

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Safety in electroheating installations –
Part 1: General requirements**

**Sécurité dans les installations électrothermiques –
Partie 1: Exigences générales**

<https://standards.iteh.ai/catalog/standards/sist/495741c-9d7f-4786-a158-47b83eeff0d/iec-60519-1-2010>



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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

V

ICS 25.180.10

ISBN 978-2-88912-264-6

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope and object	7
2 Normative references	8
3 Terms and definitions	9
4 Classification of electroheating equipment	15
4.1 General	15
4.2 Classification of electroheating equipment according to process frequency	15
4.2.1 Direct current equipment	15
4.2.2 Low-frequency equipment	16
4.2.3 Mains-frequency equipment	16
4.2.4 Medium-frequency equipment	16
4.2.5 High-frequency equipment	16
4.2.6 Microwave equipment	16
4.2.7 Infrared equipment	16
5 General requirements	16
5.1 General	16
5.2 Electroheating equipment	17
5.3 Electric equipment of electroheating installations	18
5.4 Electrostatic charges	19
5.5 Magnetic, electric and electromagnetic fields	19
5.6 Electromagnetic compatibility	19
5.7 Ionizing radiation	20
5.8 Liquid cooling	20
6 Isolation and switching	20
6.1 General	20
6.2 Switching-off of control and auxiliary circuits	21
6.3 Switching at high voltage levels	21
7 Connection to the electrical supply network and internal connections	21
7.1 General requirements	21
7.2 Fixed electric connection	22
7.3 Removable connection and flexible conductors	22
8 Protection against electric shock	22
8.1 General	22
8.2 Direct contact – special measures	23
8.3 Indirect contact – special measures	23
9 Equipotential bonding	23
9.1 General	23
9.2 Protective bonding circuits	23
9.2.1 General	23
9.2.2 Protective conductors	23
9.2.3 Continuity of the protective bonding system	23
9.2.4 Exclusion of switching devices from the protective bonding system	23
9.2.5 Parts that need not be connected to the protective bonding system	23
9.2.6 Interruption of the protective bonding system	24

9.2.7	Protective conductor connecting points	24
9.2.8	Protective bonding for electroheating installations with earth leakage current above 10 mA	24
9.3	Functional bonding	24
9.4	Prohibition of the use of earth as part of an active circuit	24
10	Control circuits and control functions	24
10.1	Control circuits	24
10.2	Earthing of control circuits	25
10.3	Control functions	25
10.3.1	General	25
10.3.2	Start and stop functions	26
10.3.3	Operating modes	26
10.3.4	Suspension of safety functions and/or protective measures	26
10.3.5	Emergency operations	26
10.3.6	Cableless control	26
10.4	Control functions in the event of failure	26
11	Protection against thermal influences	26
12	Protection against other hazards	27
13	Marking, labelling and technical documentation	27
13.1	Marking	27
13.2	Warning marking	28
13.3	Labelling	28
13.4	Technical documentation	28
14	Commissioning, inspection, operation and maintenance	28
14.1	General requirements	28
14.2	Commissioning and inspection	29
14.3	Safety instructions for operation	29
14.4	Instructions for maintenance work	29
Annex A (normative)	Protection against electric shock – special measures	31
Bibliography	32

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY IN ELECTROHEATING INSTALLATIONS –**Part 1: General requirements**

FOREWORD

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International Standard IEC 60519-1 has been prepared by IEC technical committee 27: Industrial electroheating.

This fourth edition cancels and replaces the third edition published in 2003. It constitutes a technical revision.

The main technical changes with respect to the previous edition are as follows:

- scope and object have been modified, voltage limits and classification removed;
- terms/definitions, normative references and bibliography have been updated and completed;
- Clause 4 on classification of equipment according to process frequency has been modified;
- Clause 5 (*General requirements*) has been redrafted and new provisions have been added (e.g. relating to single fault conditions and EMF issues), following the recommendations of IEC Guide 104;

- Clause 8 has been redrafted, the contents of subclauses 8.2 and 8.3 has been moved to a new normative Annex A and 8.4 has been deleted;
- a new Clause 12 (*Protection against other hazards*) has been added;
- clauses dealing with marking and documentation have been amended.

