

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Arc welding equipment –  
Part 10: Electromagnetic compatibility (EMC) requirements**

**Matériel de soudage à l'arc –  
Partie 10: Exigences de compatibilité électromagnétique (CEM)**



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2014 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  
Fax: +41 22 919 03 00  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://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](http://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](http://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](http://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](http://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 14 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

More than 55 000 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](http://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](mailto: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](http://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](http://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](http://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](http://www.electropedia.org)

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 14 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

Plus de 55 000 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](http://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](mailto:csc@iec.ch).

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Arc welding equipment –  
Part 10: Electromagnetic compatibility (EMC) requirements**

**Matériel de soudage à l'arc –  
Partie 10: Exigences de compatibilité électromagnétique (CEM)**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

V

ICS 25.160

ISBN 978-2-8322-1387-2

**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 .....	7
4 General test requirements .....	8
4.1 Test conditions .....	8
4.2 Measuring instruments.....	8
4.3 Artificial mains network .....	8
4.4 Voltage probe .....	9
4.5 Antennas .....	9
4.6 Load-decoupling network .....	9
5 Test setup for emission and immunity.....	9
5.1 General.....	9
5.2 Load .....	12
5.3 Ancillary equipment .....	12
5.3.1 General requirements .....	12
5.3.2 Wire feeders.....	12
5.3.3 Remote controls .....	13
5.3.4 Arc striking and stabilizing devices .....	13
5.3.5 Liquid cooling systems.....	13
6 Emission tests .....	13
6.1 Classification for RF emission tests .....	13
6.1.1 Class A equipment.....	13
6.1.2 Class B equipment.....	13
6.2 Test conditions .....	14
6.2.1 Welding power source .....	14
6.2.2 Load .....	15
6.2.3 Wire feeders.....	15
6.2.4 Ancillary equipment .....	15
6.3 Emission limits.....	15
6.3.1 General .....	15
6.3.2 Mains terminal disturbance voltage.....	15
6.3.3 Electromagnetic radiation disturbance .....	16
6.3.4 Harmonics, voltage fluctuations and flicker .....	16
7 Immunity tests .....	18
7.1 Classification for immunity tests.....	18
7.1.1 Applicability of tests.....	18
7.1.2 Category 1 equipment.....	18
7.1.3 Category 2 equipment.....	18
7.2 Test conditions .....	18
7.3 Immunity performance criteria.....	18
7.3.1 Performance criterion A .....	18
7.3.2 Performance criterion B .....	18
7.3.3 Performance criterion C.....	19
7.4 Immunity levels.....	19
8 Documentation for the purchaser/user .....	20

Annex A (informative) Installation and use .....	22
A.1 General.....	22
A.2 Assessment of area .....	22
A.3 Assessment of welding installation.....	22
A.4 Mitigation measures .....	23
A.4.1 Public supply system .....	23
A.4.2 Maintenance of the arc welding equipment .....	23
A.4.3 Welding cables .....	23
A.4.4 Equipotential bonding .....	23
A.4.5 Earthing of the workpiece .....	23
A.4.6 Screening and shielding .....	23
Annex B (informative) Limits .....	24
B.1 General.....	24
B.2 Mains terminal disturbance voltage limits.....	24
B.3 Electromagnetic radiation disturbance limits .....	25
B.4 Harmonic current limits .....	26
B.5 Limits for voltage fluctuations and flicker.....	28
Annex C (informative) Symbols.....	29
Bibliography.....	30
Figure 1 – Test set-up 1 for arc welding equipment.....	10
Figure 2 – Test set-up 2 for portable arc welding equipment .....	11
Figure 3 – Top view of test setup as shown in Figure 1 .....	11
Figure 4 – Overview of harmonic requirements for supply current up to 75 A .....	17
Figure 5 – Overview of flicker requirements .....	17
Table 1 – Immunity levels – Enclosure .....	19
Table 2 – Immunity levels – AC input power port.....	19
Table 3 – Immunity levels – Ports for measurement and control.....	20
Table B.1 – Mains terminal disturbance voltage limits, idle state .....	24
Table B.2 – Mains terminal disturbance voltage limits, load conditions.....	24
Table B.3 – Electromagnetic radiation disturbance limits, idle state .....	25
Table B.4 – Electromagnetic radiation disturbance limits, load conditions .....	25
Table B.5 – Maximum permissible harmonic current for equipment for non-professional use with input current $I_{1\max} \leq 16$ A .....	26
Table B.6 – Current emission limits for equipment with $I_{1\max} \leq 75$ A other than balanced three-phase equipment .....	26
Table B.7 – Current emission limits for balanced three-phase equipment with $I_{1\max} \leq 75$ A .....	27
Table B.8 – Current emission limits for balanced three-phase equipment with $I_{1\max} \leq 75$ A under specified conditions (a, b, c) .....	27
Table B.9 – Current emission limits for balanced three-phase equipment with $I_{1\max} \leq 75$ A under specified conditions (d, e, f) .....	27
Table B.10 – Limits for arc welding equipment with $I_{1\max} \leq 75$ A .....	28
Table C.1 – Symbols to describe EMC properties .....	29

