NEMA Standards Publication

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American National Standard for Arc-Welding Equipment - Part 1: Welding Power Sources

National Electrical Manufacturers Association

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900 • Rosslyn. VA 22209
www.NEMA.org

ANSI/IEC 60974-1: 2008

American National Standard
for Arc Welding Equipment

Part 1: Welding Power Sources

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Arc Welding Equipment—
Part 1: Welding Power Sources

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FOREWORD FOR U.S. ADOPTION

This American National Standard is an adoption of IEC 60974-1 edition 3, *Arc Welding Equipment – Part 1: Welding power sources*, and was developed and approved in accordance with procedures set forth by the American National Standards Institute. It is envisioned that this document will ultimately supersede ANSI/UL 60974-1, which was an adoption of IEC 60974-1, edition 2 and its amendment 1.

This standard contains all the original text as-is from IEC 60974-1, edition 3, in addition to a number of U.S. Differences to the IEC standard that were identified by Accredited Standards Committee W1, *Requirements for Apparatus Designed for Use in Arc Welding, Plasma Arc Cutting, and Allied Processes.* Each U.S. Difference is found both in a compilation of U.S. differences following this foreword, and inserted in the appropriate place(s) in the standard relating to the difference. Each insertion is in red text and is marked by three lines on its left (two thin, one thick). Each Difference is identified with the following format:

[Clause/Subclause Number]DV[Number of Difference for the Given Clause/Subclause]

Following this format, the example 17.1DV.3 signifies that it is the third U.S. Difference to subclause 17.1.

Suggestions for the improvement of this standard are welcome and should be submitted to the Secretariat of Accredited Standards Committee W1 as follows:

Greg Winchester, ASC W1 Secretary
c/o National Electrical Manufacturers Association
1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
Fax 703-841-3399
Email gre_winchester@nema.org

This standard was processed and approved by the Accredited Standards Committee W1. Committee approval does not necessarily imply that all Committee members voted for its approval. At the time this standard was published, Accredited Standards Committee W1 consisted of the following members:

John Freudenberg, Chairman Wayne Hoffman, Vice Chairman Greg Winchester, Secretary	
Organization Represented	*Name of Representative*
American Welding Society	Andrew Davis – principal Dick Holdren – alternate
CenterLine (Windsor) Limited	David Beneteau
CSA International	Andrew Krumins
ESAB Welding and Cutting	Charles Aimar
Hypertherm Inc.	Tony Zeller – principal Bill Lynn – alternate
Lincoln Electric Company	Frank Stupczy – principal Gary Mikitin – alternate
Miller Electric Manufacturing Company	David Werba – principal Terry Christianson – alternate
Northeast Product Safety Society	John Freudenberg
Wayne Hoffman – Consultant / U.S. Technical Advisor, IEC TC 26	Wayne Hoffman

The effective date for all new product submittals to this Standard is three (3) years after the publication date of this Standard. This effective date is established by the ANSI Accredited Standards Committee W1 and is not part of this Standard. This Standard cancels and replaces the first edition of ANSI/UL 60974-1 (published March 17, 2005) on the effective date.

The requirements in this Standard should be used for new product submittals made after the publication date of this Standard. If this Standard is used, a product will be evaluated under all of the requirements of this Standard. If a product within the scope of this Standard was listed to ANSI/UL 60974-1 or ANSI/UL 551, compliance with all the requirements in this Standard will be required as a condition of continued Listing after June 30, 2023.

COMPILATION OF U.S. DIFFERENCES

NOTE This section is an integral part of American National Standard ANSI/IEC 60974-1. See the section "Foreword for U.S. Adoption" for an explanation of the format used to identify U.S. Differences.

