessary. Then it is within the responsibility of the issuer of the environmental declaration, considering of simplification and readability, to not state this functions in the actual document but provide the potential environmental impacts upon request.

Additionally to the potential environmental impacts described above, the following parameters listed in Table 4 describing energy use, elementary flows and waste shall be declared:

Table 4 – Additional parameters to be declared in the environmental declaration per functional/declared unit

Topic	Unit	Comment
Use of non-renewable primary energy	**MJ, net caloric value**	**Lower heating value**
Use of renewable primary energy	**MJ, net caloric value**	**Lower heating value**
Net use of fresh water	**m^3**	
Hazardous waste disposed	**kg**	
Non-hazardous disposed	**kg**	
Radioactive waste disposed	**kg**	

NOTE 3 The characteristics that render waste hazardous are described in existing applicable legislation, e.g. in the European Waste Framework Directive.

6.2.5.2 Manufacturing phase

The following data for the manufacturing phase shall be specified in the environmental declaration for the reference product:

— emissions expressed as potential environmental impacts and resource depletion as specified in 6.2.5, Table 3;

— additional parameter as specified in 6.2.5, Table 4.

6.2.5.3 Usage phase

The following data for the usage phase shall be specified in the environmental declaration for the reference product:

— efficiency classes and related electrical power losses in accordance with EN 50598-2 (see Figure 5) and if applicable related remarks on an optimized design of the motor system;

Line fed motors Efficiency	**Converter fed motors** Efficiency	**Converters (CDM)** losses related to rated power	**Power Drive systems (PDS)** losses related to rated power
IE0 – not used	IE0 – u.c.	**IE0** – more than 25% higher than reference value	**IES0** – more than 20% higher than reference value
IE1 – can be mostly technically achieved	IE1 – u.c.	**IE1 - reference value ±25%**	**IES1 - reference value ±20%**
IE2 – can be achieved by enhancement	IE2 – u.c.	**IE2** – more than 25% lower than reference value	**IES2** – more than 20% lower than reference value
IE3 – needs significant amount of techniques	IE3 – u.c.	IE3 – u.c.	IES3 – u.c.
IE4 – will require new techniques	IE4 – u.c.	IE4 – u.c	IES4 – u.c
IE5 – experimental new technologies	IE5 – u.c.	IE5 – u.c	IES5 – u.c
IE6 – not used	IE6 – u.c.	IE6 – u.c	IES6 – u.c
IE7 – not used	IE7 – u.c.	IE7 – u.c.	IES7 – u.c.
IE8 – not used	IE8 – u.c.	IE8 – u.c.	IES8 – u.c.
IE9 – not used	IE9 – u.c.	IE9 – u.c.	IES9 – u.c.

u.c. = under consideration

Figure 5 — Metrical relation of IE, IES classes from EN 50598-2:2014, 4.9

NOTE IE classes if available in the a.m. standard. Add a remark on how to deal with devices without efficiency classes. Add standard concerning losses, energy consumption.

– emissions expressed as potential environmental impacts and resource depletion as specified in 6.2.5, Table 3;

– additional parameter as specified in 6.2.5, Table 4;

– information regarding the applied usage scenario (duty profile) and the respective power mix (e.g.”EU27”).

6.2.5.4 End of life

The following data for the EoL phase shall be specified in the environmental declaration for the reference product:

– emissions expressed as potential environmental impacts and resource depletion as specified in 6.2.5, Table 3;

– additional parameter as specified in 6.2.5, Table 4;

– recovery and recycling rate according to IEC/TR 62635.

The manufacturer shall provide information to facilitate end of life treatment for the products in the scope of the environmental declaration, e.g. dismantling, disposing, and recycling instructions compliant to IEC/TR 62650. This information shall include a list of components and their location in the product in accordance with IEC/TR 62650, B.1 and if applicable necessary requirements concerning

waste management (e.g. necessary competencies, technologies and type or level of security required for the treatment or landfill).

NOTE If applicable – once completed, Table C.1 facilitates compliance with laws and regulations for waste from electrical and electronic equipment, e.g. WEEE.

6.2.6 Other environment-related information (optional)

All other environment-related information specified in the environmental declaration is optional. This should also be flagged accordingly so that this information can be differentiated from the type III environmental declaration mandatory information; possibly by means of an additional section.

NOTE E.g. environmental payback time for certain use case or halogen free parts.

6.2.7 References within the environmental declaration

The environmental declaration shall refer to the following documents:

– this standard;

– the ECD and environmental declaration process description;

– the LCA and the life cycle inventory database on which the environmental declaration is based on;

– EN ISO 14040/ EN ISO 14044;

– EN ISO 14021;

6.3 Verification of the environmentally conscious design and declaration process

For a type II+ environmental declaration a verification is mandatory. In terms of this standard the verification shall take place through the implementation of ECD including a process description for the LCA, the accompanying LCA report and the creation of the environmental declaration into the management system and/or process landscape of the manufacturer. The verification therefore takes place via process verification within the management system and through internal audits of the manufacturer.

NOTE A third party verification can also be taken into account additionally, for instance through joining an type III environmental declaration program.

7 Basic product category rules (Core PCR)

7.1 Objective

The product category rules (PCR) serve two purposes; on one hand as an uniform approach for performing product life cycle assessments (LCA) and thereby guaranteeing a certain standard of quality and the usability in an extended product approach, on the other hand as a basis for type II+ environmental declarations in accordance with this standard, taking into account the basic principles of EN ISO 14025.

7.2 General information

This PCR shall therefore be used as the basis for LCAs for all of the products within a motor system. Since the product range is large and diverse, further detailed specifications regarding individual products or product groups are made in Annex C and additionally in the corresponding product

standards. In case of integrated products, for instance a PDS (variable speed drive and motor), the basic PCR and the PSR for the individual components shall be considered.

