IEC TR 63196

Edition 1.0 2020-01

TECHNICAL REPORT

colour inside

Switchgear and controlgear and their assemblies for low voltage – Energy efficiency

IEC TR 63196:2020-01(en)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 27.015; 29.130.20

ISBN 978-2-8322-7796-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SWITCHGEAR AND CONTROLGEAR AND THEIR ASSEMBLIES FOR LOW VOLTAGE – ENERGY EFFICIENCY

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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IEC TR 63196, which is a technical report, has been prepared by committee 121: Switchgear and controlgear and their assemblies for low voltage.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
121/44/DTR	121/47A/RVDTR

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

Energy efficiency (EE) is a horizontal topic spanning the IEC domain and may be dealt with in standards in various forms across a wide range of technologies and for different products, processes and services.

The horizontal nature of the topic and increasing integration of products, processes and services entering the market implies that standard writers identify which aspects of energy efficiency are relevant for standardization, and:

– use a systematic approach (see IEC Guide 119);

– adopt a systems approach.

The objective of an energy efficiency management system is to improve continuously the energy performance of an energy using system such as a production facility or an office building. As shown below in Figure 1 (see dark blue boxes), it is based on the particular organization's energy policy, supporting energy objectives and it is implemented by processes (planning, operations, assessment, etc.) to achieve those objectives.

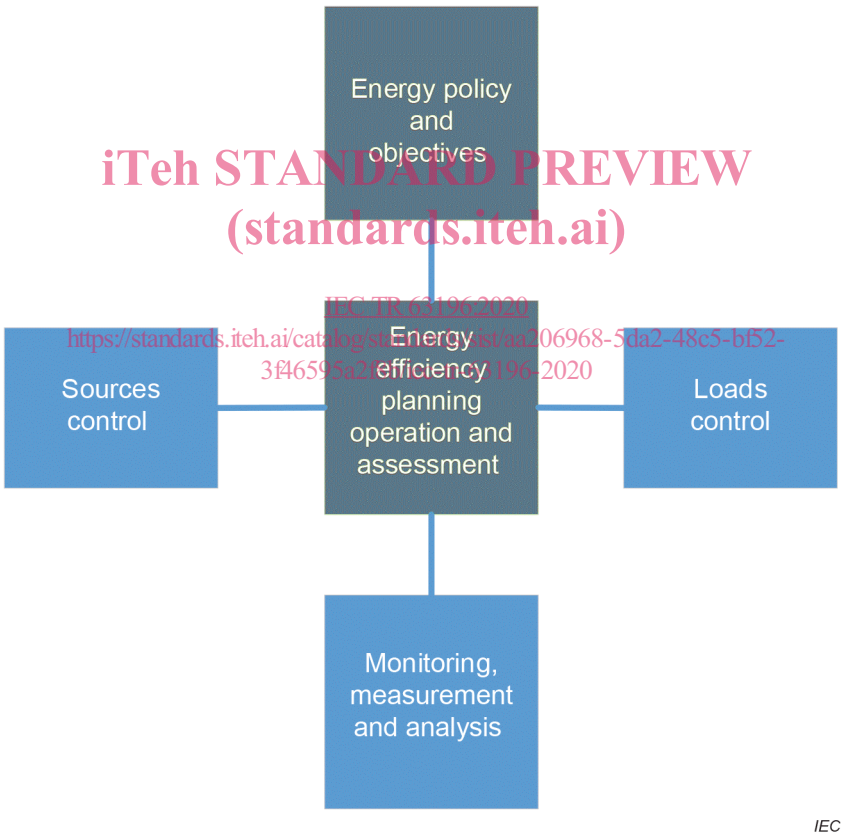

Figure 1 – Overview of energy efficiency management

Many types of equipment, including switchgear and controlgear and their assemblies, depicted in the light blue boxes in Figure 1, make an important contribution to the overall energy efficiency of a system.

This document aims to give guidance to product standards writers and other interested parties on the way energy efficiency should be considered for switchgear and controlgear and their assemblies.

By following this document, experts in standards will be encouraged to:

– consider energy efficiency aspects in their product standards and any associated publications;
– use a structured method;
– use a systems approach;
– support the dissemination of energy efficient technologies;
– accelerate the uptake of the next generation of energy efficient technologies;
– create the prerequisites for energy efficiency through enabling technologies.

SWITCHGEAR AND CONTROLGEAR AND THEIR ASSEMBLIES FOR LOW VOLTAGE –ENERGY EFFICIENCY

1 Scope

This document is following the principles of IEC Guide 119. This document defines the energy efficiency aspects of switchgear and controlgear products complying with IEC 60947 (all parts), IEC 61095 and IEC 62626 (all parts), and associated assemblies complying with IEC 61439 (all parts), in the context of the overall system energy efficiency. This document references energy policy aspects, as well as product and system aspects.