ForewordDV.1 Modify the foreword by adding the following:

The numbering system in this standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

2DV.1 Modify clause 2 by deleting the reference to IEC 60309-1

2DV.2 Modify clause 2 by adding the following to the list of normative references:

IEC 62114, *Electrical Insulation Systems (EIS) – Thermal Classification*

ANSI/UL 62, *Flexible Cord and Fixture Wire*

ANSI/UL 94, *Tests for Flammability of Plastic Materials for Parts in Devices and Appliances*

ANSI/UL 486A-486B, *Wire Connectors for Use with Aluminum Conductors*

ANSI/UL 489, *Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures*

ANSI/UL 498, *Attachment Plugs and Receptacles*

ANSI/UL 558, *Industrial Trucks, Internal Combustion Engine-Powered*

ANSI/UL 969, *Marking and Labeling Systems*

ANSI/UL 1059, *Terminal Blocks*

2DV.3 Modify clause 2 by deleting the reference to CISPR 11

2DV.4 Modify clause 2 by adding the following to the list of normative references:

ANSI/UL 1682, *Plugs, Receptacles, and Cable Connectors of the Pin and Sleeve Type*

5.3DV.1 Modify 5.3 by replacing its text with the following:

Components which due to failure may increase the risk of a hazard, shall comply with the requirements of this document or with the requirements of the relevant ANSI standards.

NOTE 1 An ANSI component standard is considered relevant only if the component in question falls within its scope.

Evaluation and testing of components for correct application in the equipment shall be carried out in one of the following ways:

a) Where a component has been certified by a recognized testing authority for compliance with a relevant ANSI component standard, that component shall be checked for correct application in accordance with its rating. The component shall be tested in accordance with this part of ANSI/IEC 60974 with the exception of those tests which are part of the relevant ANSI component standard.

b) Where a component has been certified by a recognized testing authority for compliance with a relevant ANSI component standard, but is not being used in accordance with its specified ratings, that component shall be tested in accordance with this part of ANSI/IEC 60974.

c) Where a component has not been certified by a recognized testing authority for compliance with a relevant ANSI component standard, that component shall be checked for correct application in the equipment by testing the component in accordance with this part of ANSI/ IEC 60974 or in accordance with the applicable tests of the relevant ANSI component standard.

NOTE 2 The applicable test for compliance with a component standard is typically carried out separately. The number of test samples is typically the same as that required in the component standard.

d) Where a component has not been certified by a recognized testing authority for compliance with a relevant ANSI component standard because no such standard exists, that component shall be tested in accordance with this part of ANSI/IEC 60974.

e) Where a component has been certified by a recognized testing authority for compliance to a non-ANSI standard, that component shall be deemed acceptable for use in the equipment provided that the applicable safety requirements of the non-ANSI standard are at least as high as those of a relevant ANSI standard. The component shall be tested in accordance with this part of ANSI/IEC 60974 with the exception of those tests which are part of the non-ANSI component standard.

5.4DV.1 Modify 5.4 by replacing the last paragraph with the following:

The other tests included in this document and not listed here may be carried out in any convenient sequence, with the exception of the dielectric strength test (see 6.1.5) which shall be performed immediately following the completion of thermal requirements testing (see clause 7) for at least one test condition in 7.1.1.

7.3.1DV.1 Modify 7.3.1 by replacing "IEC 60085" with "IEC 62114" in NOTE 3 of Table 6

7.3.1DV.2 Modify 7.3.1 by adding the following NOTE 4 in Table 6

NOTE 4 Insulation classes above Class 105 are evaluated with respect to the requirements in IEC 62114.

7.3.3DV.1 Modify 7.3.3 by adding the following:

The maximum temperature of fuel systems and engine compartment components shall be in accordance with ANSI/UL 558.

10.4DV.1 Modify 10.4 by adding the following new subclause 10.4.5:

10.4.5 Evaluation of input supply terminals

Input supply terminals shall be evaluated with respect to the requirements in ANSI/UL 1059 or ANSI/UL 486A-486B, as applicable.

10.7DV.1 Modify 10.7(d) by replacing it with the following:

d) be suitable for this application; where circuit breakers are used as a supply circuit on/off switching device, these circuit breakers shall be evaluated with respect to the requirements in ANSI/UL 489.

10.8DV.1 Modify 10.8(a) by replacing it with the following:

a) be suitable for the application and meet national and local regulations, including the requirements of ANSI/UL 62;

10.9DV.1 Modify 10.9 by adding the following paragraph:

Attachment plugs shall be evaluated with respect to the requirements in ANSI/UL 498, ANSI/UL 1659, and UL 1682.