The PCR document fulfils the requirements for product category rules under EN ISO 14040, EN ISO 14044 and EN ISO 14025.

This basic PCR (core PCR) for motor systems may in the future be superseded by an horizontal standard for electronic and electrical equipment issued by CLC/TC 111X. In this case the horizontal standard shall be followed instead of this chapter.

7.3 Other requirements for an type II+ environmental declaration

In order to create an environmental declaration in accordance with this PCR, the following data (certain general conditions for the LCA) have to be stated for the corresponding product group (product family, homogeneous product family) in the LCA report:

– technical specifications / functions for product and (homogeneous) product family;

– specific product parts under review;

– applied scenario for the usage phase.

7.4 Software tool

An established LCA software tool, assuring compliance to the principles of EN ISO 14040. and ILCD, shall be used.

7.5 Product description

In a broader sense, motor systems are products and solutions for driving various applications, such as pumps, fans, conveyor belts primarily in the industrial area but also in vehicles or household appliances. The main product categories are motors, inverters, motor starters and auxiliaries. Additionally product families are defined within these product categories.

Only products with the same functional scope can be compared to some extent whereas still deviations up to 25 % can be expected due to different uncertainties, for instance in generic LCI databases, in the harmonized models. This fact should be mentioned in the environmental declaration.

7.6 Functional unit

The functional unit referenced in LCA is a device, for example a motor or a converter providing a certain power. The declared unit in the environmental declaration shall then be a representative device.

In the framework of the LCA, an analysis should be performed if possible however for a defined homogeneous product family through specific key devices. This procedure shall be carried out according to the principles described in Annex B.

7.7 Basic cut-off rules

The overall contribution to environmental impacts of the cut-off parts, i.e. those parts (not main parts) not looked at in LCA study shall not exceed 1 percent in the specified impact categories in each respective life cycle stage and may not contain any substances subject to legal regulations and exceeding any mass limit of such regulation.

7.8 Product parts

The LCA and the environmental declaration to be created on the basis of this PCR shall take account of all relevant (main) product parts and components of the device that it contains at the end of the manufacturing phase. Manufacturing can take place in in-house production or also be handled by subcontractors.

Specific regulations are established for individual product categories in Annex C as to which parts and components shall be considered as main parts and which – in accordance with the basic cut-off criteria – not. If there are no further specifications in Annex C, all product parts shall be considered as main parts in accordance with the basic cut-off criteria.

7.9 Materials and chemical substances

The following materials and substances shall be taken into account in the LCA and be listed in the LCA-report:

— all materials ≥ 1 wt%;

— materials with < 1 wt% can be cut off if the potential impact will not be higher than 1 % of any impact category in the corresponding life cycle stage;

— all substances / materials that are subject to legal regulations, for example the REACH Regulation (1907/2006/EC) and the RoHS Directives (2011/65/EU) in the EU, if the mass limit of these regulations is exceeded.

The actual material declaration requirement in the environmental declaration differs from the requirement what has to be considered in the LCA.

7.10 System boundaries

The life cycle and system boundaries of a device cover the manufacturing, usage and end-of-life (EoL) phases. The so-called superstructure, such as the building of a plant, infrastructure, manufacture of production goods, transport packaging (other packaging than the final product's packaging) and personnel activities, which do not relate directly to the production of the device, shall not be looked at in this context. The system boundaries in terms of the natural environment are defined as flows of materials and energy resources to the system and flows from the system caused by emissions / waste in the air, water and ground.

These general calculation rules do not include processes for waste handling, rather only the quantity of waste accrued. Processes for waste water treatment should however be considered. If special recycled material is used in the product, this should likewise be considered accordingly. In other words, separate raw material acquisition is not performed for these materials but transport and treatment processes generally do apply.

7.11 Manufacturing phase

The manufacture of parts, components and the final assembly can be performed either internally at a production location or externally with a contract partner in the most varied geographical regions. The representation in the LCA should reflect reality as closely as possible. The following processes shall be included as a minimum:

— acquisition and manufacture of raw material from the ground for the main components of the product, including the transport processes;

— the actual manufacturing of the main parts and components;

— the final assembly of the device;

— transport of the device to the customer.

If no detailed and profound information exists for the transport to the customer, the following assumption shall be made for transports within Europe:

— truck 7,5 t, Diesel Euro 3 (50 ppm sulphur in diesel and 0,05 % biogenic carbon in fuel), over a distance of 2 000 km with an actual load of 5 t and a weight-related load factor of 85 %, taking into account the following distribution on road:

  — journey on motorway (middle speed 82 km/h): 32 %;

  — journey out of town (middle speed 70 km/h): 40 %;

  — journey in town (middle speed 27 km/h): 28 %.

The accruing energy consumption values and production waste figures are taken from the LCI database or own collections.

The LCA should be a so-called full-scale LCA based on LCI databases. If individual components are not available here, they either have to be calculated based on a detailed analysis of the material composition or estimated via a so-called screening process. Appropriate information for analysis should then be defined in the accompanying LCA report and the impact on the overall result established by means of a sensitivity analysis.

7.12 Usage phase

7.12.1 General

The following information shall be made available for the usage phase of the product:

— type of usage and operation of the product;

— energy consumption including the losses for the specific operating mode over the corresponding life time.

Various, product-specific sources are available for establishing the operating mode and calculating the energy consumption and power losses, for example customer references or surveys, at least the efficiency defined in product standards. These have to be referenced accordingly in the environmental declaration and the accompanying document.