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

FDIS	Report on voting
27/770/FDIS	27/778/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.

The French version of this standard has not been voted upon.

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

A list of all parts of IEC 60519 series, under the general title *Safety in electroheating installations*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of a new edition.

The clauses of parts of the IEC 60519 series (hereinafter called Particular Requirements) supplement or modify the corresponding clauses of Part 1. Where the text of subsequent parts indicates an "addition" to or a "replacement" of the relevant provision of Part 1, these changes are made to the relevant text of Part 1. Where no change is necessary, the words "This clause of Part 1 is applicable" are used. Additional specific provisions to those in Part 1 are given in the Particular Requirements as additional clauses, subclauses or Annexes.

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.

The contents of the corrigendum of November 2012 have been included in this copy.

INTRODUCTION

International Standard IEC 60519 *Safety in electroheating installations* consists of several parts. Part 1 comprises clauses of a general character and provisions common to various types of industrial electroheating installations or equipment. Subsequent parts of the IEC 60519 series (hereinafter called Particular Requirements) contain specific provisions for particular types of electroheating installations or equipment.

- Part 1: *General requirements*
- Part 2: *Particular requirements for resistance heating equipment*
- Part 3: *Particular requirements for induction and conduction heating and induction melting installations*
- Part 4: *Particular requirements for arc furnace installations*
- Part 5: *Specifications for safety in plasma installations*
- Part 6: *Specifications for safety in industrial microwave heating equipment*
- Part 7: *Particular requirements for installations with electron guns*
- Part 8: *Particular requirements for electroslag remelting furnaces*
- Part 9: *Particular requirements for high-frequency dielectric heating installations*
- Part 10: *Particular requirements for electrical resistance trace heating systems for industrial and commercial applications*
- Part 11: *Particular requirements for installations using the effect of electromagnetic forces on liquid metals*
- Part 21: *Particular requirements for resistance heating equipment – Heating and melting glass equipment*

NOTE Additional parts covering particular industrial electroheating installations or equipment may be prepared in the future.

<https://standards.iec.org/standards/info/95741e-9d7f4786-a158-47B83ceff0d/iec-60519-1-2010>

SAFETY IN ELECTROHEATING INSTALLATIONS –

Part 1: General requirements

1 Scope and object

This part of IEC 60519 specifies the general safety requirements applicable to industrial electroheating installations.

In case these requirements differ from those of other IEC publications, an equivalent degree of safety is ensured.

The requirements apply to industrial installations, intended for electroheating and electroheat based treatment technologies, with the possible use of the following equipment:

- equipment for direct and indirect resistance heating;
- equipment for electric resistance trace heating;
- equipment for induction heating;
- equipment using the effect of EM forces on liquid metals;
- equipment for arc heating, including submerged arc heating;
- equipment for electroslag remelting;
- equipment for plasma heating;
- equipment for microwave heating;
- equipment for dielectric heating;
- equipment for electron beam heating;
- equipment for laser heating;
- equipment for infrared radiation heating.

NOTE 1 The list presents typical examples of equipment used in installations covered by this standard and is not exhaustive.

This standard is not applicable for heating appliances for household (e.g. electric cooking), laboratory or medical applications or for welding equipment, if covered by other particular standards, nor does it apply to any kind of space heating.

This standard refers to normal operation of industrial electroheating installations. It is intended to ensure the safety of persons also in the case of abnormal operation and when faults occur in electroheating installations. This standard presumes that the installations are operated and maintained only by personnel consisting of instructed or skilled persons, respectively.

The object of this standard is to specify the general safety requirements for electroheating installations. These safety requirements concern the protection of persons and the environment against dangers of electrical origin and also against certain dangers of non-electrical origin, common to all types of equipment and installations.

Certain clauses of this standard concern not only safety of personnel but also protection of the environment.

The overall safety requirements result from the joint application of the general requirements specified in this standard and Particular Requirements concerning the specific industrial

application of electroheat. These Particular Requirements supplement, modify or replace the general requirements.

The Particular Requirements cover particular safety relevant features such as high voltages and electric fields or high currents and magnetic fields, also with respect to the frequencies.

