
Naprave za obločno varjenje - 1. del: Viri varilnega toka

Arc welding equipment - Part 1: Welding power sources

Lichtbogenschweißeinrichtungen - Teil 1: Schweißstromquellen

Matériel de soudage à l'arc - Partie 1: Sources de courant de soudage

Ta slovenski standard je istoveten z: EN 60974-1:2012

[SIST EN 60974-1:2012](https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012)

<https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012>

ICS:

25.160.30	Varilna oprema	Welding equipment
-----------	----------------	-------------------

SIST EN 60974-1:2012**en**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 60974-1:2012

<https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 60974-1

August 2012

ICS 25.160

Supersedes EN 60974-1:2005

English version

Arc welding equipment - Part 1: Welding power sources (IEC 60974-1:2012)

Matériel de soudage à l'arc -
Partie 1: Sources de courant de soudage
(CEI 60974-1:2012)

Lichtbogenschweißeinrichtungen -
Teil 1: Schweißstromquellen
(IEC 60974-1:2012)

This European Standard was approved by CENELEC on 2012-07-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 26/472/FDIS, future edition 4 of IEC 60974-1, prepared by IEC/TC 26, "Electric welding" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60974-1:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-04-17
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-07-17

This document supersedes EN 60974-1:2005.

EN 60974-1:2012 includes the following significant technical changes with respect to EN 60974-1:2005:

- the heating test shall be carried out at ambient temperature of 40 °C (see 5.1);
- new Figure 1 summarizes example of insulation requirements;
- 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);
- water test is clarified by suppression of visual inspection (see 6.2.1);
- isolation requirements of the supply circuit and the welding circuit are moved in protection against electric shock in normal service (see 6.2.4);
- touch current in normal service and in single fault condition requirements are changed (see 6.2.5, 6.2.6 and 6.3.6);
- maximum temperature for insulation systems are reviewed in accordance with current edition of EN 60085 (see Table 6);
- limits of temperature rise for external surfaces are updated depending of unintentional contact period as defined in EN ISO 13732-1 (see Table 7);
- loading test is completed by a dielectric test (see 7.4);
- conformity test for tolerance to supply voltage fluctuation is clarified (see 10.1);
- marking of terminals is limited to external protective conductor and three-phase equipment terminals (see 10.4);
- usage of hazard reducing device is clarified (see 11.1);
- requirements for control circuits are changed (see Clause 12);
- impact test is clarified (see 14.2.2);
- environmental parameters are completed (see Annex M).

In this standard, the following print types are used:

– *conformity statements: in italic type.*

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC)

Endorsement notice

The text of the International Standard IEC 60974-1:2012 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60038:2009	NOTE	Harmonized as EN 60038:2011 (modified).
IEC 60085	NOTE	Harmonized as EN 60085.
IEC 60204-1	NOTE	Harmonized as EN 60204-1.
IEC 60309-1	NOTE	Harmonized as EN 60309-1.
IEC 60950-1	NOTE	Harmonized as EN 60950-1.
IEC 60974-6	NOTE	Harmonized as EN 60974-6.
IEC 60974-10	NOTE	Harmonized as EN 60974-10.
IEC 60974-12	NOTE	Harmonized as EN 60974-12.
IEC 61558-1	NOTE	Harmonized as EN 61558-1:2012
IEC 62079	NOTE	Harmonized as EN 62079.
ISO 13732-1	NOTE	Harmonized as EN ISO 13732-1

iTeh STANDARD PREVIEW
(standards.iteh.ai)
<https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a00b918641/sist-en-60974-1-2012>

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60050-151	2001	International Electrotechnical Vocabulary (IEV) - Part 151: Electrical and magnetic devices	-	-
IEC 60050-851	2008	International Electrotechnical Vocabulary - Part 851: Electric welding	-	-
IEC 60245-6	-	Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 6: Arc welding electrode cables	-	-
IEC 60417	Data-base	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	EN 60445	-
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	EN 60664-1	2007
IEC 60664-3	-	Insulation coordination for equipment within low-voltage systems - Part 3: Use of coating, potting or moulding for protection against pollution	EN 60664-3	-
IEC 60695-11-10	-	Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods	EN 60695-11-10	-
IEC 60974-7	-	Arc welding equipment - Part 7: Torches	EN 60974-7	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61558-2-4	-	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers	EN 61558-2-4	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61558-2-6	-	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers	EN 61558-2-6	-

iTeh STANDARD PREVIEW (standards.iteh.ai)

SIST EN 60974-1:2012

<https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012>

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 60974-1:2012

<https://standards.iteh.ai/catalog/standards/sist/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012>



IEC 60974-1

Edition 4.0 2012-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Arc welding equipment –
Part 1: Welding power sources**

**Matériel de soudage à l'arc –
Partie 1: Sources de courant de soudage**

STANDARD PREVIEW
(standards.iteh.ai)
SIST EN 60974-1:2012
https://standards.iteh.ai/en/standards/SIST/4fe423e0-a5b1-4a50-8082-65a60b9f8641/sist-en-60974-1-2012