7.12.2 Applied usage scenario and duty profile

To assess the potential environmental impacts of the usage phase the energy consumption and if applicable service over the standardized usage scenario shall be taken into account. Details that shall be taken into account on energy efficiency classes and the respective losses in a certain motor system setup are defined in EN 50598-2. For applications and motor systems not specified for a certain country with a defined energy mix, the power mix “EU27” shall be used. Therefore these details on the application scenario and the used energy-mix have to be quoted in the environmental declaration and the accompanying document.

Table 5 — Standardized scenario for usage phase

Operating time in hours in a year [h]	**5 000 h, if not specified further in a PSR (e.g. Annex C)**	
Product life in years (tlife) [yrs]	**15 years, if not specified further in a PSR (e.g. Annex C)**	
Output Power [kW] / Efficiency [%] **Energy consumption [W]**	**Measured or from data sheet, in compliance with** EN 50598–2	
Duty Profile, based on EN 50598–2, Annex D	**Use of the following operating points (OP) and the corresponding load time profile over the standardized scenario (5 000h/15y), if not specified further in a PSR (e.g. Annex D)**	
Operating points and load time profile		
OPs: **OP1** **OP2** **OP3 (stand by)**	**Time [%]** **20** **70** **10**	**Load [%]** **100 (100 % Speed, 100 % Torque)** **50 (50 % Speed, 25 % Torque)** **0 (0 % Speed, 25 % Torque)**

7.13 End-of-life phase

Consideration of the EoL phase establishes the environmental impacts caused by the disposal (material recycling, land filling) at the end of the product life. The LCI database and IEC/TR 62635 shall be used for this calculation. For the end-of-life-phase it shall be differentiated in a recovery and a recycling quote. These can be calculated as follows.

Formula (1): Calculation of the recyclability rate

$$R_{cyc} = \frac{sum\ of\ recycable\ masses\ of\ each\ parts}{total\ product\ mass} \cdot 100\% \quad (1)$$

Formula (2): Calculation of the recovery rate

$$R_{cov} = \frac{sum\ of\ recoverable\ masses\ of\ each\ parts}{total\ product\ mass} \cdot 100\% \quad (2)$$

For the end-of-life-phase an energy requirement of 1 MJ/kg Product shall be assumed for all processes of material separation and sorting.

7.14 Allocation rules

In the case of parallel production of different product versions on a line or at a location where only the level of overall emissions or resource consumption is known however, “multi-output” is applied as an allocation rule in order to calculate the environmental impact on the object under review.

“Multi-Output”: The allocation is based on a quantitative calculation of the resource consumption and the emissions for example in relation to the distribution of functions or economic aspects, e.g. working hours per products or product price.

7.15 Units

SI units should be used in the LCA/environmental declaration. kW (MW) should be used for power and kWh (MWh) or kJ (MJ) for energy.

7.16 Calculation rules and requirements for data quality

7.16.1 General requirements

The general requirements concerning the LCA studies of motor systems intended to be used for documentation purposes in terms of an environmental declaration is accordance with the rules set out by the International Life Cycle System, e.g. ILCD compliance. The reference database for the generic data is the “European Life Cycle Database” (ELCD) and the ILCD rules on data quality shall be taken into account when other data sources are used. This shall be documented and stated in the environmental declaration and the LCA report.

NOTE The results of an LCA depend to a large extent on the databases used, even if the functional unit and the LCA model is based on the same PCR. This makes it difficult to compare the environmental declarations from different manufacturers.

7.16.2 Data quality in the manufacturing phase

Insofar as known, location-specific data (e.g. energy consumption) shall be used for manufacturing products and components/parts. This data should correspond to the average values for a specific year / process. In addition, generic data from a generic database may be used. This shall be documented accordingly. The power mix used in the model in the manufacturing phase shall reflect reality as closely as possible, in other words the actual data from the electricity provider for the year of the study when possible. If no values are available here, this value can be estimated from a specific power mix for the country of production. The power mix “EU27” should be used for production within the EU. The approach here shall be documented.

7.16.3 Data quality in the usage phase

7.16.3.1 General

The “EU27” power mix shall be used for calculating the environmental impacts resulting from the energy consumption and losses within the usage phase. The power mix of the respective country can also be estimated for certain, country-specific observations. The power mix shall be documented in the environmental declaration.

The actual application and if appropriate even an entire system and its design are critical factors for determining the environmental impact of products in the usage phase. This should be taken into account when selecting an operating scenario and commented on. If appropriate, various operating modes should be cited in the environmental declaration in order to emphasize this topic.

7.16.3.2 Electrical losses

This affects the environmental impacts to be established during the use phase of the product, including the electrical losses. Calculations shall be performed on the basis of the calculation rules specified in the EN 50598-2 and explained in detail in the LCA report.

7.16.4 End-of-life and recycling

The following basic scenario according to IEC/TR 62635 is assumed for recycling at the end of the product life: the device is disassembled or shredded and split into the following four fractions:

— ferrous metals → recycling;

— non-ferrous metals → recycling;

— fraction with high heating value including synthetics → recycling / thermal recycling with energy recovery;

— mineral fraction → landfill.

The modelled scenarios shall be justified accordingly and documented in the LCA-report. Further specifications concerning recovery rates for product categories can be found in Annex C and the recycling rates for certain material groups in IEC/TR 62635. Any further necessary assumptions and deviations shall be justified and stated in the LCA-report.

Annex A
(informative)

Environmental aspects in environmentally conscious design

A.1 General

It should be noted that this annex can assist only to the extent that the state of the art has been developed. As more studies and analysis are completed, more life-cycle data will be accumulated and better environmentally sound choices will be possible. Until then, the recommendation is to use this annex with care, professional judgment and a sound critical ability.

A.2 Scope

This annex is intended to give assistance in the consideration of environmental aspects relating to the impacts on the environment by products of a motor system.

