

INTERNATIONAL STANDARD

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

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INTERNATIONAL STANDARD

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

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ELECTROTECHNICAL
COMMISSION

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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.....	8
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.....	9
4.3.5 Earthing of the workpiece.....	10
4.3.6 Location of gas cylinders.....	11
5 Electromagnetic compatibility (EMC).....	11
5.1 General.....	11
5.2 Assessment of area.....	11
5.3 Methods of reducing emissions.....	11
5.3.1 Public supply system.....	11
5.3.2 Maintenance of arc welding equipment.....	12
5.3.3 Welding cables.....	12
5.3.4 Equipotential bonding.....	12
5.3.5 Earthing of the workpiece.....	12
5.3.6 Screening and shielding.....	12
6 Electromagnetic fields (EMF).....	12
7 Use.....	13
7.1 General requirements.....	13
7.2 Connection between several welding power sources.....	13
7.3 Inspection and maintenance of the welding installation.....	13
7.3.1 Periodical inspection.....	13
7.3.2 Routine inspection.....	13
7.4 Disconnection of welding power sources and/or welding circuits.....	14
7.5 Guards.....	14
7.6 Information for operators.....	14
7.7 Protective measures.....	14
7.7.1 Extraneous conductive parts in the welding area.....	14
7.7.2 Protection against electric shock.....	14
7.8 Isolation of the welding circuit from the workpiece and earth when not in use.....	14
7.9 Voltage between electrode holders or torches.....	15
7.10 Welding in an environment with increased hazard of electric shock.....	17
7.11 Use of shoulder slings.....	17
7.12 Welding at elevated positions.....	18

7.13 Welding with suspended welding equipment.....	18
Annex A (informative) Hazards associated with arc welding	19
Annex B (informative) Voltage drops in the welding circuit	25
Bibliography	27
Figure 1 – Example of d.c. voltage between electrode holders or torches.....	15
Figure 2 – Example of a.c. voltage between electrode holders or torches – Single-phase supply from the same pair of lines of a three-phase mains supply	16
Figure 3 – Example of a.c. voltage between electrode holders or torches – Single-phase supply from different pairs of lines of a three-phase mains supply.....	16
Figure 4 – Example of a.c. voltage between electrode holders connected between different lines of output.....	17
Figure A.1 – Steps for the control of welding fume.....	22
Figure A.2 – Steps of operation for work in confined spaces	24
Figure B.1 – Example of MIG/MAG equipment.....	25
Table 1 – Current ratings for copper welding cables.....	9
Table B.1 – Voltage drop in copper and aluminium welding cables at normal and elevated temperatures.....	26

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.
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International Standard IEC 60974-9 has been prepared by IEC technical committee 26: Electric welding.

This standard cancels and replaces IEC/TS 62081, published in 1999. This first edition constitutes a technical revision. The following major differences with respect to IEC/TS 62081:1999 are to be noted:

- 4.3.3 Welding cables: Now dimensions are recommended.
- 5 Electromagnetic compatibility (EMC): this is completely new.
- 6 Electromagnetic fields (EMF) : this is completely new.

- 7.3 Inspection and maintenance of the welding installation: There is now a differentiation between periodical and routine inspection.

The text of this part of IEC 60974 is based on the following documents:

FDIS	Report on voting
26/404/FDIS	26/405/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 website.

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.

A bilingual version of this standard may be issued at a later date.

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ARC WELDING EQUIPMENT –

Part 9: Installation and use

1 Scope

This part of IEC 60974 is applicable to the installation and 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 part of IEC 60974 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 part of IEC 60974.

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

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

IEC 60974-1:2005, *Arc welding equipment – Part 1: Welding power sources*

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

IEC 60974-6, *Arc welding equipment – Part 6: Limited duty manual metal arc welding power sources*

IEC 60974-10, *Arc welding equipment – Part 10: Electromagnetic compatibility (EMC) requirements*

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

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

3 Terms and definitions

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

3.1

welding circuit

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

[IEC 60974-1:2005, 3.11]

3.2

extraneous conductive part

conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the earth potential

NOTE Electrical installation includes the welding circuit.