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XE

ICS 25.160

ISBN 978-2-83220-095-7

**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.....	7
1 Scope.....	9
2 Normative references.....	9
3 Terms and definitions	10
4 Environmental conditions	18
5 Tests	19
5.1 Test conditions	19
5.2 Measuring instruments.....	19
5.3 Conformity of components	19
5.4 Type tests	20
5.5 Routine tests	20
6 Protection against electric shock.....	21
6.1 Insulation.....	21
6.1.1 General	21
6.1.2 Clearances	22
6.1.3 Creepage distances	23
6.1.4 Insulation resistance	25
6.1.5 Dielectric strength.....	25
6.2 Protection against electric shock in normal service (direct contact).....	26
6.2.1 Protection provided by the enclosure.....	26
6.2.2 Capacitors	27
6.2.3 Automatic discharge of supply circuit capacitors.....	27
6.2.4 Isolation of the welding circuit.....	28
6.2.5 Welding circuit touch current.....	28
6.2.6 Touch current in normal condition	29
6.3 Protection against electric shock in case of a fault condition (indirect contact).....	29
6.3.1 Protective provisions.....	29
6.3.2 Isolation between windings of the supply circuit and the welding circuit.....	29
6.3.3 Internal conductors and connections	29
6.3.4 Additional requirements for plasma cutting systems	30
6.3.5 Movable coils and cores.....	30
6.3.6 Touch current in fault condition	31
7 Thermal requirements.....	31
7.1 Heating test	31
7.1.1 Test conditions	31
7.1.2 Tolerances of the test parameters.....	32
7.1.3 Duration of test	32
7.2 Temperature measurement.....	32
7.2.1 Measurement conditions	32
7.2.2 Surface temperature sensor.....	32
7.2.3 Resistance.....	33
7.2.4 Embedded temperature sensor	33
7.2.5 Determination of the ambient air temperature	33
7.2.6 Recording of temperatures.....	33
7.3 Limits of temperature rise	34

7.3.1	Windings, commutators and slip-rings	34
7.3.2	External surfaces	34
7.3.3	Other components	35
7.4	Loading test	35
7.5	Commutators and slip-rings	36
8	Thermal protection	36
8.1	General requirements	36
8.2	Construction	36
8.3	Location	36
8.4	Operating capacity	36
8.5	Operation	37
8.6	Resetting	37
8.7	Indication	37
9	Abnormal operation	37
9.1	General requirements	37
9.2	Stalled fan test	38
9.3	Short circuit test	38
9.4	Overload test	38
10	Connection to the supply network	39
10.1	Supply voltage	39
10.2	Multi-supply voltage	39
10.3	Means of connection to the supply circuit	39
10.4	Marking of terminals	40
10.5	Protective circuit	40
10.5.1	Continuity requirement	40
10.5.2	Type test	41
10.5.3	Routine test	41
10.6	Cable anchorage	42
10.7	Inlet openings	43
10.8	Supply circuit on/off switching device	43
10.9	Supply cables	44
10.10	Supply coupling device (attachment plug)	44
11	Output	45
11.1	Rated no-load voltage	45
11.1.1	Rated no-load voltage for use in environments with increased risk of electric shock	45
11.1.2	Rated no-load voltage for use in environments without increased risk of electric shock	45
11.1.3	Rated no-load voltage for the use with mechanically held torches with increased protection for the operator	45
11.1.4	Rated no-load voltage for special processes for example plasma cutting	45
11.1.5	Additional requirements	46
11.1.6	Measuring circuits	47
11.2	Type test values of the conventional load voltage	48
11.2.1	Manual metal arc welding with covered electrodes	48
11.2.2	Tungsten inert gas	48
11.2.3	Metal inert/active gas and flux cored arc welding	48
11.2.4	Submerged arc welding	48

11.2.5	Plasma cutting	48
11.2.6	Plasma welding	48
11.2.7	Plasma gouging	48
11.2.8	Additional requirements	48
11.3	Mechanical switching devices used to adjust output	48
11.4	Welding circuit connections	49
11.4.1	Protection against unintentional contact	49
11.4.2	Location of coupling devices	49
11.4.3	Outlet openings	49
11.4.4	Three-phase multi-operator welding transformer	49
11.4.5	Marking	49
11.4.6	Connections for plasma cutting torches	50
11.5	Power supply to external devices connected to the welding circuit	50
11.6	Auxiliary power supply	50
11.7	Welding cables	51
12	Control circuits	51
12.1	General requirement	51
12.2	Isolation of control circuits	51
12.3	Working voltages of remote control circuits	51
13	Hazard reducing device	51
13.1	General requirements	51
13.2	Types of hazard reducing devices	52
13.2.1	Voltage reducing device	52
13.2.2	Switching device for a.c. to d.c.	52
13.3	Requirements for hazard reducing devices	52
13.3.1	Disabling the hazard reducing device	52
13.3.2	Interference with operation of a hazard reducing device	52
13.3.3	Indication of satisfactory operation	53
13.3.4	Fail to a safe condition	53
14	Mechanical provisions	53
14.1	General requirements	53
14.2	Enclosure	53
14.2.1	Enclosure materials	53
14.2.2	Enclosure strength	53
14.3	Handling means	54
14.3.1	Mechanised handling	54
14.3.2	Manual handling	54
14.4	Drop withstand	55
14.5	Tilting stability	55
15	Rating plate	55
15.1	General requirements	55
15.2	Description	55
15.3	Contents	56
15.4	Tolerances	59
15.5	Direction of rotation	60
16	Adjustment of the output	60
16.1	Type of adjustment	60
16.2	Marking of the adjusting device	60

