

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Arc welding equipment –
Part 7: Torches

STANDARD PREVIEW
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Matériel de soudage à l'arc –
Partie 7: Torches

[IEC 60974-7:2019](#)

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ARC WELDING EQUIPMENT –

Part 7: Torches

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International Standard IEC 60974-7 has been prepared by IEC technical committee 26: Electric welding.

This fourth edition cancels and replaces the third edition published in 2013 and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) definitions 3.11 and 3.20 were revised;
- b) requirements for ARC STRIKING AND STABILIZING VOLTAGE rating have been added to the sequence of type tests (see 6.2);
- c) the AC test voltage requirement for TORCHES that utilize ARC STRIKING AND STABILIZING VOLTAGES has been revised (see 7.5.2);

- d) the test configuration of isolated circuits for TORCHES that utilize ARC STRIKING AND STABILIZING VOLTAGES has been revised (see 7.5.2);
- e) the metal tube used for the heating tests has additional allowable means of cooling methods (see 8.3.2 and 8.3.5);
- f) for FUME EXTRACTION TORCHES, the instructions for use include additional information (see Clause 13, item i)).

The text of this International Standard is based on the following documents:

FDIS	Report on voting
26/673/FDIS	26/678/RVD

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

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

In this standard, the following print types are used:

- conformity statements: *in italic type*;
- terms used throughout this standard which have been defined in clause 3: SMALL ROMAN CAPITALS.

This document is to be used in conjunction with IEC 60974-1:2017.

A list of all parts in the IEC 60974 series, published under the general title *Arc welding equipment*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

ARC WELDING EQUIPMENT –

Part 7: Torches

1 Scope

This part of IEC 60974 specifies safety and construction requirements for TORCHES used for arc welding and allied processes. This document is applicable to MANUAL, MECHANICALLY GUIDED, AIR-COOLED, LIQUID-COOLED, MOTORIZED, SPOOL-ON and FUME EXTRACTION TORCHES.

In this document, a TORCH consists of the TORCH BODY, the CABLE-HOSE ASSEMBLY and other components.

This document is also applicable to a CABLE-HOSE ASSEMBLY connected between a power source and ancillary equipment.

This document is not applicable to electrode holders for manual metal arc welding or air-arc cutting/gouging.

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

NOTE 2 Other components are listed in Table A.1.

NOTE 3 In this document, all procedures and requirements are the same for "TORCHES" and "GUNS". For convenience, the term "TORCH" is used in the following text.

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2 Normative references

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The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60974-1:2017, *Arc welding equipment – Part 1: Welding power sources*

ISO 21904-3:2018, *Health and safety in welding and allied processes – Requirements, testing and marking of equipment for air filtration – Part 3: Determination of the capture efficiency of on-torch welding fume extraction devices*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

NOTE Additional terminology is given in Annex A.

3.1

torch

device that conveys all services necessary to the arc for welding, cutting or allied processes (for example, current, gas, coolant, ELECTRODE WIRE)

[SOURCE: IEC 60050-851:2008, 851-14-21]

3.2

gun

TORCH with a HANDLE substantially perpendicular to the TORCH BODY

[SOURCE: IEC 60050-851:2008, 851-14-22]

3.3

torch body

main component to which the CABLE-HOSE ASSEMBLY and other components are connected

[SOURCE: IEC 60050-851:2008, 851-14-29]

3.4

handle

part designed to be held in the operator's hand

[SOURCE: IEC 60050-851:2008, 851-14-28, modified – The statement “of a TORCH or an electrode holder” after the term is deleted.]

3.5

gas nozzle

component at the exit end of the TORCH directing the shielding gas around the arc and over the weld pool

[SOURCE: IEC 60050-851:2008, 851-14-56]

3.6

wire electrode

solid or tubular FILLER WIRE which conducts welding current

[SOURCE: IEC 60050-851:2008, 851-14-02]

3.7

contact tip

replaceable metal component fixed at the front end of the TORCH, which transfers the welding current to, and guides, the WIRE ELECTRODE

[SOURCE: IEC 60050-851:2008, 851-14-17]

3.8

cable-hose assembly

flexible assembly of cables and hoses, and their connecting elements, that delivers supplies to the TORCH BODY or ancillary equipment

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[SOURCE: IEC 60050-851:2008, 851-14-34, modified – The definition is expanded to include ancillary equipment and the word “supplies” is used instead of “all necessary services”.

