

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Arc welding equipment –
Part 9: Installation and use**

**Matériel de soudage à l'arc –
Partie 9: Installation et utilisation**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2018 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
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 - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 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: sales@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 -

webstore.iec.ch/advsearchform

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 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 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: sales@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Arc welding equipment –
Part 9: Installation and use**

**Matériel de soudage à l'arc –
Partie 9: Installation et utilisation**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 25.160.30

ISBN 978-2-8322-5635-0

**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

FOREWORD.....	4
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions.....	6
4 Installation.....	8
4.1 General.....	8
4.2 Supply circuit.....	8
4.2.1 Selection of supply cables.....	8
4.2.2 Supply disconnecting device.....	8
4.2.3 Emergency stopping device.....	9
4.3 Welding circuit.....	9
4.3.1 Isolation from the input supply.....	9
4.3.2 Summation of no-load voltages.....	9
4.3.3 Welding cables.....	9
4.3.4 Connection between the welding power source and the workpiece.....	10
4.3.5 Earthing of the workpiece.....	11
4.3.6 Location of gas cylinders.....	11
5 Electromagnetic compatibility (EMC).....	12
5.1 General.....	12
5.2 Assessment of area.....	12
5.3 Methods of reducing emissions.....	12
5.3.1 Public supply system.....	12
5.3.2 Maintenance of arc-welding equipment.....	12
5.3.3 Welding cables.....	13
5.3.4 Equipotential bonding.....	13
5.3.5 Earthing of the workpiece.....	13
5.3.6 Screening and shielding.....	13
6 Electromagnetic fields (EMF).....	13
6.1 General.....	13
6.2 Assessment of exposure.....	14
7 Use.....	14
7.1 General requirements.....	14
7.2 Connection between several welding power sources.....	14
7.3 Inspection and maintenance of the welding installation.....	14
7.3.1 Periodical inspection.....	14
7.3.2 Routine inspection.....	15
7.4 Disconnection of welding power sources and/or welding circuits.....	15
7.5 Guards.....	15
7.6 Information for operators.....	15
7.7 Protective measures.....	15
7.7.1 Extraneous conductive parts in the welding area.....	15
7.7.2 Protection against electric shock.....	15
7.8 Isolation of the welding circuit from the workpiece and earth when not in use.....	16
7.9 Voltage between electrode holders or torches.....	16

7.10	Welding in an environment with increased risk of electric shock.....	18
7.11	Use of shoulder slings.....	18
7.12	Welding at elevated positions.....	19
7.13	Welding with suspended welding equipment.....	19
8	Battery-powered welding power sources.....	19
8.1	Safety recommendations.....	19
8.2	Transportation.....	19
Annex A	(informative) Hazards associated with arc welding.....	20
A.1	General.....	20
A.2	Equipment condition and maintenance.....	20
A.3	Operation.....	20
A.4	Training.....	20
A.5	Arc radiation.....	20
A.5.1	General.....	20
A.5.2	Eye and face protection (see also A.9).....	21
A.5.3	Body protection (see also A.9).....	21
A.5.4	Protection of persons in the vicinity of an arc.....	21
A.6	EMF.....	21
A.6.1	General.....	21
A.6.2	Body protection.....	21
A.6.3	Protection of persons in the vicinity of the welding operation.....	21
A.7	Welding fume.....	21
A.8	Noise.....	22
A.9	Fire and explosion.....	24
A.9.1	General.....	24
A.9.2	Fire.....	24
A.9.3	Explosion.....	24
A.10	General protective clothing.....	24
A.11	Confined spaces.....	24
Annex B	(informative) Voltage drops in the welding circuit.....	26
Bibliography	28
Figure 1	– Example of DC voltage between electrode holders or torches.....	17
Figure 2	– Example of AC voltage between electrode holders or torches – Single-phase supply from the same pair of lines of a three-phase mains supply.....	17
Figure 3	– Example of AC voltage between electrode holders or torches – Single-phase supply from different pairs of lines of a three-phase mains supply.....	17
Figure 4	– Example of AC voltage between electrode holders connected between different lines of output.....	18
Figure A.1	– Steps for the control of welding fumes.....	23
Figure A.2	– Example steps of operation for work in confined spaces.....	25
Figure B.1	– Example of MIG/MAG equipment.....	26
Table 1	– Current ratings for copper welding cables.....	10
Table B.1	– Voltage drop in copper and aluminium welding cables at normal and elevated temperatures.....	27

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ARC WELDING EQUIPMENT –**Part 9: Installation and use**

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, accept 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 60974-9 has been prepared by IEC technical committee 26: Electric welding.

This standard cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

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

- a) addition of a new Clause 8;
- b) addition of interpolation details in Table 1.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
26/648/FDIS	26/649/RVD

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

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

In this standard, the following print types are used:

- terms defined in Clause 3: in **bold** type.

A list of all the parts of the IEC 60974 series can be found, under the general title *Arc welding equipment*, on the IEC website.

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

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

ARC WELDING EQUIPMENT –

Part 9: Installation and use

1 Scope

This document is applicable to requirements for installation and instructions for use of equipment for arc welding and allied processes designed in accordance with safety requirements of IEC 60974-1, IEC 60974-6 or equivalent.

This document is applicable for the guidance of instructors, operators, welders, managers, and supervisors in the safe installation and use of equipment for arc welding and allied processes and the safe performance of welding and cutting operations.

National and local regulations take precedence over this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60245-6, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 6: Arc welding electrode cables*

IEC 60755, *General requirements for residual current operated protective devices*

IEC 60974-1, *Arc welding equipment – Part 1: Welding power sources*

IEC 60974-4, *Arc welding equipment – Part 4: Periodic inspection and testing*

IEC 60974-11, *Arc welding equipment – Part 11: Electrode holders*

IEC 60974-12, *Arc welding equipment – Part 12: Coupling devices for welding cables*

IEC 60974-13, *Arc welding equipment – Part 13: Welding clamp*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

welding circuit

conductive material through which the welding current is intended to flow