14.2.1DV.1 Modify 14.2.1 by replacing its conformity statement with the following:

Conformity is checked by verifying the flammability rating of the non-metallic materials in accordance with ANSI/UL 94.

15.1DV.1 Modify 15.1 by adding the following:

Markings shall meet the legibility, durability, and permanence requirements in ANSI/UL 969.

17.1DV.1 Modify 17.1(d) by replacing it with the following:

d) information for selection and connection to the supply network (for example suitable supply cables, connection devices or attachment plugs, including the fuse and/or circuit-breaker rating, see also caution of 6.1.1); for a field-installed attachment plug, the instruction manual shall specify that the installation shall only be carried out by qualified personnel in accordance with relevant local and national electrical codes.

17.1DV.2 Modify 17.1(r) by not requiring the EMC classification

17.1DV.3 Modify 17.1 by adding a new list item (t) as follows:

t) for an engine-driven power source, information concerning the precautionary marking, shown in Figure 5, addressing the carbon monoxide component of engine exhaust.

17.2DV.1 Modify 17.2 by replacing its text with the following:

17.2.1 Legibility, durability and permanence requirements

Markings shall be legible, contrast with the background, and be visible to the operator when controls on the product are operated in preparation for an arc-welding operation. Markings shall be permanent and shall be located on a permanent part of the product or on a part that cannot be removed without impairing the operation of the product.

Conformity shall be checked by meeting the legibility, durability, and permanence requirements in ANSI/UL 969.

17.2.2 Read instruction manual requirements

Each welding power source shall be clearly and indelibly marked on or near the front panel or near the ON/OFF switching device with the following combination of symbols to signify “Caution! Read instruction manual”:

This marking shall also be used near the torch connector of plasma cutting power sources indicating that the operator should read the instruction manual before selecting and connecting a torch.

The following equivalent wording may be used:

Warning: Read instruction manuals before operating and servicing this equipment.

17.2.3 Requirements for precautionary markings

Precautionary markings on products shall, as a minimum, contain English text. This text may be supplemented with the use of symbols, examples of which are provided in Annex L or in NEMA EW 6.

NOTE The methodology for the design, application, use, and validation of safety labels is found in ANSI Z535.

A product shall be marked with the word ″WARNING″ and the following or the equivalent:

To reduce the risks to yourself and others, read and understand this marking.

FUMES AND GASES can injure your health.

ARC RAYS can injure eyes and burn.

ELECTRIC SHOCK can KILL.

Read and understand the manufacturer’s instructions and your employer’s safety practices.

Keep your head out of the fumes.

Use enough ventilation, exhaust at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

Wear correct eye, ear, and body protection.

Do not touch live electrical parts.

Consult instruction manual before operating.

DO NOT REMOVE THIS MARKING

17.2.4 Requirements specific to engine-driven power sources

The precautionary marking shown in Figure 5 addressing the carbon monoxide component of engine exhaust shall appear on the product and product packaging.