A.3 General considerations

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

— 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 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 enhancing recyclability;

— marking;

— adequate environmental instruction/information for the user.

A.4 Inputs and outputs to be considered

A.4.1 General

Figure A.1, based on the work of EN ISO/TC 207/WG1, presents the correlation between principal steps in the environmental life cycle of a product, the product's function, its design, performance and other external considerations. The major objectives of environmental standards are also listed, namely

consumption of material and energy, environmental emissions, recyclability, disassembly. At each step of a product’s life cycle the materials and energy balance should be considered. When data is available, the study will cover the span of the life cycle from “cradle to grave”. The figure also illustrates a product improvement cycle that leads to pollution prevention and resource conservation.

A.4.2 Inputs and outputs

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, either to alter the materials and energy used or to influence a single output, may affect other inputs and outputs (see Figure A.1).

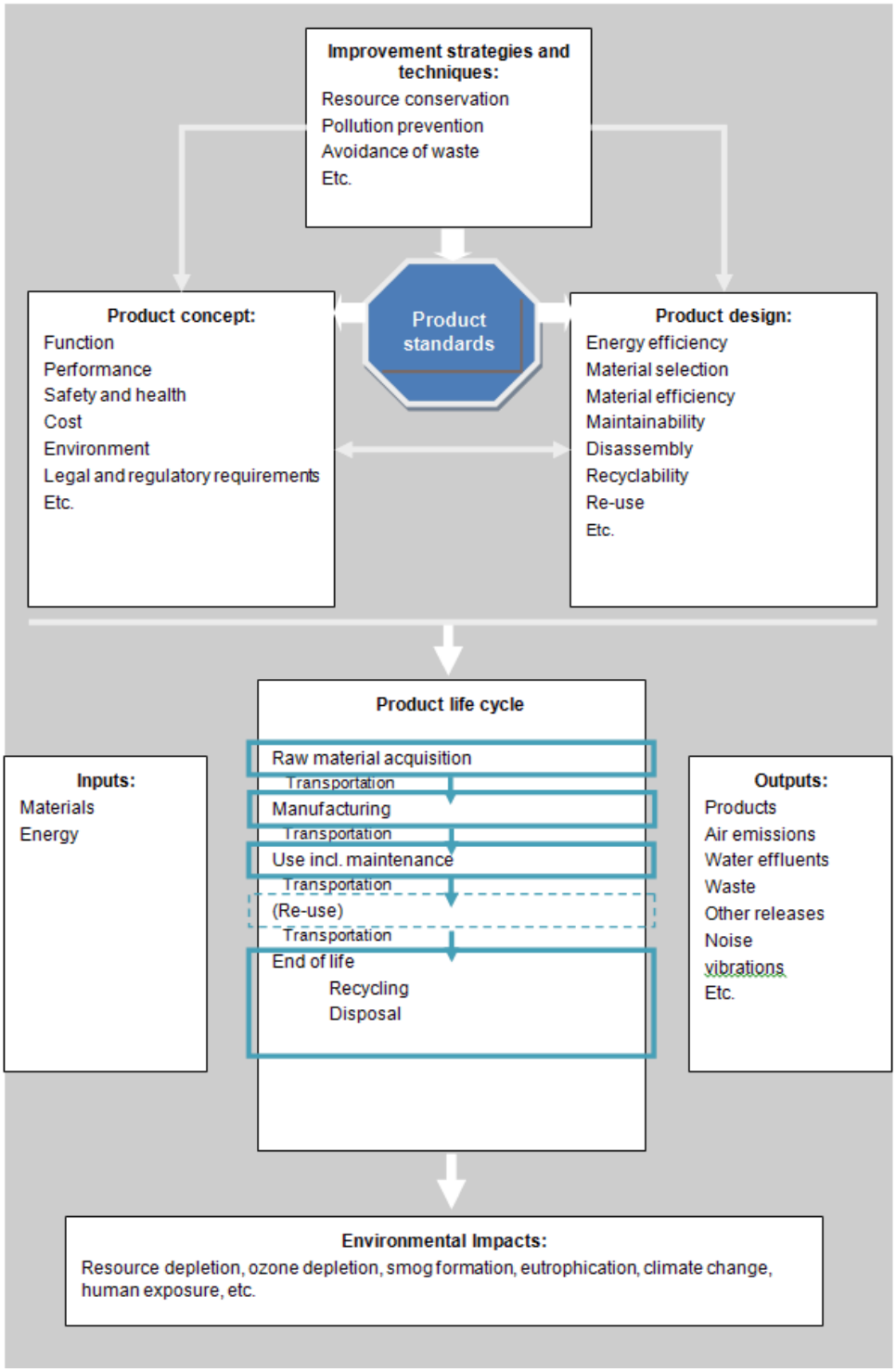


Figure A.1 — Conceptual relationship between provisions in product standards and the environmental impact associated with the product during its life cycle

- Inputs

Inputs fall into two broad categories: materials and energy. 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. Material inputs associated with product life cycle from the raw material

acquisition, manufacturing, transportation (including packaging and storage), use/maintenance, reuse/ recycling, to disposal of products can produce a variety of environmental impacts. Energy inputs are required at most stages of a product's life cycle. Energy sources include fossil fuels, nuclear, recovered waste, hydroelectric, geothermal, solar and wind energy. Each energy source has its own set of environmental impacts.

- 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.

Air emissions comprise releases of gases, 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 and greenhouse gases emissions. 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.

Emissions to water and effluents comprise the discharge of substances to a watercourse, 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.

Waste materials comprise solid or liquid materials and 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.