NOTE 2 Information on non-electrical hazards possibly arising from the utilization of industrial electroheating equipment may also be taken from European Standard EN 746-1 (see Bibliography), which specifies common safety requirements for industrial thermoprocessing equipment.

General test methods for industrial electroheating installations are specified in IEC 60398.

2 Normative references

The following referenced documents are indispensable for the application 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 60050-841:2004, *International Electrotechnical Vocabulary – Part 841: Industrial electroheat*

IEC 60071-1, *Insulation co-ordination – Part 1: Definitions, principles and rules*

IEC 60110-1:1998, *Power capacitors for induction heating installations – Part 1: General*

IEC 60204-1:2005¹, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

Amendment 1 (2008)

IEC 60204-11, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*

IEC 60364-1:2005, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-42, *Low-voltage electrical installations – Part 4-42: Protection for safety – Protection against thermal effects*

IEC 60364-4-43, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-53, *Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control*

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements, protective conductors and protective bonding conductors*

¹ There is a consolidated edition 5.1 (2009) that includes IEC 60204-1 (2005) and its amendment 1 (2008).

IEC 60417, *Graphical symbols for use on equipment*

IEC 60446, *Basic and safety principles for man-machine interface, marking and identification – Identification of conductors by colours or alphanumerics*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61936-1, *Power installations exceeding 1 kV a.c. – Part 1: Common rules*

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs in workplaces and public areas*

ISO 7000, *Graphical symbols for use on equipment – Index and synopsis*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-841:2004 and the following apply.

NOTE 1 Unless otherwise stated, the terms "voltage" and "current" apply to the r.m.s. values in the case of a.c.

NOTE 2 The electrical terms and quantities associated with the word "rated" refer to the electroheating equipment itself, unless otherwise stated. The terms "rated voltage", "rated current" or "rated power" refer to the voltage (in the case of a three-phase system, the voltage between phases), the current or the power specified by the manufacturer and marked on the electroheating equipment.

3.1

direct contact

electric contact of persons or animals with live parts

[IEC 60050-195:1998, 195-06-03]

3.2

earthing conductor

grounding conductor (US)

earth conductor (deprecated)

conductor which provides a conductive path, or part of the conductive path, between a given point in a system or in an installation or in equipment and an earth electrode

[IEC 60050-195:1998, 195-02-03]

3.3

earth leakage current

current flowing from the live parts of the installation to earth, in the absence of an insulation fault

[IEC 60050-442: 1998, 442-01-24]

3.4

electric connection

means or actual condition that allows or ensures the passage of electric current between two conductive parts

3.5

electric equipment

item used for such purposes as generation, conversion, transmission, distribution or utilization of electric energy, such as converters, transformers, capacitors, switchgear and controlgear, measuring instruments, protective devices and wiring systems

[IEC 60050-826:2004, 826-16-01, modified]

3.6

electrical installation

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

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

3.7

(electrically) instructed person

person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards which electroheating installations can create (operating and maintenance staff)

[IEC 60050-826:2004, 826-18-02, modified]

3.8

(electrically) skilled person

person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electroheating installations can create

[IEC 60050-826:2004, 826-18-01, modified]

3.9

electroheat

branch of science and technology dealing with the conversion of electric energy into thermal energy for useful purposes

[IEC 60050-841:2004, 841-21-22, modified]

3.10

electroheating equipment

electroheat equipment

equipment in which electric energy is converted into thermal energy for useful purposes

NOTE The term covers also equipment using the effect of electromagnetic forces on liquid metals.

[IEC 60050-841:2004, 841-22-01, modified]

3.11

electroheating installation

electroheat installation

installation composed of electroheating equipment, electric equipment and mechanical accessories needed for its operation and use

[IEC 60050-841:2004, 841-22-02, modified]

3.12**emergency switching-off**

operation intended to switch-off any electric power from an electrical installation to avert or alleviate a hazardous situation

[IEC 60050-826:2004, 826-17-03, modified]

3.13**enclosure**

housing affording the type and degree of protection suitable for the intended application

[IEC 60050-195:1998, 195-02-35]

NOTE For the classification of degrees of protection provided by enclosures (IP Code), see IEC 60529.

