



IEC 62135-1

Edition 2.0 2015-05

INTERNATIONAL STANDARD



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

IEC 62135-1 Ed. 2.0 - Preview only Copy via ILNAS e-Shop

IEC 62135-1:2015-05(en)





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2015 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
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 It also gives information on projects, replaced and withdrawn publications.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 more than 30 000 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

More than 60 000 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.



IEC 62135-1

Edition 2.0 2015-05

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.160

ISBN 978-2-8322-2664-3

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	6
1 Scope	8
2 Normative references	8
3 Terms and definitions	9
4 Environmental conditions	11
5 Tests	11
5.1 Test condition	11
5.2 Measuring instruments	11
5.3 Type tests	12
5.4 Routine tests	12
6 Protection against electric shock	12
6.1 General	12
6.2 Insulation	13
6.2.1 General	13
6.2.2 Clearances	13
6.2.3 Creepage distances	14
6.2.4 Insulation resistance	16
6.2.5 Dielectric strength	16
6.2.6 Welding circuit touch current	18
6.2.7 Liquid cooling	18
6.3 Protection against electric shock in normal service (direct contact)	19
6.3.1 General	19
6.3.2 Rated no-load voltage at the output	19
6.3.3 Protection provided by barriers or the enclosure	20
6.3.4 Capacitors	21
6.3.5 Automatic discharge of input capacitors	21
6.3.6 Protective conductor current under normal condition	22
6.3.7 Touch current in normal condition	22
6.4 Protection against electric shock in case of a fault condition (indirect contact)	22
6.4.1 General	22
6.4.2 Protective provisions for welding circuit	24
6.4.3 Internal conductors and connections	36
6.4.4 Touch current in fault condition	36
6.4.5 DC resistance welding equipment operating at mains frequency	37
6.4.6 DC resistance welding equipment operating at medium frequency	37
6.4.7 Continuity of the protective bonding circuit	37
6.5 Additional user requirements	38
6.6 Supply voltage	38
6.7 Conductors of the welding circuit	38
7 Thermal requirements	38
7.1 Heating test	38
7.1.1 Test conditions	38
7.1.2 Tolerances of the test parameters	39
7.1.3 Beginning of the heating test	40
7.1.4 Duration of the test	40

7.2	Temperature measurement	40
7.2.1	Measurements conditions	40
7.2.2	Surface temperature sensor.....	40
7.2.3	Resistance	40
7.2.4	Embedded temperature sensor	41
7.2.5	Determination of the ambient temperature (t_a).....	41
7.2.6	Determination of cooling liquid temperature (t_a).....	41
7.2.7	Recording of temperatures	41
7.3	Limits of temperature rise	42
7.3.1	Windings	42
7.3.2	External surfaces.....	42
7.3.3	Other components	44
7.4	Protection from thermal hazards in normal service (direct contact).....	44
7.4.1	General	44
7.4.2	Identification of hot surfaces.....	44
7.4.3	Protection provided by insulation or other barriers	45
7.4.4	Protection provided by supplemental cooling	45
8	Abnormal operation	45
8.1	General requirements	45
8.2	Stalled fan test.....	45
8.3	Cooling system failure.....	45
8.4	Overload test	46
9	Provisions against mechanical hazards	46
9.1	General.....	46
9.2	Risk analysis.....	46
9.2.1	General	46
9.2.2	Ready-to-use equipment as in delivery state.....	46
9.2.3	Equipment not ready to use as in delivery state	46
9.2.4	Equipment not ready for use and designed to be incorporated in more complex equipment.....	47
9.3	Measures	47
9.3.1	Minimum measures.....	47
9.3.2	Additional measures	47
9.4	Conformity of components	48
9.5	Starting for manual operated equipment.....	48
10	Instructions and markings.....	49
10.1	Instructions	49
10.2	Markings	49
10.3	Marking of terminals	49
Annex A (informative)	Nominal voltages of supply networks.....	51
Annex B (normative)	Construction of supply circuit terminals	52
B.1	Size of terminals	52
B.2	Spacings between supply circuit terminals	52
B.3	Connections at the terminals.....	53
B.4	Construction of the terminals	53
B.5	Fixing of the terminals.....	53
Annex C (normative)	Touch current measurement in fault condition	54
Annex D (informative)	Extrapolation of temperature to time of shutdown.....	56