16.3 Indication of current or voltage control	60
17 Instructions and markings	61
17.1 Instructions	61
17.2 Markings	62
Annex A (informative) Nominal voltages of supply networks	63
Annex B (informative) Example of a combined dielectric test	64
Annex C (normative) Unbalanced load in case of a.c. tungsten inert-gas welding power sources	65
Annex D (informative) Extrapolation of temperature to time of shutdown	67
Annex E (normative) Construction of supply circuit terminals	68
Annex F (informative) Cross-reference to non-SI units	70
Annex G (informative) Suitability of supply network for the measurement of the true r.m.s. value of the supply current	71
Annex H (informative) Plotting of static characteristics	72
Annex I (normative) Test methods for a 10 Nm impact	73
Annex J (normative) Thickness of sheet metal for enclosures	74
Annex K (informative) Examples of rating plates	76
Annex L (informative) Graphical symbols for arc welding equipment	81
Annex M (informative) Efficiency	104
Annex N (normative) Touch current measurement in fault condition	105
Bibliography	109
Figure 1 – Example of insulation configuration for Class I equipment	21
Figure 2 – Measurement of welding circuit touch current	28
Figure 3 – Measurement of r.m.s. values	47
Figure 4 – Measurement of peak values	47
Figure 5 – Principle of the rating plate	56
Figure B.1 – Combined high-voltage transformers	64
Figure C.1 – Voltage and current during a.c. tungsten inert-gas welding	65
Figure C.2 – Unbalanced voltage during a.c. tungsten inert-gas welding	66
Figure C.3 – AC welding power source with unbalanced load	66
Figure I.1 – Test set-up	73
Figure K.1 – Single-phase transformer	76
Figure K.2 – Three-phase rotating frequency converter	77
Figure K.3 – Subdivided rating plate: single-/three-phase transformer rectifier	78
Figure K.4 – Engine-generator-rectifier	79
Figure K.5 – Single-/three-phase inverter type	80
Figure L.1 – Input voltage power switch	101
Figure L.2 – Arc force control potentiometer	101
Figure L.3 – Remote receptacle and selector switches	102
Figure L.4 – Terminals with inductance selector for MIG/MAG welding	102
Figure L.5 – Process switch (MMA, TIG, MIG)	102
Figure L.6 – Selector switch on AC/DC equipment	102
Figure L.7 – Panel indicator lights (overheat, fault, arc striking, output voltage)	103

Figure L.8 – Setting pulsing parameters using digital display.....	103
Figure N.1 – Measuring network for weighted touch current	105
Figure N.2 – Diagram for touch current measurement on fault condition at operating temperature for single-phase connection of appliances other than those of class II	107
Figure N.3 – Diagram for touch current measurement on fault condition for three-phase four-wire system connection of appliances other than those of class II	108
Table 1 – Minimum clearances for overvoltage category III	22
Table 2 – Minimum creepage distances	24
Table 3 – Insulation resistance	25
Table 4 – Dielectric test voltages	25
Table 5 – Minimum distance through insulation.....	29
Table 6 – Temperature limits for windings, commutators and slip-rings	34
Table 7 – Temperature limits for external surfaces	35
Table 8 – Cross-section of the output short-circuit conductor	38
Table 9 – Current and time requirements for protective circuits	41
Table 10 – Minimum cross-sectional area of the external protective copper conductor	41
Table 11 – Verification of continuity of the protective circuit	42
Table 12 – Pull	43
Table 13 – Summary of allowable rated no-load voltages	46
Table 14 – Hazard reducing device requirements.....	52
Table E.1 – Range of conductor dimensions to be accepted by the supply circuit terminals	68
Table F.1 – Cross-reference for mm ² to American wire gauge (AWG)	70
Table I.1 – Angle of rotation θ to obtain 10 Nm impact	73
Table I.2 – Mass of the free fall weight and height of the free fall	73
Table J.1 – Minimum thickness of sheet metal for steel enclosures	74
Table J.2 – Minimum thickness of sheet metal for enclosures of aluminium, brass or copper	75
Table L.1 – Letters used as symbols	82

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ARC WELDING EQUIPMENT –**Part 1: Welding power sources****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 60974-1 has been prepared by IEC technical committee 26: Electric welding.

This fourth edition cancels and replaces the third edition published in 2005 and constitutes a technical revision.

The significant changes with respect to the previous edition are the following:

- the heating test shall be carried out at ambient temperature of 40 °C (see 5.1);
- new Figure 1 summarizes example of insulation requirements;
- 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);
- water test is clarified by suppression of visual inspection (see 6.2.1);