

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Arc welding equipment –
Part 4: Periodic inspection and testing**

**Matériel de soudage à l'arc –
Partie 4: Inspection et essais périodiques**

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IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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ARC WELDING EQUIPMENT –**Part 4: Periodic inspection and testing**

FOREWORD

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International Standard IEC 60974-4 has been prepared by IEC technical committee 26: Electric welding.

This second edition cancels and replaces the first edition published in 2006. It constitutes a technical revision.

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

- title is amended;
- scope is extended to equipment designed in accordance with IEC 60974-6;
- complementary instructions from the manufacturer shall be followed;
- qualification of test personnel is clarified (see 4.1);
- plasma cutting power sources are excluded from no-load voltage test (see 5.6);
- voltage reducing device functional test is simplified (see 6.3);
- supply voltage is recorded in test report (see 7.1).

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

FDIS	Report on voting
26/422/FDIS	26/428/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 stability 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

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ARC WELDING EQUIPMENT –

Part 4: Periodic inspection and testing

1 Scope

This part of IEC 60974 specifies test procedures for periodic inspection and, after repair, to ensure electrical safety. These test procedures are also applicable for maintenance.

This standard is applicable to power sources for arc welding and allied processes designed in accordance with IEC 60974-1 or IEC 60974-6. Stand-alone ancillary equipment designed in accordance with other part of IEC 60974 may be tested in accordance with relevant requirement of this part of IEC 60974.

NOTE 1 The welding power source may be tested with any ancillary equipment fitted that could affect the test results.

This standard is not applicable to testing of new power sources or engine-driven power sources.

NOTE 2 For a power source not built in accordance with IEC 60974-1, see Annex C.

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

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

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

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

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

IEC 61557-4, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 4: Resistance of earth connection and equipotential bonding*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in the IEC 60050-151, the IEC 60050-195, the IEC 60050-851, the IEC 60974-1, as well as the following, apply.

3.1
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 60974-1:2005, 3.3]

3.2
instructed person

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

NOTE If necessary, the person has undergone some training

[IEC 60974-1:2005, 3.4]

3.3
periodic inspection and test

examination carried out at specified intervals to reduce the risk of hazard

3.4
maintenance

service carried out at specified intervals to reduce the risk of hazard and failure

3.5
repair

restore to a safe and intended operating condition

3.6
test personnel

instructed person or expert that has been trained and authorized to perform periodic inspection and testing

4 General requirements

4.1 Qualification of test personnel

Tests of welding equipment can be hazardous and shall be carried out by an instructed person or expert in the field of electrical repair, preferably also familiar with welding, cutting and allied processes. Instructed persons should be considered qualified for simple periodic testing and maintenance provided the equipment enclosure does not have to be opened.

NOTE Hazardous voltages and currents inside the equipment enclosure may cause shock, burn or death. Only expert test personnel may open the equipment.

4.2 Test conditions

Tests shall be carried out at an ambient air temperature between 10 °C and 40 °C on dry and cleaned welding equipment.

4.3 Measuring instruments

The accuracy of measuring instruments shall be class 2.5 as a minimum, except for the measurement of insulation resistance, where the accuracy of the instruments is not specified but shall be taken into account for the measurement.

4.4 Periodic inspection and test

The periodic inspection and test specified in Table 1 shall be carried out.

Tests shall be documented in a test report in accordance with 7.1.

During the tests, complementary instructions from the manufacturer shall be followed.

4.5 Maintenance

The manufacturer's maintenance schedule and instructions shall be followed.

Tests shall be documented in a test report in accordance with 7.1.

4.6 Repair

After repair or replacement of a component which restores a welding or cutting function, an expert shall select appropriate tests to be carried out, as specified in Table 1.

NOTE After a minor repair such as replacement of a lamp, wheel or under carriage, the tests given in Table 1 may not be necessary.

Tests shall be documented in a test report in accordance with 7.1.

During the tests, complementary instructions from the manufacturer shall be observed (for example, circuit diagrams, spare part list, functional test of power source and ancillary equipment, etc.).

4.7 Test sequence

The test sequence is given in Table 1.