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

A.4.3 Tools for including environmental impacts in product design and development

Identification and assessment of how environmental impacts are influenced by products are complex and need 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:

a) analysis of a product's environmental aspects; for example life cycle assessment and environmental benchmarking based on physical metrics (for example, weight, energy consumption, volume);

b) 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;

c) 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.

NOTE The methodology of life cycle assessment as an example of a quantitative tool evaluating the environmental impacts of a product is dealt with in Clause 6.

Annex B
(normative)

Scaling functions for deriving potential environmental impacts for full environmental declarations homogeneous product families

B.1 General

The basic idea of scaling functions is to reduce the efforts for deriving the potential environmental impacts without significant losses in data quality e.g. for reporting purposes in the extended product view. EN 50598-2 deals in detail with the efficiency and losses of a motor system in the usage phase, therefore the two open life cycle stages in terms of ecodesign and reporting an environmental footprint are manufacturing and end of life. Since both basically depend on the raw material inset and the physical product design they can be accounted to in one function. Under certain circumstances, which means that the clustering of products to a homogeneous product family is possible, a scaling function can be derived through so-called key products to calculate potential environmental impacts for all variants inside this family without conducting a LCA for each variant and losing much in the quality of the quantitative statements inside the environmental declaration. This annex describes the procedure for deriving and using a scaling function.

B.2 Scaling functions for homogeneous product families

B.2.1 General

To keep the efforts for life cycle assessments in an effective ratio to the outcome in terms of ecodesign and environmental declaration, scaling functions can be used to calculate the potential environmental impacts for the environmental declaration. To ensure a certain accuracy of the results, the following principles shall be taken into account.

B.2.2 General requirements

Scaling functions shall only be used for homogenous product families and only for the manufacturing and end of life phase. For further simplification and because of typically low impacts in the end of life phase (if properly disposed), one function can be derived taking into account both life cycle stages.

NOTE As mentioned above EN 50598–1 deals with the efficiency of motor system's components and how to derive the efficiency and the losses for the extended product in the usage phase. Via power consumption and the related losses environmental impacts can be calculated for specific use cases and scenarios and a scaling function therefore is not necessary.

The homogenous product family is part of a product family and shall be defined by the manufacturer in terms of scaling potential environmental impacts through a certain environmental parameter (e.g. performance-specific variables → g CO_2e / kW or product weight → g CO_2e / kg). Therefore the homogenous product family shall be technologically and functionally consistent, e.g. AC motors, performance class IE2, X - Y kW.

The used scaling function shall be based upon a linear approximation ($f(x) = m*x + t$) and shall have the minimum accuracy of $R^2 = 0,97$.

As mentioned above the clustering of products in a homogeneous product family is the most critical step in terms deriving a sound and profound scaling function. This can only be achieved by the manufacturer with in depth knowledge of the products technology. This therefore shall be done with the most reasonable manner, assuring the avoidance of misleading environmental claims.

B.2.3 Procedure for deriving a scaling function

a) The homogenous product family shall be defined.

b) Within the homogenous product family at least three key devices shall be picked in regards to the environmental parameter. For instance if the parameter is kW, then a device with the smallest, the highest and a medium kW rating in the homogenous product family shall be taken into account.

c) For these key devices a LCA, based on the PCRs in Clause 7 and if applicable further specifications in Annex C shall be performed.

d) The assessed potential environmental impacts for the included life cycle stages (manufacturing and/or end of life) of each device relevant for reporting in an environmental declaration shall then be put into context with the environmental parameter (e.g. kW / kg).

e) Out of this context the scaling function is derived taken into account the general requirements in B.2.2.

f) The functions and their specific accuracy shall then be documented in the accompanying LCA report for the homogenous product family.

B.2.4 Example of deriving a scaling function

The example homogenous product family consists of devices of a motor system basically providing the same function (e.g. providing a certain torque) in a technological comparable way.

Table B.1 — Example data for the deriving a combined scaling function for potential environmental impacts for manufacturing and end of life phase, whereas M = manufacturing, E = end of life phase

Impact category	Device A 20 kg			Device B 120 kg			Device C 200 kg			Scaling functions for the other Devices within the product family
Life cycle phase	M	E	**M+E**	M	E	**M+E**	M	E	**M+E**	**M+E**
GWP [kg CO_2e]	18	5,2	**23,2**	83	10,4	**93,4**	135	19,3	**154,3**	**GWP = 0,73*product weight [kg] + 7,88** **R^2 = 0,9995**
TAP [kg SO_2e]										
…										

Annex C
(normative)

Further specifications for certain product categories in terms of product specific rules (PSR)

C.1 General

Whereas the basic PCR to be considered in the LCA described in Clause 7 gives a general framework for all products (mains and auxiliaries) in the scope of this standard, further product specific rules (PSR) can help to reduce the efforts of the LCA without losing in the quality of the statements inside the environmental declaration.

If for life cycle stages of products no further specifications are made in C.3 the basic PCR shall be applied in full.

C.2 Scope

This annex further specifies certain issues of the LCA, underlying the environmental declaration type III of a motor system's component, in terms of PCR.

C.3 Further specifications on motor systems components

C.3.1 Electric Motors

Preliminary to further definitions (PSR) that may be made in IEC 60034 currently the following rules apply:

The functional unit referenced in LCA/environmental declaration is one product, an electric motor in this case, supplying a certain output power (kW).

— Additional description

  — rated output power kW;

  — rated voltage (V);

  — rated torque (Nm);

  — rated frequency (Hz);

  — cooling method;

  — shaft height (mm).

— Manufacturing

  Main parts that shall be considered in any case:

  — housing (metal machining shall be considered with 15 % scrap, if not known in detail);

  — encoder (including electronics, at least PCBs, ICs (power semiconductors, ASICs), diodes and other discrete components, electrolytic capacitors, inductors and the solder paste);

- stator;
- rotor;
- cooling system;
- gear system.

