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Arc welding equipment - Part 1: Welding power sources

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English version

Arc welding equipment
Part 1: Welding power sources
(IEC 60974-1:1998)

Matériel de soudage électrique
Partie 1: Sources de courant pour soudage
(CEI 60974-1:1998)

Einrichtungen zum Lichtbogenschweißen
Teil 1: Schweißstromquellen
(IEC 60974-1:1998)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat 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 Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
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Foreword

The text of document 26/153/FDIS, future edition 2 of IEC 60974-1, prepared by IEC TC 26, Electric welding, and by ISO TC 44, Welding and allied processes, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60974-1 on 1998-04-01.

This European Standard supersedes EN 60974-1:1990.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1999-07-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2001-01-01

Annexes designated "normative" are part of the body of the standard.
Annexes designated "informative" are given for information only.
In this standard, annexes C, E, I, J and ZA are normative and annexes A, B, D, F, G, H and K are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60974-1:1998 was approved by CENELEC as a European Standard without any modification.

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ARC WELDING EQUIPMENT –

Part 1: Welding power sources

1 Scope

This part of IEC 60974 is applicable to power sources for arc welding and allied processes designed for industrial and professional use, and supplied by a voltage not exceeding that specified in table 1 of IEC 60038, or driven by mechanical means.

This standard is not applicable to welding power sources for manual metal arc welding with limited duty operation which are designed mainly for use by laymen.

This part of IEC 60974 specifies safety requirements for construction and performance requirements of welding power sources.

NOTE 1 – Typical allied processes are electric arc cutting and arc spraying.

NOTE 2 – This standard does not include electromagnetic compatibility (EMC) requirements.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60974. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60974 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60038:1983, *IEC standard voltages*

IEC 60050(151):1978, *International Electrotechnical Vocabulary (IEV) – Chapter 151: Electrical and magnetic devices*

IEC 60050(851):1991, *International Electrotechnical Vocabulary (IEV) – Chapter 851: Electric welding*

IEC 60051-2:1984, *Direct acting indicating analogue electrical measuring instruments and their accessories – Part 2: Special requirements for ammeters and voltmeters*

IEC 60068-2-63:1991, *Environmental testing – Part 2: Test methods – Test Eg: Impact, spring hammer*

IEC 60085:1984, *Thermal evaluation and classification of electrical insulation*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60204-1:1992, *Electrical equipment of industrial machines – Part 1: General requirements*

IEC 60309-1:1988, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60417:1973, *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets*

IEC 60445:1988, *Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60536:1976, *Classification of electrical and electronic equipment with regard to protection against electric shock*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60664-3:1992, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating to achieve insulation coordination of printed board assemblies*

IEC 60905:1987, *Loading guide for dry-type power transformers*

IEC 60974-12:1992, *Arc welding equipment – Part 12: Coupling devices for welding cables*

IEC 61558 (all parts), *Safety of power transformers, power supply units and similar*

ISO 7000:1989, *Graphical symbols for use on equipments – Index and synopsis. Bilingual edition*

3 Definitions

For the purpose of this part of IEC 60974, the following definitions apply, with those in IEC 60050(151), IEC 60050(851), IEC 60204-1 and IEC 60664-1:

3.1
arc welding power source
equipment for supplying current and voltage and having the required characteristics suitable for arc welding and allied processes

NOTE 1 An arc welding power source may also supply services to other equipment and auxiliaries e.g. auxiliary power, cooling liquid, consumable arc welding electrode and gas to shield the arc and the welding area.

NOTE 2 In the following text, the term "welding power source" is used.

3.2
industrial and professional use
use intended only for experts or instructed persons

3.3
expert (competent person, skilled person)
a person who can judge the work assigned and recognize possible hazards on the basis of professional training, knowledge, experience and knowledge of the relevant equipment

NOTE – Several years of practice in the relevant technical field may be taken into consideration in assessment of professional training.

3.4
instructed person
a person informed about the tasks assigned and about the possible hazards involved in neglectful behaviour

NOTE – If necessary, the person has undergone some training.

3.5
type test
a 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]

3.6
routine test
a 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]

3.7
general visual inspection
an inspection by eye to verify that there are no apparent discrepancies with respect to provisions of the standard concerned

3.8
drooping characteristic
an external static characteristic of a welding power source which, in its normal welding range, is such that, as the current increases, the voltage decreases by more than 7 V/100 A

3.9
flat characteristic
an external static characteristic of a welding power source which, in its normal welding range, is such that, as the current increases, the voltage either decreases by less than 7 V/100 A or increases by less than 10 V/100 A

3.10
static characteristic
the relationship between the load voltage and the welding current of a welding power source in a conventional welding condition

3.11
welding circuit
a circuit that includes all conductive material through which the welding current is intended to flow

NOTE 1 In arc welding, the arc is a part of the welding circuit.

NOTE 2 In certain arc welding processes, the welding arc may be established between two electrodes. In such a case, the workpiece is not necessarily a part of the welding circuit.