**3.9
manual torch**

TORCH held and guided by the operator's hand during its operation

[SOURCE: IEC 60050-851:2008, 851-14-24]

**3.10
mechanically guided torch**

TORCH fixed to, and guided by, a mechanical device during its operation

[SOURCE: IEC 60050-851:2008, 851-14-25]

**3.11
air-cooled torch**

TORCH cooled by the ambient air and, where appropriate, by gas flow

**3.12
liquid-cooled torch**

TORCH cooled by the circulation of a cooling liquid

**3.13
motorized torch**

TORCH incorporating means to supply motion to the WIRE ELECTRODE

[SOURCE: IEC 60050-851:2008, 851-14-26]

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**3.14
spool-on torch**

MOTORIZED TORCH incorporating a FILLER WIRE supply

[SOURCE: IEC 60050-851:2008, 851-14-27]

**3.15
arc striking and stabilizing voltage**

voltage superimposed on the welding circuit to initiate or maintain the arc or both

**3.16
filler metal**

metal added during welding or allied processes

[SOURCE: IEC 60050-851:2008, 851-14-43]

**3.17
filler wire**

FILLER METAL, in solid or tubular wire form, which may or may not be part of the welding circuit

[SOURCE: IEC 60050-851:2008, 851-14-44]

**3.18
plasma tip**

component that provides the constricting orifice through which the plasma arc passes

[SOURCE: IEC 60050-851:2008, 851-14-18]

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3.19 visual inspection

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

[SOURCE: IEC 60050-851:2008, 851-11-11]

3.20 plasma cutting system

combination of power source, TORCH, and associated devices for plasma cutting/gouging

[SOURCE: IEC 60050-851:2008, 851-13-03, modified – The word “safety” is deleted between the words “associated” and “devices”.]

3.21 plasma cutting power source

equipment for supplying current and voltage and having the required characteristics suitable for plasma cutting/gouging and which may supply gas and cooling liquid

Note 1 to entry: A PLASMA CUTTING POWER SOURCE may also supply services to other equipment and auxiliaries, for example auxiliary power, cooling liquid, and gas.

[SOURCE: IEC 60050-851:2008, 851-13-04, modified – The word “electric” is deleted before the word “current”.]

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3.22 torch coupling device

part of TORCH connecting the CABLE-HOSE ASSEMBLY to the welding equipment

Note 1 to entry: A TORCH COUPLING DEVICE may include several connecting parts.
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3.23 fume extraction torch

TORCH that incorporates means to capture the welding fumes

4 Environmental conditions

TORCHES shall be capable of operation when the following environmental conditions prevail:

- a) range of ambient air temperature:
during operation: –10 °C to +40 °C;
- b) relative humidity of the air:
up to 50 % at 40 °C;
up to 90 % at 20 °C.

TORCHES shall withstand storage and transport at an ambient air temperature of –20 °C to +55 °C without any damage to function and performance.

NOTE Different environmental conditions can be agreed upon between the manufacturer and the purchaser. Examples of these conditions are: high humidity, unusually corrosive fumes, steam, excessive oil vapour, abnormal vibration or shock, excessive dust, severe weather conditions, unusual coastal or shipboard conditions, vermin infestation and atmospheres conducive to the growth of mould.

5 Classification

5.1 General

TORCHES shall be classified in accordance with:

- a) the process for which they are designed, see 5.2;
- b) the method by which they are guided, see 5.3;
- c) the type of cooling, see 5.4;
- d) the method of striking the main arc for plasma processes, see 5.5.

5.2 Process

TORCHES can be designed for:

- a) MIG/MAG welding;
- b) self-shielded flux-cored arc welding;
- c) TIG welding;
- d) plasma welding;
- e) submerged arc welding;
- f) plasma cutting/gouging.

5.3 Guidance

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Methods of TORCH guidance: **(standards.iteh.ai)**

- a) manual;
- b) mechanical.

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5.4 Cooling

Type of TORCH cooling method:

- a) ambient air or shielding gas, see 3.11;
- b) liquid, see 3.12.

5.5 Main arc striking for plasma processes

Methods for striking the main arc:

- a) by an arc striking voltage;
- b) by a pilot arc;
- c) by contact.

6 Test conditions

6.1 General

Tests shall be carried out on new and completely assembled TORCHES, fitted with the CABLE-HOSE ASSEMBLY normally supplied.

All tests shall be carried out at any ambient air temperature given in Clause 4, item a).

The accuracy of measuring instruments shall be:

- a) electrical measuring instruments: class 1 ($\pm 1\%$ of full-scale reading), except for the measurement of insulation resistance and dielectric strength where the accuracy of the instruments is not specified, but shall be taken into account for the measurement;
- b) temperature measuring device: ± 2 K.

6.2 Type tests

Unless otherwise specified, the tests in this document are type tests.

The type tests given below shall be carried out on the same sample and in the following sequence:

- a) general VISUAL INSPECTION;
- b) insulation resistance (preliminary check), see 7.2 without humidity treatment;
- c) impact resistance, see 11.1;
- d) resistance to hot objects, see Clause 10;
- e) protection against direct contact, see 7.4;
- f) insulation resistance, see 7.2;
- g) dielectric strength, see 7.3;
- h) requirements for ARC STRIKING AND STABILIZING VOLTAGE rating, see 7.5;
- i) general VISUAL INSPECTION.

The heating test in accordance with 8.3 may be carried out on a separate sample and shall be followed by the coolant leakage test in accordance with Clause 9. The other tests included in this document and not listed here may be carried out in any convenient sequence.