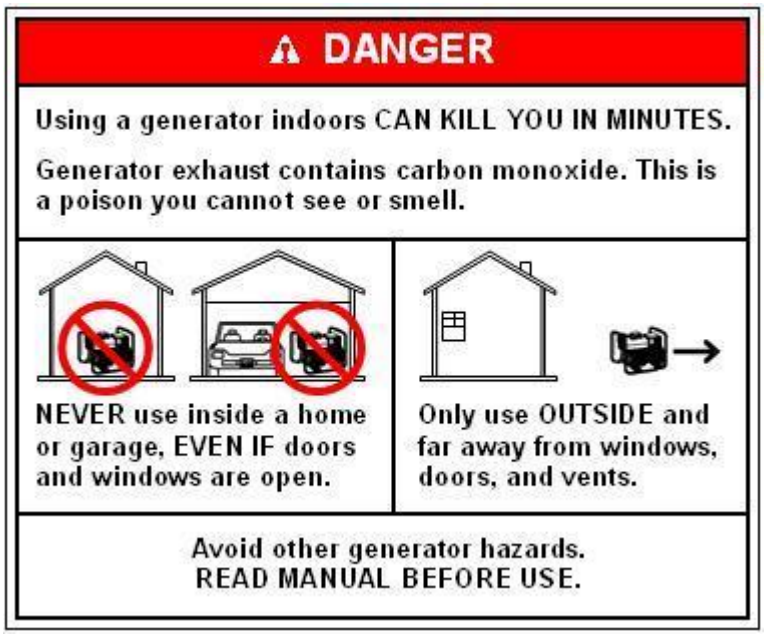


Figure 5 – Carbon monoxide precautionary marking

17.2.5 Requirements specific to fuse-protected receptacles

The fuseholder location of a cartridge fuse that protects a 15- or 20-ampere attachment-plug receptacle intended for general use shall be marked ″WARNING – To prevent electrical shock, disconnect welder before replacing fuse″ unless a switch is provided on the supply side.

The size of the replacement fuse shall also be marked at the fuseholder location.

17.2.6 Requirements specific to switches with no 'off' position

A tap, a tap switch, or a primary switch that has no off position shall be marked with the text ″Do not operate under load″ (or the equivalent) adjacent to the switch.

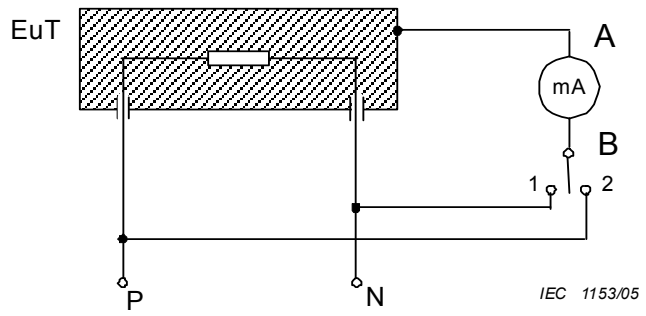
17.2.7 Requirements specific to input connections

If all connectors used in a product are acceptable for use with copper wire only, the product shall be marked ″USE CU WIRE ONLY.″

17.2.8 Requirements specific to factory traceability

If a manufacturer produces or assembles the same product at more than one factory, each finished product shall have a distinctive marking, by which it may be identified as the product of a particular factory.

NDV.1 Modify Annex N by replacing Figure N.1 and its title with the following:

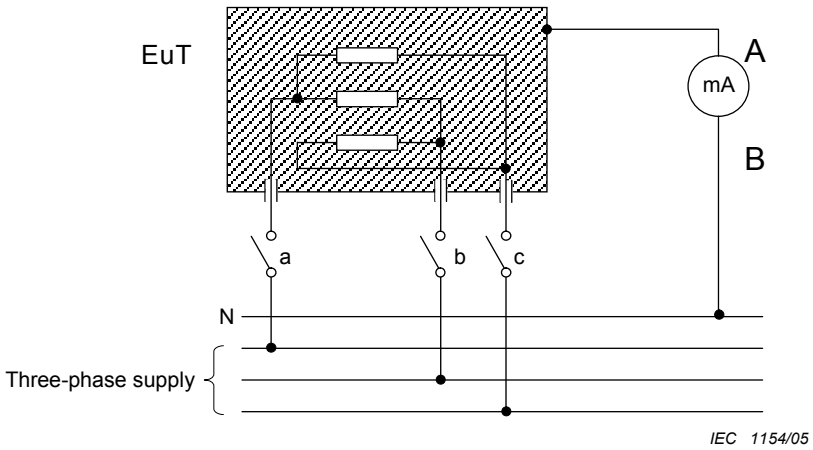


Key

1 switch position for measurement to neutral
2 switch position for measurement to phase
A measuring network connection point to the equipment under test
B measuring network connection point to the switch
EuT equipment under test isolated from earth
mA measuring network shown in Figure 2 used with an appropriate measuring instrument
N neutral
P phase

Figure N.1 – Diagram for leakage current measurement for single-phase connection of appliances other than those of class II

NDV.2 Modify Annex N by replacing Figure N.2 and its title with the following:

