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INTERNATIONAL STANDARD

colour inside

Low-voltage electrical installations – Part 8-1: Functional aspects – Energy efficiency

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 8-1: Functional aspects – 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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International Standard IEC 60364-8-1 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) revision of Annex B;
b) revision of 4.2: Energy efficiency assessment for electrical installations;
c) update of 8.3: Input from loads, sensors and forecasts;
d) introduction of new definitions.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
64/2353/FDIS	64/2360/RVD

Full information on the voting for the approval of this International Standard 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.

It has the status of a group energy efficiency publication in accordance with IEC Guide 118 and IEC Guide 119.

The reader's attention is drawn to the fact that Annex C lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

A list of all parts in the IEC 60364 series, published under the general title *Low-voltage electrical installations*, can be found on the IEC website.

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.

The contents of the corrigendum of May 2019 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The optimization of electrical energy usage can be facilitated by appropriate design and installation considerations. An electrical installation can provide the required level of service and safety for the lowest electrical consumption. This is considered by designers as a general requirement of their design procedures in order to establish the best use of electrical energy. In addition to the many parameters taken into account in the design of electrical installations, more importance is nowadays focused on reducing losses within the system and its use. The design of the whole installation has therefore to take into account inputs from users, suppliers and utilities.

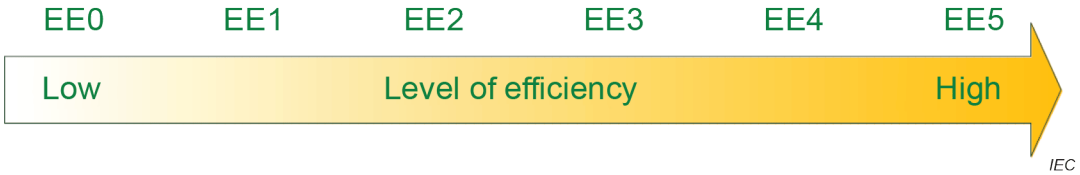
It is important that this document covers existing electrical installations in buildings, in addition to new installations. It is in the refurbishment of existing buildings that significant overall improvements in energy efficiency can be achieved.

The optimization of the use of electricity is based on energy efficiency management which is based on the price of electricity, electrical consumption and real-time adaptation. Efficiency is checked by measurement during the whole life of the electrical installation. This helps identify opportunities for any improvements and corrections. Improvements and corrections may be implemented by redesign or equipment replacement. The aim is to provide a design for an efficient electrical installation which allows an energy management process to suit the user's needs, and in accordance with an acceptable investment. This document first introduces the different measures to ensure an energy efficient installation based on kWh saving. It then provides guidance on giving priority to the measures depending on the return of investment; i.e. the saving of electrical energy and reducing of electrical power costs divided by the amount of investment.

This document is intended to provide requirements and recommendations for the electrical part of the energy management system addressed by ISO 50001.

It introduces requirements, recommendations and methods for the design and the energy efficiency assessment of an electrical installation within the framework of an energy efficiency management approach in order to get the best permanent functionally equivalent service for the lowest electrical energy consumption and the most acceptable energy availability and economic balance.

The assessment method described in Annex B based on the electrical energy efficiency of the installation allows a classification of energy efficiency installation according to the following levels:



NOTE Account can be taken, if appropriate, of induced works (civil works, compartmentalization) and the necessity to expect, or not, the modifiability of the installation.

This document introduces requirements and recommendations to design the adequate installation in order to give the ability to improve the management of the energy performance of the installation by the tenant/user or for example the energy manager.

All requirements and recommendations of this part of IEC 60364 enhance the requirements contained in Parts 1 to 7 of the IEC 60364 series.

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 8-1: Functional aspects – Energy efficiency

1 Scope

This part of IEC 60364 provides additional requirements, measures and recommendations for the design, erection, operation and verification of all types of low voltage electrical installation including local production and storage of energy for optimizing the overall efficient use of electricity.

It introduces requirements, recommendations and methods for the design and the energy efficiency (EE) assessment of an electrical installation within the framework of an energy efficiency management approach in order to get the best permanent functionally equivalent service for the lowest electrical energy consumption and the most acceptable energy availability and economic balance.

These requirements, recommendations and methods apply, within the scope of IEC 60364 (all parts), for new installations and modification of existing installations.

This document is applicable to the electrical installation of a building or system and does not apply to products. The energy efficiency of products and their operational requirements are covered by the relevant product standards.

Where another standard provides specific requirements for a particular system or installation application (e.g. manufacturing system covered by ISO 20140 (all parts)), those requirements may supersede this document.

This document does not specifically address building automation systems.

This group energy efficiency publication is primarily intended to be used as an energy efficiency standard for the low voltage electrical installations mentioned in Clause 1, but is also intended to be used by technical committees in the preparation of standards, in accordance with the principles laid down in IEC Guide 119 and IEC Guide 118.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 12: Power metering and monitoring devices (PMD)*

IEC 61869-2, *Instrument transformers – Part 2: Additional requirements for current transformers*

IEC 62053-21, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)*

IEC 62053-22, *Electricity metering equipment (a.c.) – Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S)*

IEC Guide 118, *Inclusion of energy efficiency aspects in electrotechnical publications*

IEC Guide 119, *Preparation of energy efficiency publications and the use of basic energy efficiency publications and group energy efficiency publications*

3 Terms, definitions and abbreviated terms

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 General

3.1.1
zone
area (or surface) defining a part of an installation

Note 1 to entry: Examples of a zone can be a kitchen of 20 m^2 or a storage area of 500 m^2.

