

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

Arc welding equipment –  
Part 8: Gas consoles for welding and plasma cutting systems  
(standards.iteh.ai)

Matériel de soudage à l'arc –  
Partie 8: Consoles de gaz pour soudage et systèmes de coupage plasma

IEC 60974-8:2009  
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## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Terms and definitions .....	6
4 Environmental conditions.....	7
5 Tests .....	7
5.1 Test conditions .....	7
5.2 Measuring instruments .....	7
5.3 Conformity of components .....	7
5.4 Type tests .....	7
5.5 Routine tests .....	8
5.5.1 External gas console .....	8
5.5.2 Internal gas console .....	8
6 Protection against electric shock .....	8
6.1 Insulation .....	8
6.2 Protection against electric shock in normal service (direct contact) .....	8
6.2.1 Protection provided by the enclosure .....	8
6.2.2 Capacitors .....	8
6.3 Protection against electric shock in case of a fault condition (indirect contact) .....	8
7 Thermal requirements.....	9
7.1 Heating test.....	9
7.2 Maximum temperature .....	9
8 Connections for plasma cutting torches.....	9
9 Mechanical requirements.....	9
9.1 Protection against fire or explosion.....	9
9.2 Gas line purging .....	9
9.3 Enclosure .....	10
9.3.1 Design requirements.....	10
9.3.2 Enclosure purging.....	10
9.3.3 Safe design of gas console.....	11
9.3.4 Open structure.....	11
9.3.5 Solid filled enclosure .....	11
9.4 External gas console .....	11
9.5 Internal gas console .....	12
10 Gas lines .....	12
10.1 Gas hoses and tubing.....	12
10.2 Gas fittings.....	12
10.3 Leak test .....	12
11 Control circuits .....	13
12 Rating plate.....	13
12.1 External gas console .....	13
12.2 Internal gas console .....	13
13 Instructions and markings.....	14
13.1 Instructions .....	14
13.2 Marking .....	14

Annex A (informative) Mechanized plasma system diagram .....	15
Annex B (informative) Example of a rating plate layout .....	16
Bibliography.....	17
Figure A.1 – Example of a mechanized plasma system.....	15
Figure B.1 – Principle of a rating plate .....	16
Table 1 – Colour coding and marking.....	12

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## ARC WELDING EQUIPMENT –

## Part 8: Gas consoles for welding and plasma cutting systems

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International Standard IEC 60974-8 has been prepared by IEC technical committee 26: Electric welding.

This standard is to be used in conjunction with IEC 60974-1.

This second edition cancels and replaces the first edition published in 2004. This edition constitutes a technical revision.

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

- removal of intrinsically safe design;
- introduction of gas mixing function;
- new informative rating plate layout;
- induced changes due to publication of IEC 60974-1, edition 3.

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

CDV	Report on voting
26/381/CDV	26/391/RVC

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

The French version of this standard has not been voted upon.

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

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

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## ARC WELDING EQUIPMENT –

### Part 8: Gas consoles for welding and plasma cutting systems

#### 1 Scope

This part of IEC 60974 specifies safety and performance requirements for gas consoles intended to be used with combustible gases or oxygen. These gas consoles are designed to supply gases for use in arc welding, plasma cutting, gouging and allied processes in non-explosive atmospheres.

The gas console can be external or internal to the power source enclosure. In the latter case, this standard also applies to the power source.

NOTE See Annex A for mechanised plasma system diagram.

#### 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 – Part 151: Electrical and magnetic devices*

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IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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

#### 3 Terms and definitions

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

##### 3.1 gas console

device for gas-flow routing, mixing or both that contains electrical apparatus in a single or multiple enclosure, or open structure

##### 3.2 lower explosion limit

###### LEL

concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive

[IEV 426-02-09, modified] [1]<sup>1</sup>

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<sup>1</sup> Figures in square brackets refer to the bibliography.



**3.3  
lower flammability limit  
LFL**

minimum concentration of combustible gas in a mixture where a combustion can be ignited by an ignition source

**3.4  
upper explosion limit  
UEL**

concentration of flammable gas or vapour in air, above which the gas atmosphere is not explosive

[IEV 426-02-10, modified]

**3.5  
upper flammability limit  
UFL**

maximum concentration of combustible gas in a mixture where a combustion can be ignited by an ignition source

**3.6  
external gas console**

gas console not incorporated in a power source

**3.7  
internal gas console**

gas console incorporated in a power source

**3.8  
single-fault condition**

condition in which one means for protection against hazard is defective

NOTE If a single-fault condition results unavoidably in another single-fault condition, the two failures are considered as one single-fault condition.

[IEC 61010-1, definition 3.5.11, modified] [7]

**4 Environmental conditions**

As specified in Clause 4 of IEC 60974-1.

**5 Tests****5.1 Test conditions**

As specified in 5.1 of IEC 60974-1.

**5.2 Measuring instruments**

As specified in 5.2 of IEC 60974-1.

**5.3 Conformity of components**

As specified in 5.3 of IEC 60974-1.

**5.4 Type tests**

As specified in 5.4 of IEC 60974-1.

The other tests included in this standard may be carried out in any convenient sequence.

## 5.5 Routine tests

### 5.5.1 External gas console

All routine tests shall be carried out on each external gas console in the following sequence:

- a) general visual inspection, see 3.7 of IEC 60974-1;
- b) continuity of protective circuit, see 10.4.2 of IEC 60974-1;
- c) dielectric strength, see 6.1.5 of IEC 60974-1;
- d) leak test, see 10.3;
- e) general visual inspection, see 3.7 of IEC 60974-1.