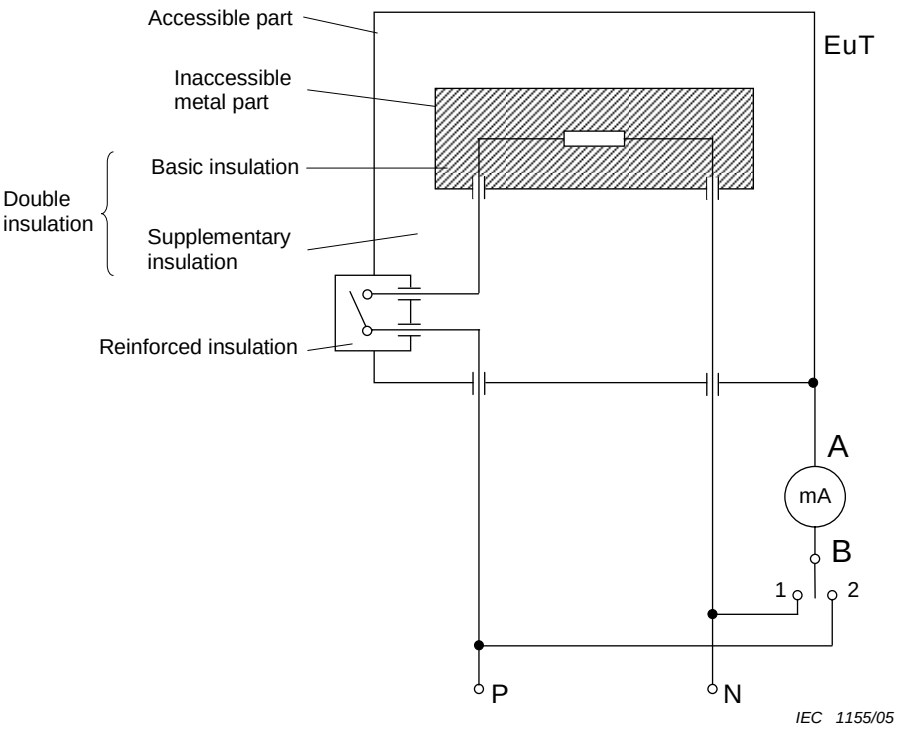


Key

a switch position for measurement to phase a
b switch position for measurement to phase b
c switch position for measurement to phase c
A measuring network connection point to the equipment under test
B measuring network connection point to neutral
EuT equipment under test isolated from earth
mA measuring network shown in Figure 2 used with an appropriate measuring instrument
N neutral

Figure N.2 – Diagram for leakage current measurement for three-phase four-wire system connection of appliances other than class II

NDV.3 Modify Annex N by replacing Figure N.3 and its title with the following:

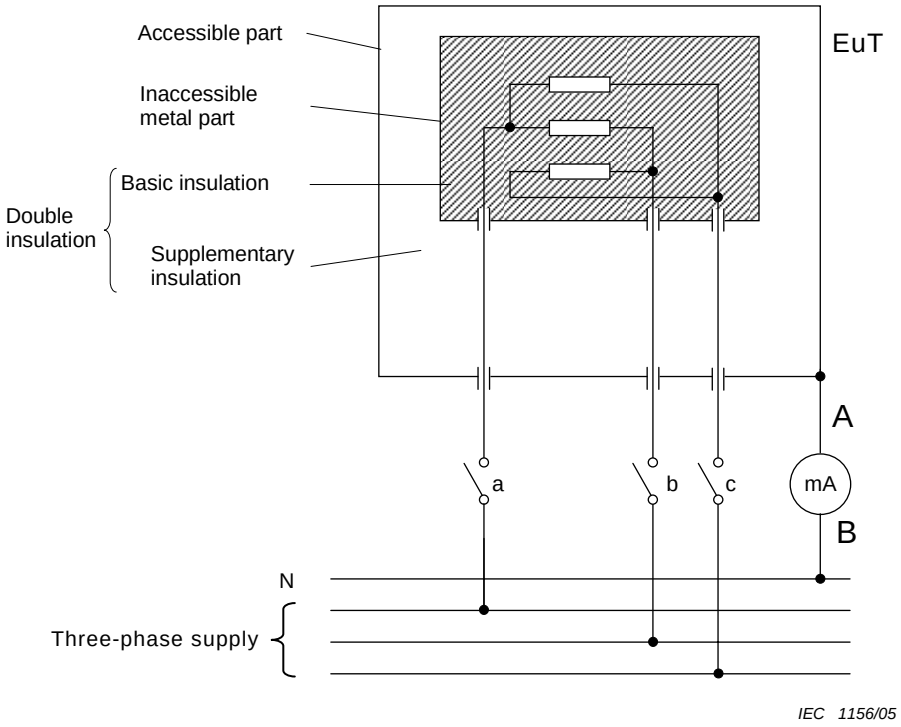


Key

1 switch position for measurement to neutral
2 switch position for measurement to phase
A measuring network connection point to the equipment under test
B measuring network connection point to the switch
EuT equipment under test
mA measuring network shown in Figure 2 used with an appropriate measuring instrument
N neutral
P phase

