
Okoljsko primerna zasnova motornih pogonskih sistemov, motornih zaganjalnikov, močnostne elektronike in njihove aplikacije, ki jih ti poganjajo - 1. del: Splošne zahteve za določitev standardov energijske učinkovitosti motorno gnane opreme z uporabo razširjenega proizvodnega pristopa (EPA) in polanalitičnega modela (SAM)

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)

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Ökodesign für Antriebssysteme, Motorstarter, Leistungselektronik und deren angetriebene Einrichtungen -- Teil 1: Allgemeine Anforderungen für die Erstellung von Normen zur Energieeffizienz von Ausrüstungen mit Elektroantrieb nach dem erweiterten Produktansatz (EPA) und semi-analytischen Modellen (SAM)

Ecoconception des entraînements électriques de puissance, des démarreurs de moteur, de l'électronique de puissance et de leurs applications entraînées -- Partie 1: Exigences générales pour définir les normes d'efficacité énergétique d'un équipement entraîné via l'approche produit étendu (EPA) et par le modèle semi-analytique (SAM)

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31.020	Elektronske komponente na splošno	Electronic components in general

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Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Contents	Page
Foreword.....	3
1 Scope	6
2 Normative references	6
3 Terms, definitions, symbols, units and abbreviated terms	6
4 Requirements for the development of energy efficiency standards for extended products	9
4.1 General	9
4.2 Responsibility of the driven equipment technical committee	10
4.3 Elements included in the extended product approach	10
5 Requirements for the semi analytical model (SAM) of the extended product	11
5.1 General	11
5.2 Torque/Power versus speed profiles	12
5.3 Operating points over time	13
6 Requirements for the semi analytical model (SAM) of the motor system	14
6.1 General	14
6.2 Speed versus torque loss points of a PDS and the associated power losses	15
6.3 Requirements if the motor system contains no CDM	15
7 Merging the semi analytical models (SAMs) to the extended product approach	16
7.1 General	16
7.2 Speed versus torque loss points of a motor system	17
7.3 How to determine intermediate speed versus torque loss points of a motor system	17
7.3.1 General	17
7.3.2 Determination of intermediate relative losses for speed versus torque operating points of a motor system	17
7.3.3 Loss determination by maximum losses of neighboured loss points	18
7.3.4 Loss determination by two-dimensional interpolation of losses of neighboured loss points	18
Annex A (informative) Example how to apply the SAM in the EPA for pump systems with a required speed versus torque loss points using the PDS	20
Annex B (informative) General calculation of the energy consumption based on the duty profile	22
Annex C (informative) Illustration of the collaboration of different responsibilities in the extended product approach	23
Bibliography	24

Foreword

This document (EN 50598-1:2014) 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) 2015-11-17
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2017-11-17

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.

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

EN 50598, *Ecodesign for power drive systems, motor starters, power electronics & their driven applications*, will consist 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 analytical 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 CLC/TC 22X/WG 06 is the enabled task force for dealing with the Mandate M/476 from European Commission for the standardization in the field of variable speed drives and/or power drive system products.

It has been set 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 aspects and ecodesign requirements together with a pilot stakeholder committee CEN/TC 197 from the customers side.

Key points:

- Requirements on the content of semi analytical models for motor system driven equipment;
- Requirements how to use them in the extended product approach.

The content could be of interest for the following technical committees CLC/TC 59X, CLC/TC 111X, CEN/TC 44, CEN/TC 113, CEN/TC 121, CEN/TC 123, CEN/TC 142, CEN/TC 143, CEN/TC 156, CEN/TC 228, CEN/TC 232 and CEN/TC 299.

It is the intention of the working group that this document, once finalized as European standard series, will be further processed to an international consensus in IEC and ISO.

EN 50598-1:2014 (E)

Introduction

The Technical Committee CLC/TC 22X has circulated at 2010-03-31 the document CLC/TC 22X/Sec0100/DC document including the mandate M/476 from 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 requirements for measuring of the energy efficiency of motors with non-sinusoidal supply is under the responsibility of CLC/TC2 covering the requirement from Mandate M/470.

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

The CLC/TC 22X/WG 06 as being the standardization task force for dealing with this Mandate has close collaboration with several other technical committees (i.e. CLC/TC 2; CLC/TC 17B).

Therefore CLC/TC 22X committee has been enabled responsible to clarify all relevant 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 are illustrated in Figure 1. The work has been agreed to provide the reasonable target as a best compromise.