3.14**equipotential bonding**

provision of electric connections between conductive parts, intended to put them at a substantially equal potential

[IEC 60050-195:1998, 195-01-10, modified]

3.15**equipotential bonding system****EBS**

interconnection of conductive parts providing equipotential bonding between those parts

NOTE If an equipotential bonding system is earthed, it forms part of an earthing arrangement.

[IEC 60050-195:1998, 195-02-22]

3.16**exposed conductive part**

conductive part of electrical equipment, which can be touched and which is not live in normal operation, but which can become live under fault conditions

[IEC 60050-826:2004, 826-12-10, modified]

3.17**extraneous conductive part**

conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth

[IEC 60050-826:2004, 826-12-11]

3.18**failure**

termination of the ability of an item to perform a required function

NOTE 1 After a failure the item has a fault.

NOTE 2 "Failure" is an event, as distinguished from "fault", which is a state.

NOTE 3 This concept as defined does not apply to items consisting of software only.

NOTE 4 In practice, the terms fault and failure are often used synonymously.

[IEC 60204-1:2005, 3.25]

3.19

fault

state of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

NOTE 1 A fault is often the result of a failure of the item itself, but may exist without prior failure.

NOTE 2 In English, the term "fault" and its definition are identical with those given in IEC 191-05-01. In the field of machinery, the French term "défaut" and the German term "Fehler" are used rather than the terms "panne" and "Fehlzustand" that appear with this definition.

[IEC 60204-1:2005, 3.26]

3.20

fixed electric connection

electric connection requiring the use of a tool for mounting and dismantling purposes

NOTE In all other cases, the connection is removable.

3.21

functional bonding

equipotential bonding necessary for proper functioning of electrical equipment

[IEC 60204-1:2005, 3.27]

3.22

functional switching

operation intended to switch on or off or vary the supply of electric energy to an electrical installation or parts of it for normal operating purposes

[IEC 60050-826:2004, 826-17-05]

3.23

harm

physical injury or damage to the health of people, or damage to property or the environment

[ISO/IEC Guide 51:1999, 3.3]

3.24

hazard

potential source of harm

NOTE The term hazard can be qualified in order to define its origin (e.g. electrical hazard, mechanical hazard) or the nature of the potential harm (e.g. electric shock hazard, cutting hazard, toxic hazard, fire hazard).

[ISO/IEC Guide 51:1999, 3.5, modified]

3.25

indirect contact

electric contact of persons or animals with exposed-conductive parts which have become live under fault conditions

[IEC 60050-195:1998, 195-06-04]

3.26

input frequency

frequency of the supply voltage to the electroheating installation

**3.27
insulation**

all the insulating materials necessary to ensure the proper operation of the equipment and protection against electric shock

NOTE 1 It refers also to the action of insulating.

NOTE 2 Under certain circumstances, the heat insulation materials employed for electroheating equipment may equally perform the function of the electrical insulation.

**3.28
isolation**

function intended to make dead for reasons of safety all or a discrete section of the electrical installation by separating the electrical installation or section from every source of electric energy

[IEC 60050-826:2004, 826-17-01]

**3.29
leakage current
earth current (deprecated)**

electric current in an unwanted conductive path under normal operating conditions

[IEC 60050-195:1998, 195-05-15]

**3.30
live part**

conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

NOTE This concept does not necessarily imply a risk of electric shock.

[IEC 60050-195:1998, 195-02-19]

**3.31
manufacturer**

maker of the electroheating equipment or installation (who may also be the supplier, importer or agent) responsible for compliance with this standard

NOTE From the perspective of the user, the manufacturer is a party responsible for the design, development, manufacture, supply and commissioning of the equipment or installation.

**3.32
normal operation**

operation of the electroheating installation or equipment specified by the manufacturer and agreed with the user

**3.33
PEL conductor**

conductor combining the functions of both a protective earthing conductor and a line conductor

[IEC 60050-195:1998, 195-02-14]

**3.34
PEM conductor**

conductor combining the functions of both a protective earthing conductor and a mid-point conductor

[IEC 60050-195:1998, 195-02-13]