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1999-05

Arc welding equipment – Installation and use

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CONTENTS

	Page
FOREWORD	5
Clause	
1 Scope	7
2 Normative references	7
3 Definitions	9
4 Installation	11
4.1 General	11
4.1.1 Selection of supply cable and protection against overload	11
4.1.2 Supply disconnecting device	11
4.1.3 Emergency stopping device	11
4.1.4 Protection against electric shock from the mains supply	13
4.2 Welding circuit	13
4.2.1 Isolation from the mains supply	13
4.2.2 Welding voltage supply	13
4.2.3 Connection between the welding power source and the work piece	13
4.2.4 Earthing of the work piece	15
4.2.5 Location of gas cylinders	15
5 Use	17
5.1 General requirements	17
5.2 Connection between several welding power sources	17
5.3 Inspection and maintenance of the welding installation	17
5.4 Disconnection of welding power sources and/or welding circuits	17
5.5 Guards	19
5.6 Information for operators	19
5.7 Protective measures	19
5.7.1 Extraneous conductive parts in the welding area	19
5.7.2 Protection against electric shock	19
5.8 Isolation of the welding circuit from the work piece and earth when not in use	19
5.9 Voltage between electrode holders or torches/guns	21
5.10 Welding in an environment with increased hazard of electric shock	25
5.11 Use of shoulder slings	27
5.12 Welding at elevated positions	27
Annex A – Hazards connected with arc welding	29
Bibliography	41

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ARC WELDING EQUIPMENT –
Installation and use**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62081, which is a technical specification, has been prepared by technical committee 26: Electric welding.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
26/136/CDV	26/143 + 143A/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

ARC WELDING EQUIPMENT – Installation and use

1 Scope

This technical specification is applicable to the installation and industrial and professional use of welding power sources, equipment and accessories for arc welding and allied processes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this technical specification. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical specification are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050-195:1998, *International Electrotechnical Vocabulary – Part 195: Earthing and protection against electric shock*

IEC 60204-1:1997, *Electrical equipment of industrial machines – Part 1: General requirements*

IEC 60364-4-41:1992, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 41: Protection against electric shock*

IEC 60947-2:1995, *Low-voltage switchgear and controlgear – Part 2: Circuit breakers*

IEC 60974-1:1998, *Arc welding equipment – Part 1: Welding power sources*

IEC 60974-11:1992, *Arc welding equipment – Part 11: Electrode holders*

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

IEC 61008 (all parts), *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCB's)*

IEC 61009 (all parts), *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBO's)*

IEC 61140:1997, *Protection against electric shock – Common aspects for installation and equipment*

3 Definitions

For the purpose of this technical specification, the following definitions apply:

3.1

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 arc may be established between two electrodes. In such a case, the work piece is not necessarily a part of the welding circuit. [IEC 60974-1, 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 electric potential of a local earth [IEV 195-06-11]

NOTE – Electrical installation includes the welding circuit.

3.3

work piece

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 position (kneeling, sitting, lying) 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, 3.46]

3.6

industrial and professional use

use intended only for experts or instructed persons [IEC 60974-1, 3.2]

3.7

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 [IEC 60974-1, 3.3]

3.8

wire feeder

equipment that delivers filler wire to the arc or weld zone. It includes the wire feed control and means to apply motion to the filler wire. It may also include the filler wire supply [IEC 60974-5, 3.1]

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 power sources, equipment, cables and accessories used in arc welding installations should be intended for the purpose and built according to the relevant standards, e.g. IEC 60974-1.

Electromagnetic compatibility (EMC) requirements should be taken into consideration during installation.

Full use should be made of the technical data relevant to the welding equipment e.g. manufacturers' instructions.

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

4.1.1 Selection of supply cable and protection against overload

Supply cables for welding power sources and their overload protection should be selected according to the information given by the manufacturer of the welding equipment.

Supply cables should be placed or armoured, 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 according to IEC 61008, IEC 61009 or IEC 60947-2 (annex B) should be used to reduce the risk of electric shock.

For equipment other than that covered by clause 4, IEC 60204-1 may be applicable.

4.1.2 Supply disconnecting device

If the welding equipment is not fitted with a supply disconnecting device, the installer should ensure that such a device is fitted at the point of supply.

4.1.3 Emergency stopping device

Emergency stopping device should conform to IEC 60204-1.

NOTE – For welding in an environment with increased hazard of electric shock (see additionally 5.1).

4.1.4 Protection against electric shock from the mains supply

Equipment should be constructed according to the relevant standard, e.g. IEC 60204-1 and IEC 60974-1.

4.2 Welding circuit

4.2.1 Isolation from the mains supply

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

Verification should be carried out by an expert.

4.2.2 Welding voltage supply

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 should be installed so as to minimize this risk. Guidance is given in 5.9.

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 5.9).

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.

4.2.3 Connection between the welding power source and the work piece

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 should be eliminated by the following means:

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

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

- d) The welding circuit should not be earthed unless required by national or local regulations (see 4.2.4).
- e) Connection of the welding return cable to the work piece should 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 work piece are sufficiently large, even, conductive and clean (e.g. free from rust and primer) and if the contact area of the work piece is magnetic.

NOTE – If work pieces 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 should
- 1) have an adequate covering of insulating material to prevent inadvertent contact with live parts, when connected, with the exception of the welding return current clamp at the work piece 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 should be used within their specified current rating. The connection device should not be fitted with a cable smaller in diameter than specified by the manufacturer of the connection device.

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


4.2.4 Earthing of the work piece

The welding circuit should not be earthed, since it can increase the risk of stray welding currents (see 4.2.3). 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 work pieces 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 work piece may be in permanent contact with earth, e.g. with protection class I equipment which itself has protective conductors connected to earth. Such a work piece is considered to be inherently connected to earth.

An assessment of the welding circuit and the welding area should ensure that welding current will not flow through a connection intended for the protective earth connection of equipment frame conduit or any object connected to earth but not intended or capable to carry the welding current.

If electrical tools are used, which may come into contact with the work piece, then those tools should be of 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 should be made by a separate dedicated cable or conductor with a rating of at least that of the welding return cable and connected directly to the work piece.

Precautions should be taken to insulate the operator from earth as well as from the work piece (see 5.7.2).

NOTE 3 – Where external radio frequency suppression networks are connected to the welding circuit, an expert should assess whether the welding circuit can still be regarded as insulated from earth.

NOTE 4 – External radio frequency suppression networks could consist of a number of different components e.g. LCR filters (inductance/capacitance/resistance).

4.2.5 Location of gas cylinders

Care should be taken to prevent gas cylinders in the vicinity of the work piece becoming part of the welding circuit.