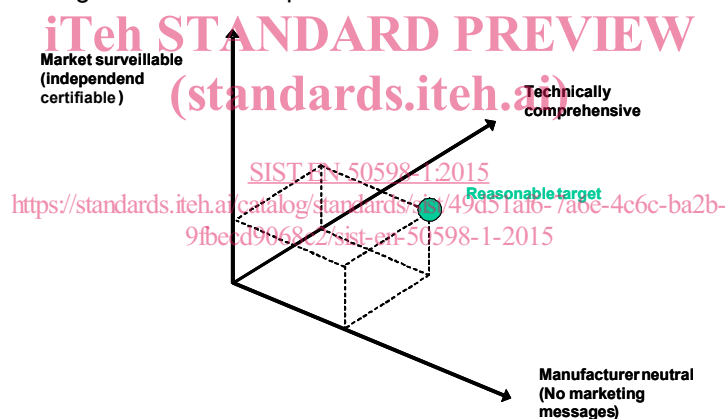


Figure 1 — Illustration of controversial requirements for the energy related product (ErP) standardization

EN 50598 is developed under the CENELEC projects number 24602 to 24604 for compliance with requirements from the horizontal mandate M/495.

Its three parts are together directly related to the mandates M/470 and M/476.

For the other mandates listed in Table 1, this standard could be applied if the future product standards developed will make reference to it.

Table 1 — Mandates of the European Commission given to CEN, CENELEC and ETSI and how they are contributed by these standard series parts

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	✓	✓	(✓)

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EN 50598-1:2014 (E)**1 Scope**

This European Standard provides a general methodology to energy efficiency standardization for any extended product including a motor system by using the methodological guidance of the extended product approach (EPA).

It enables product committees for driven equipment with included motor systems to interact with the relative power losses of the included motor system (e.g. PDS) in order to determine the system energy efficiency aspects for the extended product by calculation.

This should be based on specified calculation models for speed/load profiles, the duty profiles and relative power losses of appropriate torque versus speed operating points.

This part of the EN 50598 series specifies the methodology of determination of losses of the extended product including a motor system and its sub-parts.

This framework is explained by an example for pumps.

This part of the standard does not specify requirements for environmental impact declarations.

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.

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*

IEC 60050-161, *International Electrotechnical Vocabulary. Chapter 161: Electromagnetic compatibility*

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3 Terms, definitions, symbols, units and abbreviated terms

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

3.1**Energy Efficiency Index**

EEI

value describing an energy efficiency aspect of an application, resulting from the extended product approach (EPA)

Note 1 to entry: If the extended product is a pump system, the EEI is the ratio of the input power to the theoretical reference power required for the application.

3.2**Extended Product**

EP

driven equipment together with its included motor system (e.g a PDS, a motor starter)

Note 1 to entry: See Figure 2.