This document generally assumes electrical energy input, whereas the output can be a number of different products and/or services.

This document:

– helps to harmonize the energy efficiency requirements and guidance in product standards;
– raises awareness that provisions in publications can generally influence energy efficiency;
– helps to identify energy efficiency aspects;
– promotes the use of a systems approach to energy efficiency.

Other than energy efficiency aspects, this document does not cover environmental impacts (see IEC TS 63058).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
energy management
coordinated activities directing and controlling the energy use of an entity

3.2
energy management system
EnMS
set of interrelated or interacting elements to establish an energy policy and energy objectives, and processes and procedures to achieve those objectives

[SOURCE: ISO 50001:2011, 3.9]

3.3
energy efficiency
EE
ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy taking into account the driving parameters and the boundaries

Note 1 to entry: Both input and output need to be clearly specified in quantity and quality, and be measurable.

EXAMPLE Conversion efficiency; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

[SOURCE: ISO/IEC 13273-1:2015, 3.4.1, modified – Insertion of “taking into account the driving parameters and the boundaries”, symbol “E_f” renamed to “EE”, and “Efficiency conversion energy” renamed to “Conversion efficiency” in example.]

3.4
recovered energy
energy that is withdrawn from system energy loss to become applied energy at another energy using system

[SOURCE: ISO/IEC 13273-1:2015, 3.1.11.2.1]

3.5
load
electric equipment intended to convert electric energy into another form of energy, for example light, heat, mechanical energy

3.6
peak shaving
process in an electrical system intended to not exceed a maximum overall energy demand

Note 1 to entry: Peak shaving can be obtained by planning of energy needs within the manufacturing system or load shedding or autonomous energy production.

[SOURCE: IEC TR 62837:2013, 3.3.8]

3.7
load shedding
process of deliberately disconnecting preselected loads from a power system in order to maintain a certain performance level

[SOURCE: IEC 60050-603:1986, 603-04-32, modified – “the integrity of the remainder of the system” replaced by “a certain performance level”.]

3.8
energy performance
measurable results related to energy efficiency, energy use and energy consumption

Note 1 to entry: Energy performance can be improved by reducing the energy consumption and/or improving the energy efficiency.

[SOURCE: ISO/IEC 13273-1:2015, 3.3.1, modified – New Note 1 to entry.]

3.9
energy efficiency improvement
increase in energy efficiency as a result of technological, design, behavioural or economic changes

[SOURCE: ISO/IEC 13273-1:2015, 3.4.3]

3.10
energy policy
statement by the organization of its overall intentions and direction of an organization related to its energy performance, as formally expressed by top management

Note 1 to entry: The energy policy provides a framework for action and for the setting of energy objectives and energy targets.

[SOURCE: ISO 50001:2011, 3.14]

3.11
energy control centre
ECC
switchgear and controlgear assembly designed to manage different types of energy sources and/or their loads

4 Contribution of low-voltage switchgear and controlgear and their assemblies to energy efficiency

Many energy-efficient technologies and solutions are already available and cost-effective; nevertheless, a lack of awareness may slow down the deployment of these technologies and impedes harvesting their energy efficiency potential. In this context, switchgear and controlgear can be used as resources (see Figure 1) for three different roles:

1) controlling the electrical (energy-using) loads in an efficient way;
2) source control: selecting, connecting or disconnecting the source of energy, as appropriate;
3) monitoring, measuring, analysing such as:
   - the availability of energy sources;
   - the power from each source and the power consumed by each load, including power quality;
   - sensing other environmental inputs (temperature, overload conditions, etc.).

5 General concepts of energy efficiency

5.1 Concept of energy efficiency system

5.1.1 System considerations

Energy efficiency relates the output of an activity to its energy input, for a given system. The input can be expressed in various energy units (kWh, etc.), while the output may not be necessarily expressed in energy units and covers a wide range of activities and services,for example controlling a load (switch on/switch off/protect/monitor), providing data, etc. See Figure 2.

It is key for energy efficiency not to reduce the given service but to optimize the energy input for a given service.

NOTE Implementation of energy efficiency measures can be based on energy price consideration.

It should be noted that:

– energy efficiency may vary when the system changes;
– energy efficiency may vary and degrade in time.

EXAMPLE A system boundary to measure EE could be an electric motor itself or a motor-pump combination or the whole pumping system, consisting of a motor, a pump and the pipe installation.