3.3

workpiece

metal piece or pieces on which welding or allied processes are performed

3.4

protective clothing and accessories

protective clothing and accessories (e.g. gloves, hand shields, head masks and filter lenses) used in order to diminish electric shock risks and the effects of fume and spatter and to protect the skin and eyes against arc radiation

3.5

environments with increased hazard of electric shock

environments where the hazard of electric shock by arc welding is increased in relation to normal arc welding conditions

NOTE 1 Such environments are found for example

- a) in locations in which freedom of movement is restricted, so that the operator is forced to perform the welding in a cramped (for example kneeling, sitting, lying) position with physical contact with conductive parts;
- b) in locations which are fully or partially limited by conductive elements and in which there is a high risk of unavoidable or accidental contact by the operator;
- c) in wet, damp or hot locations where humidity or perspiration considerably reduces the skin resistance of the human body and the insulating properties of accessories.

NOTE 2 Environments with increased hazard of electric shock are not meant to include places where electrically conductive parts in the near vicinity of the operator which can cause increased hazard have been insulated.

[IEC 60974-1:2005, 3.46]

3.6

industrial and professional use

use intended only for experts or instructed persons

[IEC 60974-1:2005, 3.2]

3.7

expert

competent person

skilled person

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.

[IEC 60974-1:2005, 3.3]

3.8

wire feeder

equipment that delivers filler wire to the arc or weld zone which includes the wire-feed control and means to apply motion to the filler wire and may also include the filler wire supply

[IEC 60974-5:2007, 3.11]

3.9

auxiliary power output

circuit of a welding power source designed to provide electrical power to auxiliary equipment

4 Installation

4.1 General

Welding equipment used in arc welding installations shall be intended for the purpose and shall be built in accordance with IEC 60974-1, IEC 60974-4, IEC 60974-6, IEC 60974-10, IEC 60974-11 and IEC 60974-12 (see Clause 2), as given on the rating plate.

Electromagnetic compatibility (EMC) requirements shall be taken into consideration during installation, see Clause 5.

The requirements of national and local regulations shall be taken into consideration during installation, including grounding or protective earth connections, fuses, supply disconnecting device, type of supply circuit, etc.

Read the manufacturers' instruction manual before installing the equipment. Full use shall be made of the technical information relevant to the welding equipment.

Specific advice may be obtained from the welding equipment manufacturer if necessary.

4.2 Supply circuit

4.2.1 Selection of supply cables

Supply cables for welding equipment and their overload protection, if not provided by the manufacturer, shall be selected in accordance with the information given in the manufacturers' instruction manual.

Supply cables shall be placed, so that they cannot be damaged in use. If that cannot be achieved, a sensitive residual current circuit breaker, capable of operating at a leakage current not exceeding 30 mA in accordance with IEC/TR 60755 shall be used to reduce the risk of electric shock.

4.2.2 Supply disconnecting device

The installer shall ensure that a supply disconnecting device is fitted at the point of supply.

NOTE A plug may be used as supply disconnecting device in accordance with national or local regulation.

4.2.3 Emergency stopping device

When an emergency stopping device is required by national regulation (e.g. automatic welding equipment), it shall conform to relevant IEC standard.

For welding in an environment with increased hazard of electric shock, see 7.10.

4.3 Welding circuit

4.3.1 Isolation from the input supply

The welding circuit and circuits electrically connected to the welding circuit shall be electrically isolated from the mains supply.

Verification shall be carried out by an expert.

4.3.2 Summation of no-load voltages

If more than one welding power source is in use at the same time, their no-load voltages can be cumulative and could create an increased hazard of electric shock. Welding power sources shall be installed so as to minimize this risk. Guidance is given in 7.9.

NOTE 1 In the case of two welding transformers connected to the same lines, the resulting output voltage may be the sum of both no-load voltages. This can be avoided by using a suitable input or output connection (see 7.9).

NOTE 2 Where more than one welding power source is installed, individual welding power sources with their separate controls and connections should be clearly identified to show which items belong to any one welding circuit.