Figure N.3 – Diagram for leakage current measurement for single-phase connection of Class II Appliances

NDV.4 Modify Annex N by replacing Figure N.4 and its title with the following:



Key

a switch position for measurement to phase a
b switch position for measurement to phase b
c switch position for measurement to phase c
A measuring network connection point to the equipment under test
B measuring network connection point to neutral
EuT equipment under test
mA measuring network shown in Figure 2 used with an appropriate measuring instrument
N neutral

Figure N.4 – Diagram for leakage current measurement for three-phase four-wire system connection of class II appliances

BibliographyDV.1 Modify bibliography by adding the following:

NEMA EW 6, *Guidelines for Precautionary Labeling for Arc-Welding and Cutting Products*

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.
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International Standard IEC 60974-1 has been prepared by IEC technical committee 26: Electric welding.

This third edition cancels and replaces the second edition published in 1998, amendment 1 (2000) and amendment 2 (2003) and constitutes a technical revision.

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

– The scope includes relationship to other parts of IEC 60974.
– Environmental conditions were changed (see 4.a and 4.e).
– Conformity of components is given (see 5.3).
– Sequence of type test was changed (see 5.4).
– More precise requirements for measuring the no-load voltage during routine test are given (see 5.5d).

– Creepage values for printed circuit boards are implemented (see Table 2).
– Requirements for enclosures are changed (see 6.2.1).
– Requirements for primary leakage current are included (see 6.3.7 and Annex N).
– Requirements for engine driven power sources are changed (see 7.1.2 and 7.3.2).
– Requirements for supply circuit terminals are changed (see 10.4.3 and 10.4.4).
– Requirements for cable anchorage are changed (see 10.5).
– Requirements for coupling devices are changed (see 10.9).
– Standard characteristic for plasma welding is included (11.2.6).
– Requirements for welding cables are added (see 11.7).
– Requirements for plastic material used as enclosure materials are added (see 14.2.1).
– Requirements for manual handling are added (see 14.3.2).
– Taken care of existing ISO symbols and labels (see 15.3 and 17.2).

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

FDIS	Report on voting
26/307/FDIS	26/311/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.

IEC 60974 consists of the following parts, under the general title *Arc welding equipment*:

Part 1: Welding power sources
Part 2: Liquid cooling systems
Part 3: Arc striking and stabilizing devices
Part 4: Safety, maintenance and inspection of arc welding equipment in use [1]
Part 5: Wire feeders
Part 6: Limited duty manual metal arc welding power sources
Part 7: Torches
Part 8: Gas consoles for welding and plasma cutting systems
Part 10: Electromagnetic compatibility (EMC) requirements
Part 11: Electrode holders
Part 12: Coupling devices for welding cables
Part 13: Terms [1]

_____

[1] Under consideration.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

ForewordDV.1 Modify the foreword by adding the following:

The numbering system in this standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. Examples: 1 000 means 1,000; 1,01 means 1.01.

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 part of IEC 60974 specifies safety and performance requirements of welding power sources and plasma cutting systems.

This part of IEC 60974 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 is not applicable to testing of power sources during periodic maintenance or after repair.

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

NOTE 2 This part of IEC 60974 does not include electromagnetic compatibility (EMC) requirements.

2 Normative references

The following referenced documents are indispensable for the application 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 60038, *IEC standard voltages*

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

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

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60245-6, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 6: Arc welding electrode cables*

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

2DV.1 Modify clause 2 by deleting the reference to IEC 60309-1

IEC 60417-DB:2002[2], *Graphical symbols for use on equipment*

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[2] "DB" refers to the IEC on-line database.