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ARC WELDING EQUIPMENT –****Part 10: Electromagnetic compatibility (EMC) requirements**

## 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 60974-10 has been prepared by IEC technical committee 26: Electric welding.

This third edition cancels and replaces the second edition published in 2007 and constitutes a technical revision.

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

- inclusion of optional use of a decoupling network and a load outside the test chamber;
- inclusion of an alternative test setup for portable equipment;
- inclusion of test conditions for complex controls, liquid cooling systems and arc striking and stabilizing devices;
- update of the applicable limits related to the updated reference to CISPR 11;
- exclusion of the use of narrow band relaxations for RF emission limits;

- update of the applicable limits for harmonics and flicker and inclusion of flow-charts related to the updated reference to IEC 61000-3-11 and IEC 61000-3-12;
- update of the requirements for voltage dips related to the updated reference to IEC 61000-4-11 and IEC 61000-4-34;
- update of the informative annex for installation and use;
- inclusion of symbols to indicate the RF equipment class and restrictions for use.

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

FDIS	Report on voting
26/519/FDIS	26/526/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 60974 series, under the general title *Arc welding equipment*, can be found on the IEC web site.

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.

## ARC WELDING EQUIPMENT –

### Part 10: Electromagnetic compatibility (EMC) requirements

#### 1 Scope

This part of IEC 60974 specifies

- a) applicable standards and test methods for radio-frequency (RF) emissions;
- b) applicable standards and test methods for harmonic current emission, voltage fluctuations and flicker;
- c) immunity requirements and test methods for continuous and transient, conducted and radiated disturbances including electrostatic discharges.

This standard is applicable to equipment for arc welding and allied processes, including power sources and ancillary equipment, for example wire feeders, liquid cooling systems and arc striking and stabilizing devices.

NOTE 1 Allied processes are, for example, plasma cutting and arc stud welding.

NOTE 2 This standard does not specify basic safety requirements for arc welding equipment such as protection against electric shock, unsafe operation, insulation coordination and related dielectric tests.

Arc welding equipment type tested in accordance with, and which has met the requirements of, this standard is considered to be in compliance for all applications.

#### 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 60050 (all parts), *International Electrotechnical Vocabulary* (available at <<http://www.electropedia.org>>)

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

IEC 60974-6, *Arc welding equipment – Part 6: Limited duty equipment*

IEC 61000-3-2:2005, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)*

Amendment 1:2008

Amendment 2:2009

IEC 61000-3-3:2013, *Electromagnetic compatibility (EMC) – Part 3-3: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current  $\leq 16$  A per phase and not subject to conditional connection*

IEC 61000-3-11:2000, *Electromagnetic compatibility (EMC) – Part 3-11: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current  $\leq 75$  A and subject to conditional connection*



IEC 61000-3-12:2011, *Electromagnetic compatibility (EMC) – Part 3-12: Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and  $\geq 75$  A per phase*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

IEC 61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*

CISPR 11:2009, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*<sup>1</sup>  
Amendment 1:2010

CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*

CISPR 16-1-2, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-2: Radio disturbance and immunity measuring apparatus – Ancillary equipment – Conducted disturbances*

CISPR 16-1-4, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-4: Radio disturbance and immunity measuring apparatus – Antennas and test sites for radiated disturbance measurements*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-161 concerning EMC and the relevant phenomena, given in IEC 60050-851 on arc welding equipment and in IEC 60974-1, as well as the following, apply.

#### 3.1 click

disturbance which exceeds the limit of continuous disturbance no longer than 200 ms and which is separated from a subsequent disturbance by at least 200 ms

Note 1 to entry: Both intervals are related to the level of the limit of continuous disturbance.

<sup>1</sup> There exists a consolidated edition 5.1 (2010) that includes Edition 5 and its Amendment 1.