Components that may not be considered in regards to the general cut off criteria

- connecting elements (e.g. screws);
- small mechanical parts;
- wiring.

— Usage

See 7.12.2, Efficiency factor derived via EN 60034-30-1

Additionally, if applicable, necessary maintenance steps, e.g.

- change of grease sealings;
- change of ball bearing;
- change of encoder.

— EoL

- no further specifications.

C.3.2 Variable Speed Drive (VSD)

The functional unit referenced in LCA/environmental declaration is one product, a basic drive module (variable speed drive) in this case, supplying a certain rated apparent power.

— Additional description

- rated apparent power kVA;
- rated voltage (V);
- rated frequency (Hz);
- cooling method.

— Manufacturing

Main parts that shall be considered in any case:

- housing (metal machining shall be considered with 15 % scrap, if not known in detail);
- cooling system;
- electronics, power and control, at least:

- the PCBs, ICs (power semiconductors, ASICs), diodes and other discrete components, electrolytic capacitors, inductors and the solder paste;

- cables;

- chokes;

- transformers.

Components that may not be considered in regards to the general cut off criteria

- connecting elements (e.g. screws);

- small mechanical parts.

— Usage

See 7.12.2 Efficiency factor derived via EN 50598-2

Additionally, if applicable, necessary maintenance steps, e.g.

- change of contactor-pins;

- change of grease sealings;

- change of ball bearing.

— EoL

- no further specifications.

C.3.3 Motor starters

Preliminary to further definitions (PSR) that may be made in IEC 60947 currently the following rules apply:

Contactors and contactor relays

— Manufacturing

- no further specifications.

— Usage

- standardized usage scenario: 3 500 h per year, 20 years, 80 % load.

— EoL

- no further specifications.

Motor starters and motor starter protection

— Manufacturing

- no further specifications.

— Usage

- standardized usage scenario: 3 500 h per year, 20 years, 80 % load.

— EoL

- no further specifications.

Soft starters and solid state relays

— Manufacturing

- no further specifications.

— Usage

- standardized usage scenario: 3 500 h per year, 10 years, 80 % load.

— EoL

- no further specifications.

Overload relays

— Manufacturing

- no further specifications.

— Usage

- standardized usage scenario: 3 500 h per year, 20 years, 80 % load.

— EoL

- no further specifications.

Annex D
(normative)

Usage of environmental declaration in the extended product view

D.1 General

An additional point of this standard is the usage of the data from the environmental declaration of the motor system components to derive the environmental footprint of the application, e.g. pump or ventilation system, by the system manufacturer. This is possible through the harmonized approach on the topic environmental declaration and especially the life cycle assessment through the standardized basic product category rules.

D.2 environmental declaration of a driven application

The basic idea is that the environmental declaration of the driven application is a summary of environmental declarations of the motor system components needed to drive the application. This environmental declaration is generated through the addition of each components potential environmental impacts and the materials insets (if the environmental declaration is a type II+/III declaration) or just the material inset and a summary of qualitative statements (if the environmental declaration is a type II declaration). For the content of the environmental declaration of driven application 5.2 or 6.2 shall be taken into account. In addition, the main components to be considered mandatorily and the auxiliary parts to be considered optionally are defined in Annex C, whereas in case of an environmental declaration type II+ the basic category rules defined in Clause 7 shall be taken into account. This means that the consideration of auxiliaries, which basically is optional, shall get mandatory if the contribution to one of the potential environmental impacts in one life cycle stage is expected to be greater 1 %.

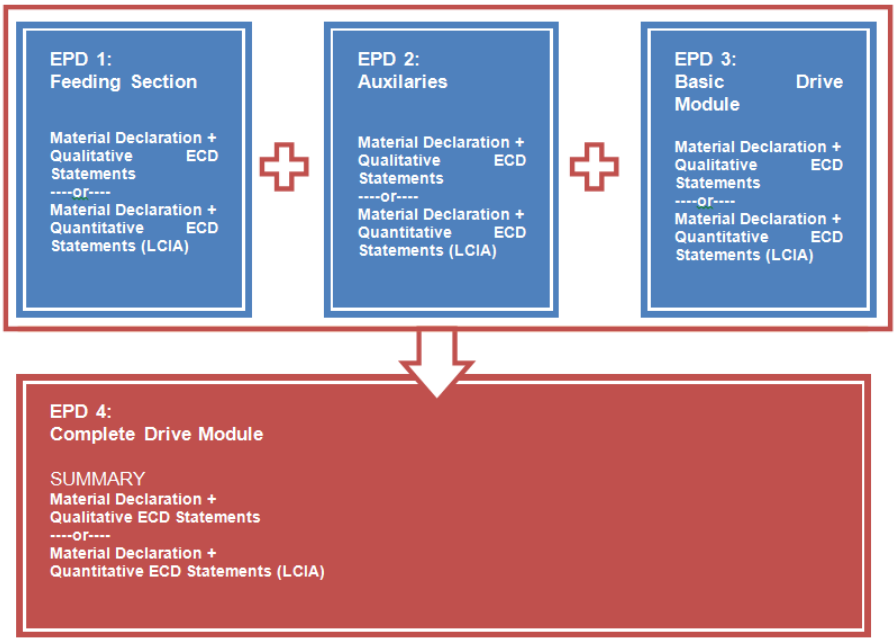


Figure D.1 — Visualization of generating an EPD for a CDM (EPD 4) by adding up the information provided in EPDs (EPD 1, EPD 2, EPD 3) for its components