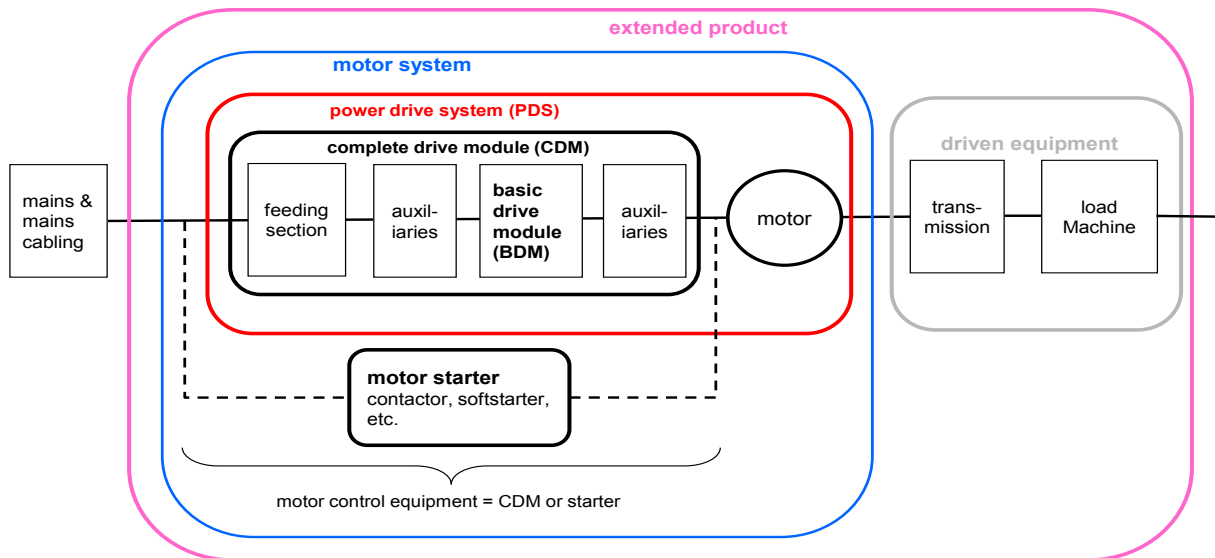


Figure 2 — Illustration of the extended product including a motor system

3.3

Extended Product Approach

EPA

methodology to determine the energy efficiency index (EEI) of the extended product (EP) using the speed torque profiles of the driven equipment, the relative power losses of the motor system and the duty profile of the application

3.4

motor control equipment

either a CDM or a motor starter

3.5

motor system

motor control equipment and a motor

3.6

duty profile

fraction of time spent at each operating point during the total operating time or a complete cycle of operation of the extended product

Note 1 to entry: Typically this profile is represented by an histogram.

Note 2 to entry: The standby mode can be included in the load time profile.

3.7

$P_{\text{Electrical}}$

power consumption [kW] of an application

3.8

$P_{\text{Electrical Max}}$

power consumption [kW] at 100 % speed and 100 % load

3.9

P_i

power consumption [kW] at operating point i

3.10

$P_{\text{in,CDM}}$

input power [kW] of the CDM from the power loss measurement

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EN 50598-1:2014 (E)**3.11** $P_{in,PDS}$

input power [kW] of the PDS from the power loss measurement

3.12 P_n

nominal Power [kW] of equipment which is typical for its population of the same rating

Note 1 to entry: See EN 60034-1 for motors.

3.13 $P_{out,CDM}$

output power [kW] of CDM from the power loss measurement

3.14 $P_{out,PDS}$

output power [kW] of PDS from the power loss measurement

3.15 P_r

rated power [kW] of equipment which is assigned by its manufacturer

3.16 $P_{Reference}$

power consumption [kW] used for reference, defined by the extended product committee

3.17 P_L

electrical power losses with the indices CDM dedicates it to the complete drive module, Mot dedicates it to the motor, Aux dedicates it to the auxiliary devices like cables, transformers or filters

Note 1 to entry: The relative power losses are the per unit losses relative to the nominal power of the device.

3.18 $P_{L,CDM}$

power losses of a CDM

3.19 $P_{L,CDM, determined}$

power losses of CDM from the power loss determination method

3.20 $P_{L,CDM,relative}$

power losses of the CDM, referred to its rated apparent power

3.21 $P_{L,inverter}$

power losses in the inverter section of a CDM

3.22 $P_{L,PDS, determined}$

power losses of PDS from the power loss determination method

3.23 $P_{LT,Mot}$

total losses of a motor according to EN 60034-2-1, method 2-1-1B when supplied by a converter (non sinusoidal power supply)

3.24**Semi Analytical Model
SAM**

model for determining energy efficiency characteristics of a specific motor system or driven equipment, based on mathematical equations and/or measured data

3.25 t_w

working time of an equipment

3.26 T_i

torque [Nm] at operating point i

3.27**timefraction_i**

percentage of time when the extended product is operated at one specific operating point i

4 Requirements for the development of energy efficiency standards for extended products

4.1 General

This document specifies a methodology to determine the energy efficiency index of an application, based on the concept of semi analytical models (SAM). The methodology shall be referred to as the extended product approach (EPA).

This document also specifies the responsibilities and tasks of the different stakeholders creating or using these extended products standards, as well as the data flows in-between.

- a) Specific information about the equipment shall be considered:
- 1) The torque versus speed profile of the driven equipment as specified by the manufacturer of the driven equipment or the extended product technical committee.
 - 2) The losses of the motor system or its constituents (Motor, CDM or starter) at reference part-load operating points. These shall be provided by the different manufacturers as specified in EN 50598-2.
 - 3) The duty profile of the driven equipment. The extended product standards committee can for example define typical applications of their extended products, each associated with a typical duty profile
- b) The extended product approach shall be used to determine an energy efficiency indicator (losses, efficiency, energy consumption...):
- 1) EN 50598-2 specifies the methods for the determination of losses of the motor system using measurement and/or calculations.
 - 2) extended product standardization committees shall define how to combine the losses of the motor system and the losses of the load to obtain an overall energy efficiency aspects related indicator for the extended product within the defined application.

The interactions between the different stakeholders of the extended product approach are shown in Figure C.1.