IEC 62135-1

Edition 2.0 2015-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Resistance welding equipment –
Part 1: Safety requirements for design, manufacture and installation

Matériels de soudage par résistance –
Partie 1: Exigences de sécurité pour la conception, la fabrication et l'installation

IEC 62135-1:2015-05(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

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms, containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue
Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,…). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org
Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary
65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 62135-1

Edition 2.0 2015-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Resistance welding equipment –
Part 1: Safety requirements for design, manufacture and installation

Matériels de soudage par résistance –
Partie 1: Exigences de sécurité pour la conception, la fabrication et l'installation

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.160

ISBN 978-2-8322-3084-8

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

RESISTANCE WELDING EQUIPMENT –

Part 1: Safety requirements for design, manufacture and installation

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.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62135-1 has been prepared by IEC technical committee 26: Electric welding.

This second edition cancels and replaces the first edition published in 2008. This edition constitutes a technical revision.

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

– creepage distances for pollution degree 4 are no longer valid (see Table 2);
– insulation requirements for Class II equipment are defined (see Table 3);
– dielectric test voltage interpolation restriction lower limit is changed to 220 V and interpolation for control and welding circuit is clarified (see Table 4);
– maximum temperature for insulation systems are reviewed in accordance with current edition of IEC 60085 (see Table 7);

– marking of terminals is defined (see 10.3);
– table for nominal voltages of supply networks is changed adopting Table B.2 of IEC 60664-1:2007 in place of the Table B.1 values referenced in the previous edition to provide for equipment to be connected to both earthed and unearthed systems. The change impacts the creepage and clearance distance requirements for some supply voltage ratings (see Annex A);
– touch current in fault condition are measurement procedures are clarified (see 6.4.4 and Annex C).
– welding circuit touch current is defined (see 6.2.6);
– touch current in normal condition are clarified and moved in protection against electric shock in normal service (see 6.3.7);
– heating test conditions are clarified (see 7.1.1);
– external surface temperature rise limitation is changed (see 7.3.2).

This bilingual version (2016-01) corresponds to the monolingual English version, published in 2015-05.

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

FDIS	Report on voting
26/558/FDIS	26/570/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.

The list of all the parts of the IEC 62135 series, under the general title *Resistance welding equipment,* 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 website 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 February 2016 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.

RESISTANCE WELDING EQUIPMENT –

Part 1: Safety requirements for design, manufacture and installation

1 Scope

This part of IEC 62135 applies to equipment for resistance welding and allied processes and includes single and multiple welding stations which may be manually or automatically loaded and/or started.

This part of IEC 62135 covers stationary and portable equipment.

This part of IEC 62135 specifies electrical safety requirements for design, manufacture and installation. It does not cover all non-electrical safety requirements (e.g. noise, vibration).

This part of IEC 62135 does not include electromagnetic compatibility (EMC) requirements, which are included in IEC 62135-2.

To comply with this standard, all safety risks involved in loading, feeding, operating and unloading the equipment, where applicable, should be assessed and the requirements of related standards should be observed.

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 60204-1:2005, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-6, *Low-voltage electrical installations – Part 6: Verification*

IEC 60417-DB:2011[1], *Graphical symbols for use on equipment*

IEC 60445, *Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors*

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

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

---

1 "DB" refers to the IEC on-line database.

IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

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

ISO 669, *Resistance welding – Resistance welding equipment – Mechanical and electrical requirements*

ISO 13849-1, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 669, IEC 60664-1 and IEC 60204-1, as well as the following, apply.

3.1
equipment for resistance welding and allied processes
equipment associated with carrying out the processes of resistance welding or allied processes consisting of, for example, power source, electrodes, tooling and associated control equipment

Note 1 to entry: It may be a separate unit or part of a complex machine.

Note 2 to entry: The term "resistance welding equipment" is used in the following text.