Table D.1 — Example calculation of an environmental declaration (EPD 6) for a PDS through the addition of the data from a CDM (EPD 4) and a motor (EPD 5). On the next level of the application the other devices can be added accordingly, e.g. in this case the transmission (EPD 7)

		EPD 4			EPD 5			EPD 6			EPD 7		
Material Declaration		**CDM**			**MOTOR**			**PDS**			**Transmission**		
Material Class	ID		mass [kg]	weight-%		mass [kg]	weight-%		mass [kg]	weight-%		mass [kg]	weight-%
Metals	M-001	Stainless Steel		0,00	Stainless Steel	162,73	24,47	Stainless Steel	162,73	11,52	Stainless Steel	183,80	33,13
	M-002	Other ferrous alloys, non-stainless steels	334,05	44,72	Other ferrous alloys, non-stainless steels	426,73	64,16	Other ferrous alloys, non-stainless steels	760,78	53,88	Other ferrous alloys, non-stainless steels	370,93	66,86
	M-003	Aluminium and its alloys	77,63	10,39	Aluminium and its alloys		0,00	Aluminium and its alloys	77,63	5,50	Aluminium and its alloys		0,00
	M-004	Copper and its alloys	164,96	22,08	Copper and its alloys	64,75	9,73	Copper and its alloys	229,70	16,27	Copper and its alloys		0,00
Plastics and rubber	M-013	Thermoplastics	62,13	8,32	Thermoplastics		0,00	Thermoplastics	62,13	4,40	Thermoplastics		0,00
	M-014	Duromers	20,00	2,68	Duromers	8,50	1,28	Duromers	28,50	2,02	Duromers		0,00
Other organics	M-015	Other organic materials	60,00	8,03	Other organic materials	2,00	0,30	Other organic materials	62,00	4,39	Other organic materials		0,00
		Electronics	27,15	3,63	Electronics		0,00	Electronics	27,15	1,92	Electronics		0,00
		Other materials	1,06	0,14	Other materials	0,44	0,07	Other materials	1,50	0,11	Other materials	0,05	0,01
		product weight	746,97	100	product weight	665,15	100	product weight	1412,12	100	product weight	554,78	100
Impact Categories		**CDM**			**MOTOR**			**PDS**			**Transmission**		
Eutophication (CML2001 - Nov. 09)	EP	[kg Phosphat-Eqv.]	0,37		[kg Phosphat-Eqv.]	1,54		[kg Phosphat-Eqv.]	1,91		[kg Phosphat-Eqv.]	0,59	
Ozone Depletion (CML2001 - Nov. 09)	ODP	[kg R11-Eqv.]	0,00		[kg R11-Eqv.]	0,00		[kg R11-Eqv.]	0,00		[kg R11-Eqv.]	0,00	
Photochemical Ozone Creation (CML2001 - Nov. 09)	POCP	[kg Ethen-Eqv.]	0,58		[kg Ethen-Eqv.]	3,33		[kg Ethen-Eqv.]	3,90		[kg Ethen-Eqv.]	0,42	
Global Warming (CML2001 - Nov. 09)	GWP	[kg CO2-Eqv.]	1241,22		[kg CO2-Eqv.]	5572,15		[kg CO2-Eqv.]	6813,37		[kg CO2-Eqv.]	1321,78	
Acidification (CML2001 - Nov. 09)	AP	[kg SO2-Eqv.]	4,19		[kg SO2-Eqv.]	49,62		[kg SO2-Eqv.]	53,80		[kg SO2-Eqv.]	4,59	
primary energy from reg. ressources (lower heat value)	PE reg	[MJ]	1046,80		[MJ]	8469,02		[MJ]	9515,82		[MJ]	1066,51	
primary energy from non-reg. ressources (lower heat value)	PE fos	[MJ]	16376,78		[MJ]	72490,92		[MJ]	88867,71		[MJ]	17444,67	

Annex E
(informative)

Template for an environmental declaration

E.1 General

The following annex shall give a basic idea how an environmental declaration could look like. It is based on the requirements of the basic environmental declaration type II. For the full environmental declaration (type II+) the potential life cycle impacts derived from the life cycle assessments have to be stated in the respective clauses. The template including the content has and can be modified to the specific needs of the issuer and/or declaration requirements, since some of the content may not be applicable.

NOTE The need of adaption of the template applies specifically to statements made in the example texts, such as "…all manufacturing location are certified".

E.2 Basic template

Introduction

The data in this environmental declaration according to EN 50598-3 is related to the _____ product family, exemplarily shown for one _____. The stated environmental claims have been evaluated within a qualitative approach on environmentally conscious design process according to EN 62430.

Environmental Policy

…

Description of the product family, the reference product and its packaging

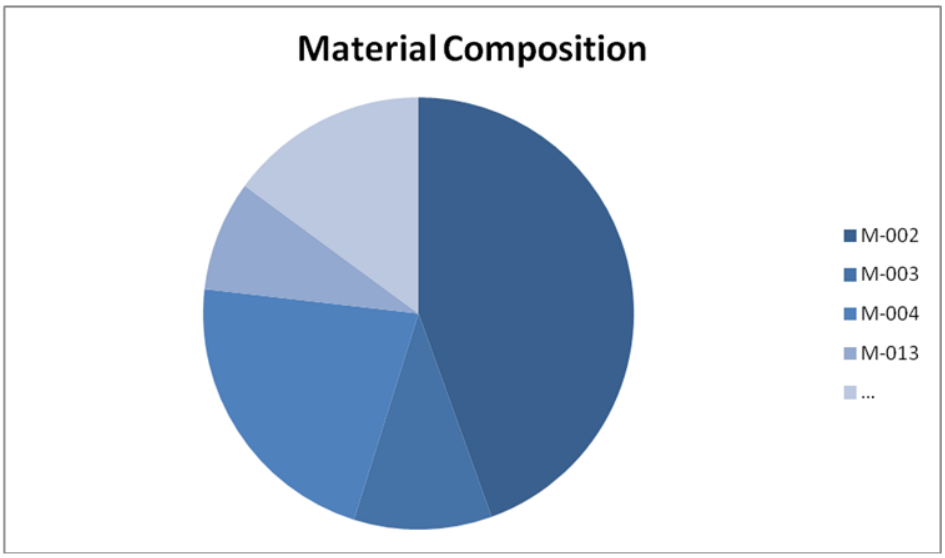
The product family _____ in the scope of this environmental declaration includes the products ABC to XYZ *(product identification numbers)*, in a rated power range from X to Y kW with product weight from X to Y kg. The packing consist of recycled paper, cardboard and wood.