Table 1 – Test sequence on used arc welding equipment

Periodic inspection and test	After repair
a) Visual inspection in accordance with 5.1	a) Visual inspection in accordance with 5.1
b) Electrical test: <ul style="list-style-type: none"> – protective conductor resistance in accordance with 5.2 – insulation resistance^a in accordance with 5.3 – no-load voltage in accordance with 5.6 	b) Electrical test: <ul style="list-style-type: none"> – protective conductor resistance in accordance with 5.2 – insulation resistance^a in accordance with 5.3 – no-load voltage in accordance with 5.6
c) Functional test: <ul style="list-style-type: none"> – no requirement 	c) Functional test: <ul style="list-style-type: none"> – function in accordance with 6.1 – supply-circuit on/off switching device in accordance with 6.2 – voltage-reducing device in accordance with 6.3 – magnetic gas valve in accordance with 6.4 – signal and control lamps in accordance with 6.5
d) Documentation in accordance with Clause 7	d) Documentation in accordance with Clause 7
<p>^a If the insulation resistance test cannot be carried out without disconnection of any component of the equipment to be tested (e.g. interference suppression networks, protection capacitors or surge protection component), the insulation resistance test may be replaced by both the primary and welding circuit leakage current tests in accordance with 5.4 and 5.5.</p>	

5 Protection against electrical shock

5.1 Visual inspection

Visual inspection shall be carried out in accordance with the conditions of use of welding equipment and the manufacturer's instructions.

An example of items for a visual inspection is given in Annex A.

5.2 Continuity of the protective circuit

For mains-powered welding equipment of protection class I, including ancillary equipment (for example, cooling system) having mains connecting cables up to a length of 5,0 m, the maximum measured protective conductor resistance shall not exceed 0,3 Ω.

For cables longer than 5,0 m, the permissible value of the protective conductor resistance is increased by 0,1 Ω per additional 7,5 m cable. The maximum permissible value of the protective conductor resistance is 1 Ω.

Conformity shall be checked by measuring the resistance between the protective conductor contact at the plug and exposed conductive parts with testing equipment according to IEC 61557-4.

During the measurement, the cables shall be bent, flexed or twisted along the whole length, especially in the vicinity of cable entries into the enclosure, in order to detect interruptions in the protective conductor.

5.3 Insulation resistance

The insulation resistance shall be not less than the values given in Table 2.

Table 2 – Insulation resistance

Measurement ^a			Resistance	Insulation
Supply circuit	to	welding circuit	5,0 MΩ	Double or reinforced
Welding circuit	to	protective circuit	2,5 MΩ	Basic
Supply circuit	to	protective circuit	2,5 MΩ	Basic
Supply circuit of Class II equipment	to	accessible surfaces ^b	5,0 MΩ	Double or reinforced
a Control circuits are tested together with the circuit to which they are galvanically connected.				
b For measurement to accessible non-conductive surfaces, such surfaces shall be considered to be covered by metal foil.				

Conformity shall be checked by the stabilized measurement of the insulation resistance by application of a d.c. voltage of 500 V at room temperature.

During the measurement, torches shall be disconnected, solid-state electronic components and their protective devices may be short-circuited and liquid cooling units shall be tested without liquid.

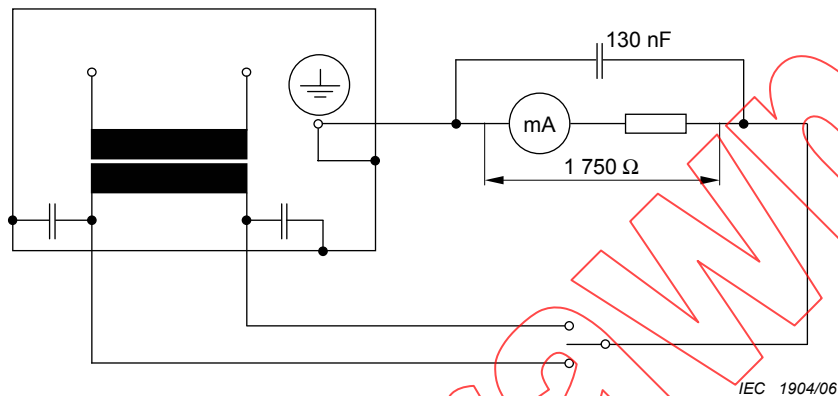
5.4 Welding circuit leakage current

The leakage current between the welding outlets and the protective conductor terminal shall not exceed 10 mA a.c. r.m.s.

Conformity shall be checked by measurement of the leakage current with a circuit as shown in Figure 1 at the rated supply voltage and no-load condition.

The measuring circuit shall have a total resistance of $1\,750\ \Omega \pm 250\ \Omega$ and be shunted by a capacitor so that the time constant of the circuit will be $225\ \mu\text{s} \pm 15\ \mu\text{s}$.

In the case of $1\,750\ \Omega$, the capacitor will be $130\ \text{nF}$.



NOTE For class II equipment, use the PE-terminal of earthed supply circuit network.