6.3 Routine tests

[IEC 60974-7:2019](https://standards.iteh.ai/catalog/standards/sist/27603bf0-e04f-4806-a625-e6ff16745c01/iec-60974-7-2019)

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The following routine tests shall be carried out on each TORCH in the following sequence:

- a) general VISUAL INSPECTION;
- b) functional test as specified by the manufacturer, for example, leaks of fluid or gas, trigger operation.

7 Protection against electric shock

7.1 Voltage rating

TORCHES shall be rated according to the classification and use as given in Table 1.

Table 1 – Voltage rating of TORCHES

Classification	Voltage rating V_{peak}	Insulation resistance MΩ	Dielectric strength V RMS	Degree of protection in accordance with IEC 60529			
				NOZZLE orifice	HANDLE	TORCH COUPLING DEVICE ^a	Other parts ^{b, c}
Manually guided TORCHES except for plasma cutting	113	1	1 000	IP0X	IP3X	IP2X	IP3X
MECHANICALLY GUIDED TORCHES except for plasma cutting and submerged arc welding	141	1	1 000	IP0X	Not applicable	IPXX	IP2X
MECHANICALLY GUIDED submerged arc welding TORCHES	141	1	1 000	IP0X	Not applicable	IPXX	IPXX
Manually guided plasma cutting TORCHES	500	2,5	2 100	PLASMA TIP, see 7.4.2	IP4X	IP3X	IP3X
MECHANICALLY GUIDED plasma cutting TORCHES	500	2,5	2 100	IP0X	Not applicable	IP2X	IP2X

^a Degree of protection for TORCH COUPLING DEVICE is tested while coupled.

^b Other parts are, for example, GAS NOZZLE, neck.

^c Wire drive systems of MOTORIZED TORCHES that are accessible to touch are not considered as other parts: IPXX.

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7.2 Insulation resistance

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The insulation resistance of a new TORCH shall, after the humidity treatment, be not less than the values given in Table 1.

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Conformity shall be checked by the following test:

a) Humidity treatment

A humidity cabinet is maintained at a temperature t between 20 °C and 30 °C and a relative humidity between 91 % and 95 %.

The TORCH fitted with the CABLE-HOSE ASSEMBLY (LIQUID-COOLED TORCHES without cooling liquid) is brought to a temperature between t and $(t + 4)$ °C and is then placed for 48 h in the humidity cabinet.

b) Insulation resistance measurement

Immediately after the humidity treatment, the TORCH HANDLE and 1 m at each end of the CABLE-HOSE ASSEMBLY are wiped clean and tightly wrapped in a metal foil covering the external surface of the insulation.

The insulation resistance is measured by the application of a DC voltage of 500 V between

– all circuits and the metal foil,

and

– all wires and circuits intended to be isolated from each other within the TORCH.

The reading is made after stabilization of the measurement.

7.3 Dielectric strength

7.3.1 General requirement

The insulation shall withstand the test voltages of Table 1 without any flashover or breakdown.

The AC test voltage shall be of an approximate sine waveform with a peak value not exceeding 1,45 times the voltage of Table 1, having a frequency of approximately 50 Hz or 60 Hz. Alternatively, a DC test voltage of 1,4 times the RMS test voltage may be used.

Conformity shall be checked by the following test:

LIQUID-COOLED TORCHES are tested without cooling liquid.

The HANDLES are tightly wrapped with a metal foil. The CABLE-HOSE ASSEMBLY is placed in contact with a conductive surface throughout its entire length, for example wrapped around a metal cylinder or coiled on a flat metal surface. The metal foil and the conductive surface are electrically connected.

The full value of the test voltage is applied for 60 s between:

- a) the conductive surface and each isolated circuit;
- b) all circuits intended to be isolated from each other (e.g. trigger or other remote control circuits).

At the discretion of the manufacturer, the test voltage may be slowly raised to the full value.

The maximum permissible setting of the overload release shall be 100 mA. The high-voltage transformer shall deliver the prescribed voltage up to the tripping current. Tripping is regarded as a flashover or breakdown.

NOTE For the operator's safety, the lowest setting of the tripping current (less than or equal to 10 mA) is typical.

7.3.2 Additional requirements for plasma cutting TORCHES

In addition for manual plasma cutting TORCHES the insulation between the HANDLE and the cutting circuit shall withstand a test voltage of 3 750 V RMS. During the dielectric strength test of plasma cutting TORCHES, the electrode and PLASMA TIP connections shall be electrically connected together.

Conformity shall be checked by the test given in 7.3.1.

7.4 Protection against electric shock in normal service (direct contact)

7.4.1 Degree of protection requirements

TORCHES shall meet the degree of protection requirements of Table 1. In addition CABLE-HOSE ASSEMBLY shall meet the degree of protection IP 3X. TORCHES are not intended for operation during rain or snow or equivalent conditions.

Conformity shall be checked in accordance with IEC 60529.

7.4.2 Additional requirements for plasma cutting TORCHES

The plasma cutting TORCH, parts (e.g. parts typically replaced due to wear) and PLASMA CUTTING POWER SOURCE, recommended by the manufacturer, shall form a safe system.