3.12
control circuit
a circuit for the operational control of a welding power source and/or for protection of the power circuits [IEC 60204-1:1992, 3.9 modified]

3.13
welding current
the current delivered by a welding power source during welding

3.14
load voltage
the voltage between the output terminals when the welding power source is delivering welding current

3.15
no-load voltage
the voltage, exclusive of any arc striking or arc stabilizing voltage, between the output terminals of a welding power source when the external welding circuit is open

3.16
conventional value
a 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.

3.17
conventional welding condition
a condition of the welding power source in the energized and thermally stabilized state defined by a conventional welding current driven by the corresponding conventional load voltage through a conventional load at rated supply voltage and frequency or speed of rotation

3.18
conventional load
a practically non-inductive constant resistive load having a power factor not less than 0,99

3.19
conventional welding current (I_2)
the current delivered by a welding power source to a conventional load at the corresponding conventional load voltage

NOTE – The values of I_2 are given as r.m.s. values for a.c. and arithmetic mean values for d.c.

3.20
conventional load voltage (U_2)
the load voltage of a welding power source having a specified linear relationship to the conventional welding current

NOTE 1 The values for U_2 are given as r.m.s. values for a.c. and arithmetic mean values for d.c.

NOTE 2 The specified linear relationship varies in accordance with the process (see 11.2).

3.21
rated value
an assigned value, generally by the manufacturer, for a specified operating condition of a component, device or equipment

3.22
rating
the set of rated values and operating conditions

3.23
rated output
the rated values of the output of a welding power source

3.24
rated maximum welding current (I_{2max})
the maximum value of the conventional welding current that can be obtained at the conventional welding condition from a welding power source at its maximum setting

3.25
rated minimum welding current (I_{2min})
the minimum value of the conventional welding current that can be obtained at the conventional welding condition from a welding power source at its minimum setting

3.26
rated no-load voltage (U_0)
the no-load voltage, measured in accordance with 11.1, at rated supply voltage and frequency or rated no-load speed of rotation

NOTE – If a welding power source is fitted with a hazard reducing device, this is the voltage measured before the hazard reducing device has performed its function.

3.27
rated reduced no-load voltage (U_r)
the no-load voltage of a welding power source, fitted with a voltage reducing device, measured in accordance with 11.1 immediately after the device acts to effect a reduction in the voltage

3.28
rated switched no-load voltage (U_s)
the d.c. no-load voltage of a welding power source, fitted with an a.c. to d.c. switching device

3.29
rated supply voltage (U_1)
the r.m.s. value of an input voltage for which the welding power source is designed

3.30
rated supply current (I_1)
the r.m.s. value of an input current to the welding power source at a rated conventional welding condition

3.31
rated no-load supply current (I_0)
the input current to the welding power source at rated no-load voltage

3.32
rated maximum supply current (I_{1max})
the maximum value of the rated supply current

3.33
maximum effective supply current (I_{1eff})
the maximum value of the effective input current, calculated from the rated supply current (I_1), the corresponding duty cycle (duty factor) (X) and the supply current at no-load (I_0) by the formula:

$$I_{1eff} = \sqrt{I_1^2 \times X + I_0^2 \times (1 - X)}$$

3.34
rated load speed (n)
the speed of rotation of a rotating welding power source when operating at rated maximum welding current

3.35
rated no-load speed (n_0)
the speed of rotation of a rotating welding power source when the external welding circuit is open

NOTE – If an engine is fitted with a device to reduce the speed when not welding, n_0 will be measured before the speed reduction device has operated.

3.36
rated idle speed (n_i)
the reduced no-load speed of an engine driven welding power source

3.37
duty cycle; duty factor (X)
the ratio for a given time interval of the on-load duration to the total time

NOTE 1 This ratio, lying between 0 and 1, may be expressed as a percentage.

NOTE 2 For the purpose of this standard, the time period of one complete cycle is 10 min. For example, in the case of a 60 % duty cycle (duty factor), load is applied continuously for 6 min followed by a no-load period of 4 min.

3.38
clearance
the shortest distance in air between two conductive parts [IEC 60664-1:1992, 1.3.2]

3.39
creepage distance
the shortest distance along the surface of the insulating material between two conductive parts [IEV 151-03-37]

3.40
pollution degree
a numeral characterizing the expected pollution of the micro-environment [IEC 60664-1:1992, 1.3.13]

NOTE – For the purpose of evaluating creepage distances and clearances, the following four pollution degrees in the micro-environment are established in 2.5.1 of IEC 60664-1.

a) **pollution degree 1**: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.

b) **pollution degree 2**: Only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is to be expected.

c) **pollution degree 3**: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation is to be expected.

d) **pollution degree 4**: The pollution generates persistent conductivity caused by conductive dust or by rain or snow.

3.41
micro-environment
the immediate environment of the insulation which particularly influences the dimensioning of the creepage distances [IEC 60664-1:1992, 1.3.12.2]

3.42
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, e.g. glass or ceramics, which do not track, creepage distances need not be greater than their associated clearance for the purpose of insulation co-ordination.

3.43
temperature rise
the difference between the temperature of a part of a welding power source and that of the ambient air

3.44
thermal equilibrium
the state reached when the observed temperature rise of any part of the welding power source does not exceed 2 K/h