3.2
processes allied to resistance welding
processes carried out on machines comparable to resistance welding equipment considered as allied to resistance welding, for example, resistance brazing, soldering or heating

3.3
type test
test of one or more devices made to a given design, to check if these devices comply with the requirements of the standard concerned

[SOURCE: IEC 60050-851:2008, 851-12-05]

3.4
routine test
test made on each individual device during or after manufacture to check if it complies with the requirements of the standard concerned or the criteria specified

[SOURCE: IEC 60050-851:2008, 851-12-06]

3.5
welding circuit
conductive material through which the welding current is intended to flow

3.6
control circuit
circuit for the operational control of welding equipment, and/or for protection of the power circuits

3.7
conventional value
standardized value that is used as a measure of a parameter for the purposes of comparison, calibration, testing, etc.

Note 1 to entry: Conventional values do not necessarily apply during the actual welding process.

3.8
rated value
value assigned, generally by the manufacturer, for a specified operating condition of a component, device or equipment

3.9
rating
set of rated values and operating conditions

3.10
hand-held equipment
resistance welding equipment with built-in or external transformer, which is intended to be held in the hand during use, suspended or not

3.11
portable equipment
resistance welding equipment that is connected to the mains supply by means of a plug.

3.12
stationary equipment
resistance welding equipment permanently connected to the mains supply

3.13
material group
materials are separated into four groups by their comparative tracking index (CTI) values

Note 1 to entry: The groups are as follows:

Material group I	600	≤	CTI		
Material group II	400	≤	CTI	<	600
Material group IIIa	175	≤	CTI	<	400
Material group IIIb	100	≤	CTI	<	175

The CTI values above refer to values in accordance with IEC 60112.

Note 2 to entry: For inorganic insulating materials, for example, glass or ceramics, which do not track, creepage distances need not be greater than their associated clearance for the purpose of insulation coordination.

3.14
thermal equilibrium
state reached when the observed temperature rise of any part of the welding equipment does not exceed 2 K/h

3.15
thermal protection
system intended to ensure the protection of all or part of the welding equipment against excessive temperatures resulting from certain conditions of thermal overload

Note 1 to entry: It is capable of being reset (either manually or automatically) when the temperature falls to the reset value.

3.16
supply circuit
input circuit
conductive material of the power source through which the supply current is intended to flow

3.17
general visual inspection
inspection by eye to verify that there are no apparent discrepancies with respect to provisions of the standard concerned

3.18
working voltage
highest r.m.s. value of the a.c. or d.c. voltage across any particular insulation which can occur when the equipment is supplied at rated voltage

Note 1 to entry: Transients are disregarded.

Note 2 to entry: Both open-circuit conditions and normal operating conditions are taken into account.

4 Environmental conditions

Resistance welding equipment intended for indoor use and complying with this standard shall be safe to operate when the following environmental conditions prevail:

a) range of ambient air temperature:
   during operation: 5 °C to 40 °C;
b) relative humidity of the air:
   up to 50 % at 40 °C;
   up to 90 % at 20 °C;
c) ambient air, free from abnormal amounts of dust, acids, corrosive gases or substances etc. other than those generated by the welding process.
d) altitude above sea-level up to 1 000 m;
e) temperature of the cooling medium does not exceed:
   1) in the case of a liquid: 30 °C at the inlet;
   2) in the case of the ambient air: 40 °C.

NOTE Different environmental conditions can be agreed upon between the manufacturer and the purchaser and the resulting welding equipment is marked accordingly. Examples of these conditions are: outdoor use, different altitude, different temperature of cooling medium, high humidity, unusually corrosive fumes, steam, excessive oil vapour, abnormal vibration or shock, excessive dust, unusual sea coast or shipboard conditions.

5 Tests

5.1 Test condition

The tests shall be carried out on new, dry and completely assembled resistance welding equipment at an ambient air temperature between 10 °C and 40 °C. It is recommended that the thermal tests be carried out at 40 °C. Liquid-cooled resistance welding equipment shall be tested with liquid conditions as specified by the manufacturer.