Annex E (informative) Example of risk analysis and safety level requirement	57
E.1 General.....	57
E.2 Monitored hazards	57
E.3 General measures	57
E.4 Typical hazards by type of equipment	57
E.4.1 General	57
E.4.2 Spot welding.....	58
E.4.3 Projection welding	59
E.4.4 Seam welding	60
E.4.5 Butt welding.....	60
Annex F (informative) Indirect contact protection in resistance welding equipment.....	61
F.1 Protection against indirect contact by automatic disconnection of the supply	61
F.1.1 General	61
F.1.2 TN system	61
F.1.3 TT systems.....	62
F.2 Automatic disconnection of supply in single phase a.c. current equipment	63
F.2.1 TN system	63
F.2.2 TT systems.....	64
F.3 Automatic disconnection of supply in d.c. current equipment operating at medium frequency (inverter equipment)	64
F.3.1 TN system	64
F.3.2 TT systems.....	65
Bibliography.....	68
Figure 1 – Measurement of welding circuit touch current.....	18
Figure 2 – Measurement of rms values	19
Figure 3 – Example of metal screen between windings of the supply circuit and the welding circuit.....	26
Figure 4 – Example of protective conductor connected directly to the welding circuit (single-spot, a.c. current equipment).....	27
Figure 5 – Example of protective conductor connected directly to welding circuits (multi-spot, a.c. current equipment)	27
Figure 6 – Example of protective conductor connected directly to welding circuits (medium-frequency equipment).....	28
Figure 7 – Example of protective conductor connected to welding circuits through impedances	29
Figure 8 – Example of protective conductor connected to welding circuits through auto-inductances	30
Figure 9 – Example of protective conductor connected to welding circuits through auto-inductances	30
Figure 10 – Example of current operated RCD (a.c. current equipment).....	31
Figure 11 – Example of current operated RCD (medium-frequency equipment).....	32
Figure 12 – Example of current operated residual current device and voltage relay	33
Figure 13 – Example of current operated residual current device and safety-voltage relay	34
Figure 14 – Example of safety voltage relay.....	35
Figure C.1 – Measuring network for weighted touch current	54

Figure C.2 – Diagram for touch current measurement on fault condition at operating temperature for single-phase connection of appliances other than those of class II	55
Figure C.3 – Diagram for touch current measurement on fault condition for three-phase four-wire system connection of appliances other than those of class II	55
Figure E.1 – Structure of a mounted machine	58
Figure E.2 – Structure of a hand-held welding gun	58
Figure E.3 – Structure of projection welding machinery	59
Figure E.4 – Structure of seam welding machinery	60
Figure E.5 – Structure of butt welding machinery	60
Figure F.1 – Principle illustration of insulation fault	61
Figure F.2 – Illustrations of TN systems	62
Figure F.3 – Illustrations of TT systems	63
Figure F.4 – Typical fault current	65
Figure F.5 – Time-to-voltage reference curve	67
Table 1 – Minimum clearances for overvoltage category III	13
Table 2 – Minimum creepage distances	15
Table 3 – Insulation resistance	16
Table 4 – Dielectric test voltages	17
Table 5 – Minimum distance through insulation	25
Table 6 – Continuity of the protective bonding circuit	37
Table 7 – Limits of temperature rise for windings	42
Table 8 – Limits of temperature rise for external surfaces of hand-held equipment	43
Table 9 – Limits of temperature rise for external surfaces of hand-guided equipment	43
Table 10 – Limits of temperature rise for external surfaces of fixed equipment	43
Table B.1 – Range of conductor dimensions to be accepted by the supply circuit terminals	52
Table B.2 – Spacing between supply circuit terminals	53