

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**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 62135-1:2008

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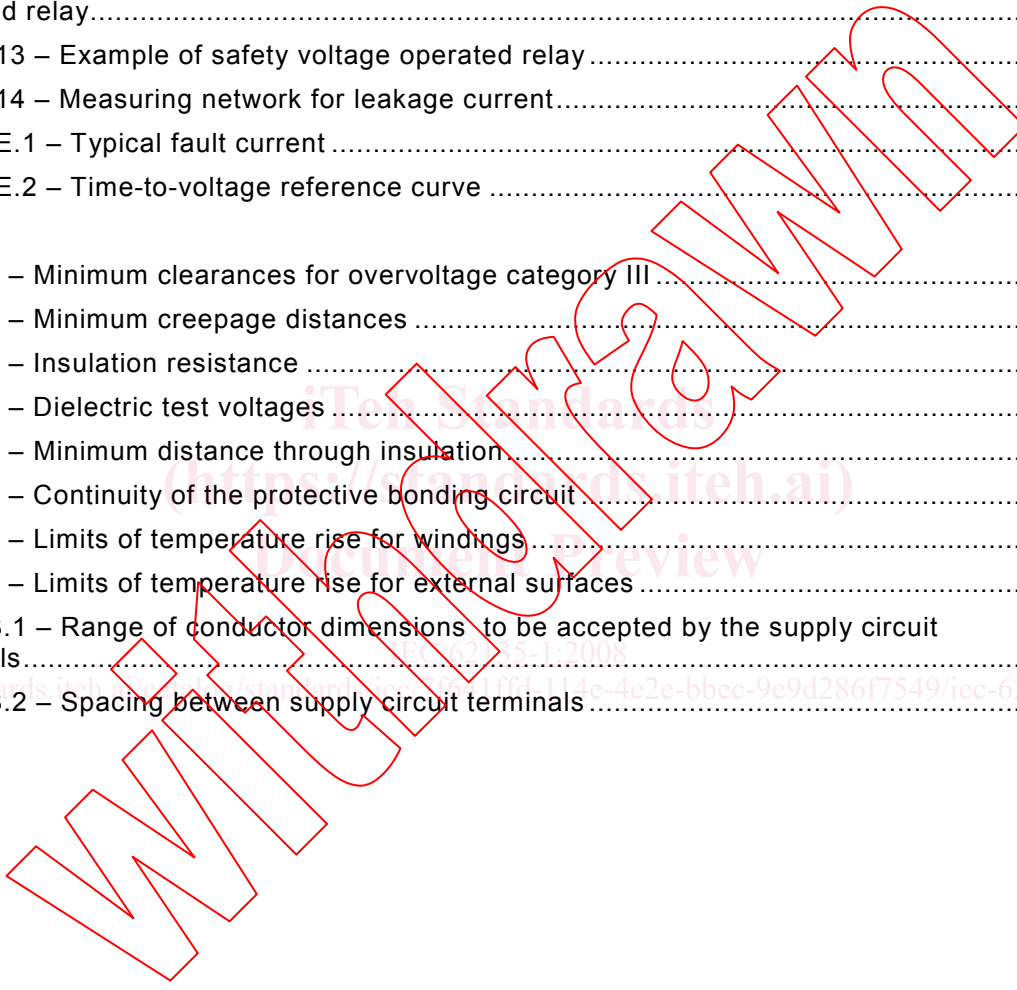
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CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Terms and definitions.....	8
4 Environmental conditions.....	10
5 Tests	10
5.1 Test conditions	10
5.2 Measuring instruments	10
5.3 Type tests	11
5.4 Routine tests	11
6 Protection against electric shock	11
6.1 General	11
6.2 Insulation	12
6.2.1 General	12
6.2.2 Clearances	12
6.2.3 Creepage distances.....	13
6.2.4 Insulation resistance.....	14
6.2.5 Dielectric strength	15
6.2.6 Liquid cooling	16
6.3 Protection against electric shock in normal service (direct contact)	16
6.3.1 General	16
6.3.2 Rated no-load voltage at the output.....	17
6.3.3 Protection provided by barriers or the enclosure.....	17
6.3.4 Capacitors.....	17
6.3.5 Automatic discharge of input capacitors.....	18
6.3.6 Protective conductor current under normal operation.....	18
6.4 Protection against electric shock in case of a fault condition (indirect contact)	19
6.4.1 General.....	19
6.4.2 Protective provisions for welding circuit.....	21
6.4.3 Internal conductors and connections.....	33
6.4.4 Touch current in fault condition.....	33
6.4.5 DC resistance welding equipment operating at mains frequency.....	34
6.4.6 DC resistance welding equipment operating at medium frequency.....	34
6.4.7 Continuity of the protective bonding circuit	35
6.5 Additional user requirements	35
6.6 Supply voltage.....	35
6.7 Conductors of the welding circuit.....	35
7 Thermal requirements.....	35
7.1 Heating test.....	36
7.1.1 Test conditions	36
7.1.2 Tolerances of the test parameters	36
7.1.3 Beginning of the heating test	36
7.1.4 Duration of the test.....	37
7.2 Temperature measurement.....	37
7.2.1 Measurements conditions	37
7.2.2 Surface temperature sensor	37