3.1.2
current-using equipment
electric equipment intended to convert electric energy into another form of energy, for example light, heat, mechanical energy

[SOURCE: IEC 60050-826:2004, 826-16-02]

3.1.3
electrical installation
assembly of associated electric equipment having co-ordinated characteristics to fulfil specific purposes

[SOURCE: IEC 60050-826:2004, 826-10-01]

3.1.4
usage
type of application for which electricity is used

EXAMPLE Lighting, heating.

3.1.5
load energy profile
figure representing the energy consumption (Y-axis) within a period of time (X-axis) based on measurements for a mesh or a group of meshes

EXAMPLE Hourly consumption of energy for a period of a week.

3.1.6
power demand profile
figure representing the power demand (Y-axis) for a given integration period within a period of time (X-axis) based on measurements for a mesh or a group of meshes

3.1.7
electrical energy efficiency
EEE
system approach for optimizing the efficiency of electricity usage

Note 1 to entry: Energy efficiency improvement measures take into account the following considerations:

– both the consumption (kWh) and the price of electricity;

– technology;

– environmental impact.

3.1.8
mesh
one or more circuits of the electrical installation for one or more zones including one or more services supplying a group of electrical equipment for the purpose of electrical energy efficiency

3.1.9
active electrical energy efficiency measure
operational measure, either manually or automatically controlled, for optimizing the energy efficiency of the electrical installation

EXAMPLE Thermostat control, occupancy lighting control, building optimization control systems.

3.1.10
passive electrical energy efficiency measure
measure for optimizing the energy efficiency of the electrical installation by selection and erection of electrical equipment other than control equipment

EXAMPLE Selection and location of transformer, cross section of cables, routing of wiring system, sub-division of circuits.

3.1.11
electrical installation efficiency class
defined level of energy efficiency for an electrical installation

Note 1 to entry: See Annex B.

3.1.12
driving parameter
external factors that affect energy efficiency

EXAMPLE Regulation, environmental conditions, occupancy, energy prices and management requirements, mode of operation, duty cycle, load curves, state, operating, parameters, indoor temperature, lighting levels, production volume.

3.1.13
barycentre method
procedure to optimize the position of energy source(s) and loads in consideration of energy efficiency

3.1.14
EE assessment
process to determine the electrical installation efficiency class of an installation

3.2 Electrical energy management

3.2.1
electrical energy management system
EEMS
system monitoring, operating, controlling and managing energy resources and loads of the installations

3.2.2
load shedding
method(s) of optimizing demand by controlling the electrical loads for variable periods of time

3.2.3
demand response
changes in electric usage by end-user customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized

3.2.4
user interface
means that allow the user to monitor and/or control the electrical installation, locally or remotely

EXAMPLE Visual or audible signal, local display, remote display, push button.

3.3 Energy measurement

3.3.1
measurement
process of obtaining value(s) that can be attributed to a quantity

3.3.2
monitoring

continuing procedure for the collection and assessment of pertinent information, including measurements, for the purpose of identifying deviations and determining the effectiveness of the plans and procedures

[SOURCE: IEC 60050-881:1983, 881-16-02, modified – Addition of "identifying deviations and"; deletion of "for radiation protection".]

3.3.3
power metering and monitoring device
PMD
combination in one or more devices of several functional modules dedicated to metering and monitoring electrical parameters in energy distribution systems or electrical installations, used for applications such as energy efficiency, power monitoring and network performance

3.3.4
billing
process that allows energy suppliers or their representatives to invoice their customers according to a defined contract

Note 1 to entry: These applications can be covered by international standards, regulations such as MID in Europe or NMI in Australia, and/or utility specifications.

3.3.5
sub-billing
process that allows the property manager to allocate an energy invoice from the energy supplier and charges as appropriate to specific tenants

3.3.6
cost allocation
process that allows a facility manager to account for energy costs from internal cost centres that consume energy

EXAMPLE Process line, test and inspection, administration.

3.3.7
estimation
process of judging one or more values that can be attributed to a quantity

Note 1 to entry: Estimation by a competent person can provide data of a reasonable accuracy.

3.3.8
forecast
estimate of the expected value of a parameter at a given future date

3.3.9
total harmonic distortion of the voltage wave
THD_U
ratio of the RMS value of the harmonic content of an alternating quantity (voltage) to the RMS value of the fundamental component of the quantity (voltage)

3.3.10
total harmonic distortion of the current wave
THD_I
ratio of the RMS value of the harmonic content of an alternating quantity (current) to the RMS value of the fundamental component of the quantity (current)

3.3.11
degree day
unit used to determine the heating requirements of buildings, representing a fall of one degree below a specified average outdoor temperature (usually 18 °C) for one day

3.4 Sectors of activities

3.4.1
residential installations
premises designed and constructed for private habitation and including associated areas

Note 1 to entry: Associated areas include common areas, garages, gardens, pools.

3.4.2
commercial installations
premises designed and constructed for commercial operations

EXAMPLE Offices, retail, distribution centres, public buildings, banks, hotels, hospitals, schools.

3.4.3
industrial installations
premises designed and constructed for manufacturing and processing operations

EXAMPLE Factories, workshops.

3.4.4
infrastructure installations
systems or premises designed and constructed for transport or utility operations

EXAMPLE Airport terminals, port facilities, transport facilities.

3.5 Abbreviated terms

BS bonus

DB distribution board

DSO distribution system operator

EEE Electrical energy efficiency