5.2 Measuring instruments

The accuracy of measuring instruments shall be as follows.

a) electrical measuring instruments: class 1 (±1 % of full-scale reading), except for the measurement of insulation resistance and dielectric strength where the accuracy of the instruments is not specified, but shall be taken into account for the measurement;

b) instruments for measuring welding current: class 5;

c) temperature measuring instruments: ±2 K.

5.3 Type tests

Unless otherwise specified, the tests in this standard are type tests.

The resistance welding equipment shall be tested with all ancillary equipment fitted that could affect the test results.

All type tests shall be carried out on the same resistance welding equipment except where it is specified that a test may be carried out on another resistance welding equipment.

As a condition of conformity, the type tests given below shall be carried out in the following sequence:

a) general visual inspection, see 3.17;

b) insulation resistance, see 6.2.4 (preliminary check);

c) protection provided by the enclosure, see 6.3.3;

d) insulation resistance, see 6.2.4;

e) dielectric strength, see 6.2.5;

f) general visual inspection, see 3.17.

The other tests included in this standard and not listed here may be carried out in any convenient sequence.

5.4 Routine tests

All routine tests shall be carried out on each resistance welding equipment. The following sequence is recommended:

a) general visual inspection, see 3.17;

b) continuity of the protective circuit, see 6.4.7;

c) dielectric strength, see 6.2.5;

d) no-load voltage, see 6.3.2;

e) test to ensure rated minimum and maximum output values in accordance with ISO 669;

f) general visual inspection, see 3.17.

6 Protection against electric shock

6.1 General

Hazardous-live-parts shall not be accessible and accessible conductive parts shall not be hazardous live

– either under normal conditions (operation in intended use, and absence of a fault); or

– under single-fault conditions.

The requirements for provisions for normal conditions protection are given in 6.3.

The requirements for provisions for fault condition protection are given in 6.4.

6.2 Insulation

6.2.1 General

The majority of resistance welding equipment falls within overvoltage category III in accordance with IEC 60664-1. All resistance welding equipments shall be designed for use in environmental conditions of pollution degree 3 as a minimum.

Design of liquid cooled equipment shall consider possible condensation which may require different conditions.

Components or subassemblies with clearances or creepage distances corresponding to pollution degree 2 are permitted, if they are completely coated, potted or moulded in accordance with IEC 60664-3.

An equipment designed with insulation based on line-to-neutral voltage values shall be provided with a caution that such equipment shall only be used on a supply system that is either a three-phase, four-wire system with an earthed neutral or a single-phase, three-wire, system with an earthed neutral.

6.2.2 Clearances

For basic insulation or supplementary and reinforced insulation, minimum clearances shall be in accordance with IEC 60664-1, as partially summarized in Table 1 for overvoltage category III.

Table 1 – Minimum clearances for overvoltage category III

Voltage[a]	Basic or supplementary insulation					Reinforced insulation				
	Rated impulse test voltage	AC test voltage	Pollution degree			Rated impulse test voltage	AC test voltage	Pollution degree		
			2	3	4			2	3	4
			Clearance					Clearance		
V r.m.s.	Peak V	V r.m.s.	mm			Peak V	V r.m.s.	mm		
50	800	566	0,2	0,8	1,6	1 500	1 061	0,5	0,8	1,6
100	1 500	1 061	0,5			2 500	1 768	1,5		
150	2 500	1 768	1,5			4 000	2 828	3		
300	4 000	2 828	3			6 000	4 243	5,5		
600	6 000	4 243	5,5			8 000	5 657	8		
1 000	8 000	5 657	8			12 000	8 485	14		
NOTE 1 Values taken from Tables F.1 and F.2 of IEC 60664-1:2007. NOTE 2 For other pollution degrees and overvoltage categories, see IEC 60664-1.										
[a] See Annex A for voltage value.										

For dimensioning clearances to accessible non-conductive surfaces, such surfaces shall be considered to be covered by metal foil wherever they can be touched by the standard test finger in accordance with IEC 60529.

Clearances shall not be interpolated.

For supply circuit terminals, see Annex B.