IEC 60364-8-1

Edition 1.0 2014-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

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

Installations électriques basse tension –
Partie 8-1: Efficacité énergétique

IEC 60364-8-1:2014-10(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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

Installations électriques basse tension – Partie 8-1: Efficacité énergétique

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 8-1: Energy efficiency

FOREWORD

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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.

The text of this standard is based on the first edition and the following documents:

FDIS	Report on voting
64/1969/FDIS	64/1977/RVD

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

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

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

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

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- withdrawn,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

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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 therefore takes into account inputs from users, suppliers and utilities.

The rate of replacement of existing properties is low, between 2 % and 5 % annually, depending on the state of the local economy. It is therefore important that this standard 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 through major investment or by an incremental method. 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 standard 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 costs divided by the amount of investment.

This standard is intended to provide requirements and recommendations for the electrical part of the energy management system addressed by ISO 50001 [1][1].

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

This standard introduces requirements and recommendations to design the adequate installation in order to give the ability to improve the management of 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 standard.

[1] Numbers in square brackets refer to the Bibliography.

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 8-1: Energy efficiency

1 Scope

This part of IEC 60364 provides additional requirements, measures and recommendations for the design, erection 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 and recommendations for the design 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 and recommendations apply, within the scope of the IEC 60364 series, for new installations and modification of existing installations.

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

This standard does not specifically address building automation systems.

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.

IEC 60034-30, *Rotating electrical machines – Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)*

IEC 60287-3-2, *Electric cables – Calculation of the current rating – Part 3-2: Sections on operating conditions – Economic optimization of power cable size*

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-5-52:2009, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60364-5-55:2011, *Low-voltage electrical installations – Part 5-55: Selection and erection of electrical equipment – Other equipment*

IEC 60364-7-712:2002, *Electrical installations of buildings – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems*

IEC 61557-12:2007, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 12: performance measuring and monitoring devices (PMD)*

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)*

3 Terms and definitions

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

3.1 General

3.1.1
zone
area (or a surface) defining 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
electrical equipment intended to convert electrical energy into another form of energy, for example light, heat, mechanical energy

[SOURCE: IEC 60050-826:2004, 826-16-02] [2]

3.1.3
electrical distribution system
set of coordinated electrical equipment such as transformers, protection relays, circuit-breakers, wires, busbars, etc. for the purpose of powering current-using equipment with electrical energy

3.1.4
usage
type of application for which electricity is used such as lighting, heating, etc.

3.1.5
distribution system design
design of cabling and associated electrical equipment for the distribution of electrical energy

3.1.6
load energy profile
electrical energy consumed over a specified period of time for a mesh or a group of meshes

3.1.7
electrical energy efficiency
EEE
system approach to optimize the efficiency of electrical energy use

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.

Note 2 to entry: “Energy efficiency” is considered to represent “Electrical energy efficiency” in this standard.

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

3.1.9
active electrical energy efficiency measures
measures for the optimization of electrical energy produced, supplied, flowing and consumed by an electrical installation for the best permanent functionally equivalent service

Note 1 to entry: In this context, the word “measure” is to be understood as “provision”.

3.1.10
passive electrical energy efficiency measures
measures for the choice of parameters of electrical equipment (type, location, etc.) in order to improve overall electrical energy efficiency of the electrical installation while not affecting initial construction parameters such as limiting air penetration, water penetration, and thermal insulation, and other parts of the structure of the building

Note 1 to entry: In this context, the word “measure” is to be understood as “provision”.

3.1.11
electrical energy efficiency profile
set of criteria defining the electrical energy efficiency of an electrical installation

3.1.12
electrical installation efficiency class
EIEC
combination of efficiency measures (EM) and energy efficiency performance levels (EEPL)

3.1.13
efficiency measures
EM
level of implementation of measures to improve energy efficiency of an electrical installation

3.1.14
energy efficiency performance level
EEPL
level of energy efficiency improvement attained by measures implemented for improving the energy efficiency of an electrical installation

3.1.15
energy efficiency parameter
influencing factor on the energy efficiency of the installation

3.2 Electrical energy management

3.2.1
installation monitoring and supervision system
set of coordinated devices for the purpose of controlling and supervising electrical parameters in an electrical distribution system

Note 1 to entry: Examples of devices are

– current sensors,
– voltage sensors,
– metering and monitoring devices,
– power quality instruments,
– supervision software tools.