Figure 1 – Measurement of leakage current of welding circuit

5.5 Primary leakage current

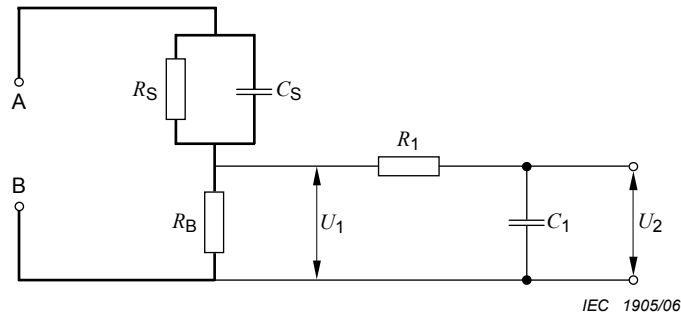
The primary leakage current in the external protective conductor shall not exceed

- 5 mA r.m.s. for plug-connected equipment rated up to and including 32 A;
- 10 mA r.m.s. for plug-connected equipment rated more than 32 A;
- 10 mA r.m.s. for equipment for permanent connection, without special measures for the protective conductor;
- 5 % of the rated input current per phase, for equipment for permanent connection with a reinforced protective conductor.

Conformity shall be checked using the measuring circuit shown in Figure 2 with a conventional voltmeter under the following conditions:

- the welding equipment is
 - isolated from the ground plane;
 - supplied by the rated supply voltage;
 - not connected to the protective earth except through measurement components;
- the output circuit is in the no-load condition;
- interference suppression capacitors shall not be disconnected.

NOTE 1 The circuit given in Figure 2 is used to obtain reproducible results.



Key

A, B	test terminals	U_1	rated supply voltage
R_S	1 500 Ω	R_1	10 000 Ω
R_B	500 Ω	U_2	conventional load voltage
C_S	0,22 μF	C_1	0,022 μF

$$\text{Leakage current } I_{PE} = \frac{U_2}{R_B}$$

Figure 2 – Measuring network for primary leakage current

The measurement of the primary leakage current may be made direct or in the form of a difference current measurement (see Figure 3). Instead of the ammeter shown in Figure 3, the measuring circuit in Figure 2 shall be used. The tolerance of the component values in the measurement circuit shall not exceed $\pm 5\%$.

Equipment for permanent connection with a reinforced protective conductor shall be tested according to the manufacturer's specification.

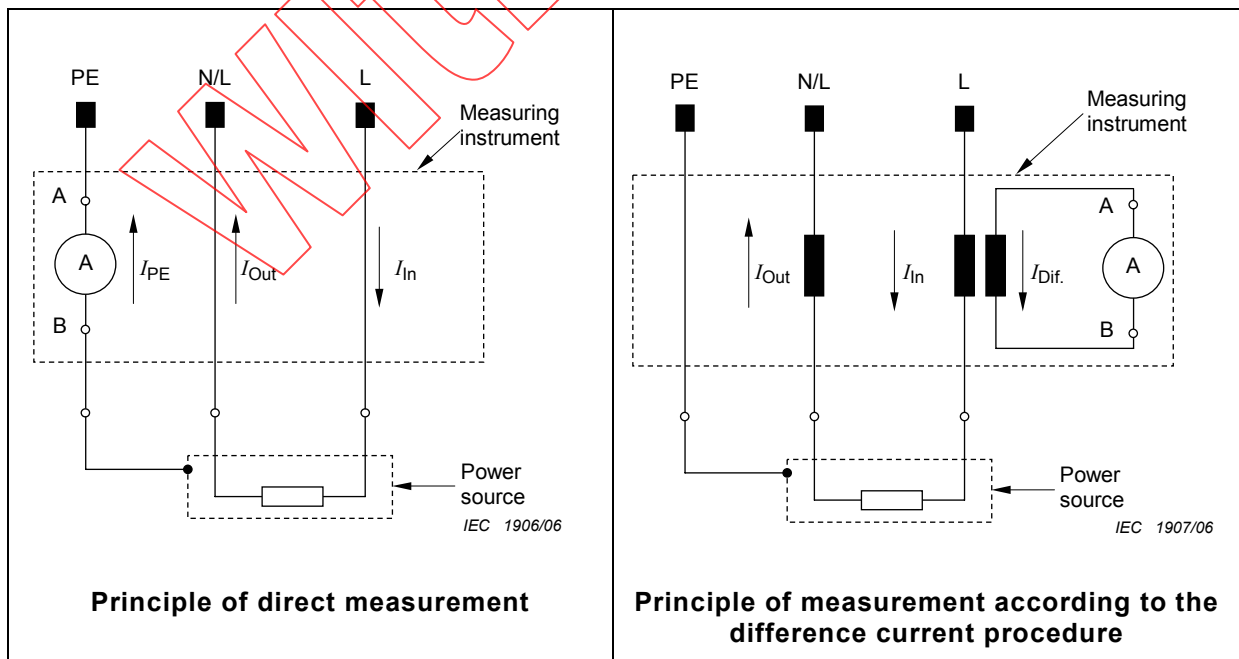


Figure 3 – Principles of primary leakage current measurement for single phase equipment

NOTE 2 Caution! A qualified person should perform this test. The protective conductor is disabled for this test.