4.3.3 Welding cables

Welding cables shall comply with IEC 60245-6. Copper conductor welding cables shall be selected in accordance with duty cycle and national regulations or, when not existing, current rating given in Table 1. Where long cable runs are involved, it may be necessary to choose the cable size on the basis of voltage drop, see Annex B.

Table 1 – Current ratings for copper welding cables

Nominal cross-sectional area mm ²	Current ratings for specified duty cycle at an ambient temperature of 25 °C ^a						
	100 %	85 %	80 %	60 %	35 %	20 %	8 %
	A	A	A	A	A	A	A
10	100	100	100	101	106	118	158
16	135	136	136	139	150	174	243
25	180	182	183	190	213	254	366
35	225	229	231	243	279	338	497
50	285	293	296	316	371	457	681
70	355	367	373	403	482	602	908
95	430	448	456	498	606	765	1 164
120	500	524	534	587	721	917	1 404
150	580	610	622	689	853	1 090	1 676
185	665	702	717	797	995	1 277	1 971

^a For higher ambient temperatures, a correction factor shall be applied:
0,96 (30 °C) ; 0,91 (35 °C) ; 0,87 (40 °C) ; 0,82 (45 °C).

4.3.4 Connection between the welding power source and the workpiece

When the welding current does not flow entirely in the welding circuit, stray currents, which are components of the welding current, occur. These can cause damage and may be eliminated by the following means:

- a) the electrical connection between the welding power source and the workpieces shall be made as direct as practicable by means of an insulated return cable having an adequate current carrying capacity;
- b) extraneous conductive parts, such as metal rails, pipes and frames shall not be used as part of the welding circuit, unless they constitute the workpiece itself;
- c) the return clamp shall be as near as practicable to the welding arc;

NOTE 1 When the return clamp is removed, it should be electrically isolated from parts connected to earth, e.g. metallic enclosures with protective earth connection (class I), metal floors, building services.

- d) the welding circuit shall not be earthed unless required by national or local regulations (see 4.3.5);
- e) connection of the return cable to the workpiece shall be ensured by the use of devices having suitable means for cable connection, a fastening system not liable to come loose accidentally, and good electrical contact. Magnetic devices only present a good electrical contact if the contact surfaces of the magnetic device and the contact area of the workpiece are sufficiently large, even, conductive and clean (e.g. free from rust and primer) and if the contact area of the workpiece is magnetic;

NOTE 2 If workpieces are on a welding bench or a work-handling device, the return cable may be connected to the bench or device.

- f) connection devices for non-stationary flexible welding cables in the welding circuit shall:
 - 1) have an adequate covering of insulating material to prevent inadvertent contact with live parts, when connected, with the exception of the return clamp at the workpiece itself;
 - 2) be suitable for the sizes of cables used and the welding current;
 - 3) be effectively connected to the welding cables and in good electrical contact with them.

Both the welding cable and the connection device shall be used within their specified current rating. The connection device shall not be fitted with a cable smaller in diameter than specified by the manufacturer of the connection device.

When coupling devices are used, they shall comply with IEC 60974-12.

4.3.5 Earthing of the workpiece

The welding circuit should not be earthed, since it can increase the risk of stray welding currents (see 4.3.3). Earthing of the welding circuit can also increase the area of metal through which a person in contact with the welding circuit (e.g. the welding electrode) could receive a shock.

NOTE 1 There are workpieces which have an inherent connection to earth, e.g. steel structures, ships, pipelines etc. When these are welded, the possibility of stray currents is increased.

NOTE 2 In some cases the workpiece may be in permanent contact with earth, e.g. with protection class I equipment which itself has protective conductors connected to earth. Such a workpiece is considered to be inherently connected to earth.

An assessment of the welding circuit and the welding area shall be made to ensure that stray welding current will not flow through any object connected to earth and not intended or capable of carrying the welding current (e.g. protective earth connection).

If electrical hand-tools are used, which may come into contact with the workpiece, then those tools shall be class II equipment (i.e. with double or reinforced insulation without protective earth connection).

If earthing is required by national or local regulations, the earth connection shall be made by a separate dedicated cable or conductor with a rating of at least that of the return cable and connected directly to the workpiece.