7.2.3	Resistance	37
7.2.4	Embedded temperature sensor	38
7.2.5	Determination of the ambient temperature (t_a)	38
7.2.6	Determination of cooling liquid temperature (t_a)	38
7.2.7	Recording of temperatures	38
7.3	Limits of temperature rise	38
7.3.1	Windings	38
7.3.2	External surfaces	39
7.3.3	Other components	40
8	Abnormal operation	40
8.1	General requirements	40
8.2	Stalled fan test	40
8.3	Cooling system failure	40
8.4	Overload test	41
9	Provisions against mechanical hazards	41
9.1	General	41
9.2	Risk analysis	41
9.2.1	General	41
9.2.2	Ready to use equipment as in delivery state	41
9.2.3	Equipment not ready to use as in delivery state	41
9.2.4	Equipment not ready to use and designed to be incorporated in a more complex equipment	42
9.3	Measures	42
9.3.1	Minimum measures	42
9.3.2	Additional measures	42
9.4	Conformity of components	43
9.5	Starting for manual operated equipment	43
10	Instructions and markings	44
10.1	Instructions	44
10.2	Markings	44
Annex A (informative)	Nominal voltages of supply networks	45
Annex B (normative)	Construction of supply circuit terminals	46
Annex C (informative)	Extrapolation of temperature to time of shutdown	48
Annex D (informative)	Example of risk analysis and safety level requirement	49
Annex E (informative)	Indirect contact protection in resistance welding equipment	53
Bibliography	60
Figure 1	– Measurement of leakage current	22
Figure 2	– Example of metal screen between windings of the supply circuit and the welding circuit	23
Figure 3	– Example of protective conductor connected directly to the welding circuit (single-spot, a.c. current equipment)	24
Figure 4	– Example of protective conductor connected directly to welding circuits (multi-spot, a.c. current equipment)	24
Figure 5	– Example of protective conductor connected direct to welding circuits (medium-frequency equipment)	25
Figure 6	– Example of protective conductor connected to welding circuits through impedances	26

Figure 7 – Example of protective conductor connected to welding circuits through auto-inductances	27
Figure 8 – Example of protective conductor connected to welding circuits through auto-inductances	27
Figure 9 – Example of current operated residual current device (a.c. current equipment)	28
Figure 10 – Example of current operated residual current device (medium-frequency equipment)	29
Figure 11 – Example of current operated residual current device and voltage relay	30
Figure 12 – Example of current operated residual current device and safety voltage operated relay.....	31
Figure 13 – Example of safety voltage operated relay	32
Figure 14 – Measuring network for leakage current.....	34
Figure E.1 – Typical fault current	57
Figure E.2 – Time-to-voltage reference curve	59
Table 1 – Minimum clearances for overvoltage category III	12
Table 2 – Minimum creepage distances	14
Table 3 – Insulation resistance	15
Table 4 – Dielectric test voltages	15
Table 5 – Minimum distance through insulation.....	21
Table 6 – Continuity of the protective bonding circuit.....	35
Table 7 – Limits of temperature rise for windings.....	39
Table 8 – Limits of temperature rise for external surfaces	39
Table B.1 – Range of conductor dimensions to be accepted by the supply circuit terminals.....	46
Table B.2 – Spacing between supply circuit terminals.....	47



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RESISTANCE WELDING EQUIPMENT –**Part 1: Safety requirements for design,
manufacture and installation**

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

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

FDIS	Report on voting
26/377/FDIS	26/383/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.

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 maintenance result 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

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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 standard covers stationary and portable equipment.

It specifies safety requirements for design, manufacture and installation.

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 normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 62135. 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, *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 60439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies*

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*

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 5828, *Resistance welding equipment – Secondary connecting cables with terminals connected to water-cooled lugs – Dimensions and characteristics*

ISO 8205-1, *Water-cooled secondary connection cables for resistance welding – Part 1: Dimensions and requirements for double-conductor connection cables*

ISO 8205-2, *Water-cooled secondary connection cables for resistance welding – Part 2: Dimensions and requirements for single-conductor connection cables*

ISO 12100-1, *Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology*

ISO 12100-2, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles*

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

ISO 14121-1, *Safety of machinery – Risk assessment – Part 1: Principles*

3 Terms and definitions

For the purposes of this document, the following terms and definitions, together with those given in ISO 669, IEC 60664-1 and IEC 60204-1, 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 It may be a separate unit or part of a complex machine.

NOTE 2 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

[IEV 851-02-09]

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

[IEV 851-02-10]

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 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, 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 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 It is capable of being reset (either manually or automatically) when the temperature falls to the reset value.

3.16

supply 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 Transients are disregarded.

NOTE 2 Both open-circuit conditions and normal operating conditions are taken into account.

4 Environmental conditions

Resistance welding equipment complying with this standard shall be safe to operate under the following service conditions.

- a) At an ambient air temperature from 5 °C to 40 °C at a relative humidity of
- up to 50 % at 40 °C;
 - up to 90 % at 20 °C.

The ambient air shall be free from excessive amounts of dust, acids, corrosive gases or substances etc. other than those generated by the welding process. These environmental conditions apply to equipment intended for indoor use only.

- b) The 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.
- c) The altitude above sea-level does not exceed 1 000 m.

NOTE Different environmental conditions may be agreed upon between the manufacturer and the purchaser and the resulting welding equipment so marked. 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 0,5 ($\pm 0,5$ % 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.

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 ¹ V r.m.s.	Basic or supplementary insulation			Reinforced insulation						
	Rated impulse test voltage Peak V	AC test voltage V r.m.s.	Pollution degree			Rated impulse test voltage Peak V	AC test voltage V r.m.s.	Pollution degree		
			2	3	4			2	3	4
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.

NOTE 2 For other pollution degrees and overvoltage categories, see IEC 60664-1.

¹ 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.

Clearances between parts of resistance welding equipment (for example, circuits or components) which are protected by an overvoltage limiting device (for example, oxide varistor) may be rated in accordance with overvoltage category I (see IEC 60664-1).