3.2.2
electrical energy management system
EEMS
system comprising different equipment and devices in the installation for the purpose of energy efficiency management

3.2.3
rational use of energy
energy use by consumers in a manner best suited to the realization of economic objectives, taking into account technical, social, political, financial and environmental constraints

3.2.4
electrical energy management and efficiency
system approach to optimize the efficiency of energy used to perform a given service, activity or function and taking care of inputs from user needs, utilities needs and energy pricing, availability of local storage or production of electrical energy

3.2.5
load shedding
approach where the electrical loads are switched off for variable periods of time to optimize demand

3.3 Energy measurement

3.3.1
energy measurement
process of obtaining one or more values that can be attributed to a quantity of energy

3.3.2
metering
applying a device measuring energy or other consumption

3.3.3
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.

3.3.4
monitoring
continuing procedure for the collection and assessment of pertinent information, including measurements, for the purpose of determining the effectiveness of the plans and procedures

[SOURCE: IEC 60050-881:1983, 881-16-02 [3], modified – the words "for radiation protection" have been omitted]

3.3.5
evaluation
comparison of monitored results against targets

3.3.6
forecast
an estimate of the expected value of a parameter at a given future date

3.3.7
total harmonic distortion of the voltage wave
THDu
ratio of the r.m.s. value of the harmonic content of an alternating quantity (voltage) to the r.m.s. value of the fundamental component of the quantity (voltage)

3.3.8
total harmonic distortion of the current wave
THDi
ratio of the r.m.s. value of the harmonic content of an alternating quantity (current) to the r.m.s. value of the fundamental component of the quantity (current)

3.4 Sectors of activities

3.4.1
residential buildings (dwellings)
premises designed and constructed for private habitation

3.4.2
commercial buildings
premises designed and constructed for commercial operations

Note 1 to entry: Examples of commercial buildings are offices, retail, distribution, public buildings, banks, hotels.

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

Note 1 to entry: Examples of industrial buildings are factories, workshops, distribution centres.

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

Note 1 to entry: Examples of infrastructures are airport terminals, port facilities, transport facilities.

4 General

4.1 Fundamental principles

4.1.1 Safety of the electrical installation

The requirements and recommendations of this part of IEC 60364 shall not impair requirements included in other parts of the IEC 60364 series. The safety of persons, property and livestock remains of prime importance.

Active electrical energy efficiency measures shall not impair the passive energy efficiency measures of the building.

4.1.2 Availability of electrical energy and user decision

Energy efficiency management shall not reduce electrical availability and/or services or operation below the level desired by the user.

The user of the electrical installation shall be able to take the final decision over whether they accept or not to use a service at nominal value, or optimized value or not to use it for a certain time.

At any time the user shall be able to make an exemption and to use the service in accordance with his needs while being aware that this can be more costly than expected from the electrical energy point of view.

NOTE Examples are if someone is ill, the user may decide to heat the room at a higher temperature, even during peak consumption; if a company receives an urgent delivery order, the workshop may need to work at an unexpected hour.

4.1.3 Design requirements and recommendations

The design principles of this standard take into account the following aspects:

– load energy profile (active and passive);
– availability of local generation (solar, wind, generator, etc.);
– reduction of energy losses in the electrical installation;
– the arrangement of the circuits with regard to energy efficiency (meshes);
– the use of energy according to customer demand;
– the tariff structure offered by the supplier of the electrical energy;

without losing the quality of service and the performance of the electrical installation.

5 Sectors of activities

For a general approach to electrical energy efficiency, four sectors may be identified, each having particular characteristics requiring specific methodology of implementation of EEE:

– residential buildings (dwellings);
– commercial buildings;
– industrial buildings;
– infrastructure.

6 Design requirements and recommendations

6.1 General

This clause gives the design principles of the installation, taking into account:

– the load energy profile (active and passive);
– the minimization of energy losses in the electrical installation by means of
  • optimal location of the HV/LV substation, local energy production source and switchboard (barycentre),
  • reduction of losses in wiring.

6.2 Determination of load profile

The main load demands within the installation shall be determined. The loads in kVA, together with their durations of operation, and/or an estimate of the annual load consumption (in kWh) should be identified and listed.

6.3 Determination of the transformer and switchboard location with the barycentre method

Account shall be taken of the building's use, construction and space availability for the best position to be obtained, but this should be determined with the building's designers and owners prior to construction. To keep losses to a minimum, transformers and main distribution switchboards shall be located (where possible) in such a way as to keep distances to main loads to a minimum. The methods used for determining the position can be used to determine the optimal available site for the distribution equipment and transformers.

The barycentre method is one solution which identifies if the load distribution is uniform or of localized type and determines the total load barycentre location. See examples of calculations in Annex A.