No.	Product No.	Rated Power …[kW]	Product weight [kg]	Packaging material, weight [kg]
1	ABC	2	2	Paper and cardboard, 0,2
2	DEF	20	7	Paper and cardboard, 0,3
3	XYZ	200	20	Paper and cardboard / Wood, 0,3 / 2

The main manufacturing site of the products is _____ in _____, other production locations are _____ in _____ and _____ in _____. All respective manufacturing locations are certified according to ISO 14001.

Material Declaration

Materials in accordance with EN 62474.



		Product No. 1		Product No. 2		Product No. 3	
Material class	**ID**	**Mass [kg]**	**Weight-%**	**Mass [kg]**	**Weight-%**	**Mass [kg]**	**Weight-%**
Metals	**M-001**	**/**	**0**				
	M-002	**0,33**	**44,72**				
	M-003	**0,077**	**10,39**				
	M-004	**1,64**	**22,08**				
Plastics and Rubber	**M-013**	**0,62**	**8,32**				
…	**…**	**…**	**…**	**…**	**…**	**…**	**…**

The products are compliant to the substances restrictions in the EU RoHS directive (2011/65/EU) and do not have any batteries included.

Use phase

The following data concerning the use phase is derived in accordance to EN 50598-2:

No.	**Product No.**	**Rated Power …[kW]**	**Efficiency Class (according to** EN 50598–2**)**	**Related power losses (according to** EN 50598–2**)**
1	**ABC**	**2**	**IE 2**	
2	**DEF**	**20**	**IE 2**	
3	**XYZ**	**200**	**IE 2**	

End of life

Information for end-of-life treatment according to IEC/TR 62635:

— Dismantle the parts that require selective treatment, product parts with single recyclable material and the parts that are difficult to process (shredding).

— Parts that are difficult to process can be shredded.

— After shredding materials should be collected through magnetic separation (ferrous metals), eddy current separation (metals) and water and salt water separation (plastics).

— …

— Any residues of the end-of-life treatment shall be appropriately disposed according to local legislation.

	Items	Location	Product No.
Potential hazards identification			
Reusable parts			
Selective treatment	**APCBs, integrated circuits, electrolyte capacitors,…**		
Single recyclable material parts	**Housing, screws, heat sink,…**		
Parts difficult to process	**PCB,…**		

Environmental Impacts (relevant for full environmental declaration type II+)

The assessed potential environmental impacts through a LCA of a _____ are given in Table X below. For instance the global warming, which is evaluated in CO_2 equivalents, is the rising of the global temperature due to emissions of greenhouse gases like carbon dioxide and methane among others. The LCA was performed according to EN ISO 14040 / EN ISO 14044 standards and the product category/specific rules described in EN 50598-3 with software _____ and the _____ database from _____.

Product _____					
Impact-category	**Unit**	**Manufacturing**	**Use-Phase**	**End-of-Life**	**Total**
ODP	**kg CFC-11[5]**	**…**	**…**	**…**	**…**
TAP	**kg Sb-Eq.**	**0,52**	**1105,218**	**-0,08**	**1105,66**
FEP	**kg P-Eq.**	**0,03**	**54,12**	**-0,01**	**54,14**
HTP	**kg 1,4 DB-Eq.**	**35,85**	**18705,82**	**-1,34**	**18740,33**
TET	**kg 1,4 DB-Eq.**	**…**	**…**	**…**	**…**
POCP	**kg NMVOC**	**0,05**	**76,52**	**-0,01**	**76,56**
GWP	**kg CO_2-Eq.**	**98,72**	**218277,38**	**-9,83**	**218366,27**
TAP	**kg SO_2-Eq.**	**0,64**	**1355,38**	**-0,01**	**1356,01**
FEP	**kg P-Eq.**	**…**	**…**	**…**	**…**
MDP	**kg Fe-Eq.**	**…**	**…**	**…**	**…**
FDP	**kg**	**…**	**…**	**…**	**…**

Potential environmental impacts of a _____ evaluated with the LCA methodology

Manufacturing:

— includes the material inventory which involves the extraction of natural resources, transport to the processing sites and the production of raw materials;

— includes all manufacturing consumptions like electricity, water and gas at factory;

— includes impacts from the transport scenario.

Use-Phase:

— calculated with an operating time of _____ years and _____ hours per year at _____ load

End-of-Life:

— calculated with recovery and recycling quotes for the different material fractions from IEC/TR 62635

Interpretation

For instance a ____ has a GWP of about X t CO2eq and the “Use-Phase” is the main contributor with 99,95 % of the emissions. Even though the calculation scheme with an operation always at _____ load is not very likely for this device and the emissions strongly depend on the CO_2 factor of the electricity mix – the “real” emissions should therefore be significantly lower – the importance of this life cycle stage can be seen clearly. Based on this knowledge special attention should be paid to an application optimized design of the whole motor system.

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