### 5.5.2 Internal gas console

All routine tests, as specified in 5.5 of IEC 60974-1, shall be carried out on each internal gas console, with the following addition:

- g) leak test, see 10.3.

## 6 Protection against electric shock

### 6.1 Insulation

As specified in 6.1 of IEC 60974-1, with the following exception:

Printed circuit boards shall be enclosed, coated, or encapsulated.

### 6.2 Protection against electric shock in normal service (direct contact)

#### 6.2.1 Protection provided by the enclosure

The minimum degree of protection for gas consoles shall be IP21S in accordance with IEC 60529.

*Conformity shall be checked by*

- a) *applying the articulated finger and ball, as specified in IEC 60529, to any openings and ensuring it does not contact any hazardous parts; and*
- b) *verifying that immediately after the water test, as specified in IEC 60529, the unit satisfies insulation resistance and the dielectric strength tests and is able to operate.*

*No power is applied to the unit while performing these tests.*

#### 6.2.2 Capacitors

As specified in 6.2.2 of IEC 60974-1.

### 6.3 Protection against electric shock in case of a fault condition (indirect contact)

As specified in 6.3 of IEC 60974-1.

## 7 Thermal requirements

### 7.1 Heating test

As specified in 7.1 of IEC 60974-1.

For an external gas console, only the relevant tests are performed.

### 7.2 Maximum temperature

The temperature at any point shall not exceed the ignition temperature of any combustible gas intended to be used in the gas console.

*Conformity shall be checked by operating the gas console as specified by the manufacturer*

- a) *with the combinations of gas(es) and flow rates which creates the worst-case condition, as specified by the manufacturer;*
- b) *with the cooling liquid as specified by the manufacturer.*

## 8 Connections for plasma cutting torches

As specified in 11.4.6 of IEC 60974-1, where the torch connects to the gas console.

## 9 Mechanical requirements

As specified in Clause 14 of IEC 60974-1, with the following additions.

### 9.1 Protection against fire or explosion

The gas console shall be designed to prevent fire or explosion under normal operating conditions and under a single-fault condition (for example, defective valve, hose, etc.).

Where a gas console uses a combustible gas, any circuit, subassembly, or component shall not be capable of creating temperatures or a spark with sufficient energy to cause an ignition.

Where a gas console uses a combustible gas in a mixture, the mixture shall not be included within flammability limit that is defined by LFL and UFL.

*Conformity shall be checked by*

- a) *design evaluation and calculations of the circuits, subassembly, or component verification;*  
*or*
- b) *applying a fault (for example, open circuit, short circuit, and/or restriction of movement) to the circuits, subassembly, or component until an event occurs (for example, a spark which does not cause ignition, fuse opens, unit shuts down, etc.) or a steady-state temperature is achieved.*

### 9.2 Gas line purging

The gas console shall have a means to purge gas lines when changing to a different type of gas (for example, oxidizing or oxygen containing to combustible) to reduce the risk of fire or explosion. In some cases, a small amount of combustible gas or oxygen may accumulate in the torch. This volume shall be small enough so that no risk can result.

The purging shall occur after each change in gas routing or when the previous gas routing is unknown.

NOTE 1 A means of accomplishing this can be by purging the lines with a sufficient volume of an inert gas.

NOTE 2 When a risk of fire or explosion exists in the gas lines due to changing gas, the purging can be performed with the following pressure cycle:

1. reduce the pressure of the gas console circuit to atmosphere pressure;
2. purge the gas console circuit with the purging gas;
3. increase the pressure to the maximum pressure of purging gas;
4. reduce the pressure of the gas console circuit to atmosphere pressure.

*Conformity shall be checked by risk analysis and the following test.*

The gas lines, when installed with all devices (valves, fittings, etc.) shall be filled with a combustible gas and measured with a gas detector. Immediately after, the gas lines shall be purged according to the instruction manual. Once purging has been completed, the contents of the gas lines shall be measured with the gas detector to ensure that the lines have been purged to a level lower than the lower flammability level (LFL) of the gas. If more than one combustible gas is used, the test shall be repeated for each combustible gas.

### 9.3 Enclosure

#### 9.3.1 Design requirements

The gas console (external or internal) shall be designed to withstand or prevent an explosion. This shall be accomplished by complying with at least one of the requirements in 9.3.2 through 9.3.4.

NOTE All tests described below are dangerous, and it is recommended that they are performed by qualified personnel.

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#### 9.3.2 Enclosure purging

Purging means typically include positive pressure of an inert gas and forced ventilation (e.g. use of a non-arcing fan). Any automatic means to purge the gas console enclosure of combustible gases shall be activated before other electrical devices are energized.

Where a fan or other device is used for purging, a malfunction shall be indicated and the system shall be prevented from continuing to operate.

After purging, the level of combustible gas shall not exceed the lower explosion level (LEL).

*Conformity shall be checked in a draught-free environment by a) or b) below.*

- a) *Simulate a continuous gas leak inside the enclosure equal to the maximum flow rate and pressure as specified by the manufacturer. Monitor and adjust the gas in the enclosure until saturation or stabilization occurs. Activate the purging device(s) and monitor the gas to ensure it reaches the LEL before a potential ignition source is energized. Repeat for each type of combustible gas used.*
- b) *Place a simulated arcing device inside the purged enclosure. Monitor and adjust the gas in the enclosure until saturation or stabilization occurs. Operate all purging means and initiate start-up sequence. Energize the arcing device to simulate the electronics start-up, and operate continuously ensuring that no ignition occurs. Repeat for each type of combustible gas used.*

NOTE 1 A safe level of gas is 50 % of the LEL.

NOTE 2 The leak rate needs to be considered when performing these tests.