
International Standard



700

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Power sources for manual metal arc welding with covered electrodes and for the TIG process

Sources d'alimentation pour soudage manuel à l'arc avec électrodes enrobées et procédé TIG

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 700 was developed by Technical Committee ISO/TC 44, *Welding and allied processes*, and was circulated to the member bodies in May 1979.

It has been approved by the member bodies of the following countries :

Australia	Finland	Norway
Austria	France	Poland
Belgium	Germany, F.R.	Romania
Bulgaria	India	South Africa, Rep. of
Canada	Ireland	Spain
China	Italy	Sweden
Czechoslovakia	Libyan Arab Jamahiriya	Switzerland
Egypt, Arab Rep. of	New Zealand	United Kingdom

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Japan
Netherlands
USA

This International Standard cancels and replaces ISO Recommendation R 700-1968, of which it constitutes a technical revision.

Power sources for manual metal arc welding with covered electrodes and for the TIG process

1 Scope

This International Standard specifies the necessary information for the description and specification of power sources for manual metal arc welding with covered electrodes and for the TIG process. It specifies the information to appear on the rating plate and describes test methods to verify the compliance of the power source with this International Standard.

It also specifies the minimum requirements for establishing a common basis for the specification of such power sources. It does not cover electrical safety requirements : these are included in IEC requirements which are currently in preparation.

2 Field of application

This International Standard applies to the types of power sources most commonly used in industrial applications for manual metal arc welding with covered electrodes and for the TIG process, except for oil-cooled power sources. It does not cover the ancillary equipment referred to in annex A.

2.1 Types of power source

The power sources are of the single operator type with drooping characteristics, for example :

- a) single-phase transformer,
- b) single-phase transformer/rectifier,
- c) static frequency converter/transformer/rectifier,
- d) polyphase transformer/rectifier,
- e) direct current generator with commutator,
- f) alternator,
- g) alternator with rectifier,
- h) motor generator (consisting of electric motor and direct current generator with commutator),

- j) motor alternator rectifier (consisting of electric motor and direct current generator with commutator),
- k) rotary frequency converter,
- m) static frequency converter,
- n) combined a.c. and d.c. power source consisting of transformer and rectifier,
- p) combined a.c. and d.c. power source consisting of electric motor, alternator and rectifier.

NOTES

1 The above list includes power sources coupled to internal combustion engines.

2 A welding power source with a drooping characteristic is defined as having an external static characteristic which, in its normal welding range, is such that the voltage decreases as the current increases, the slope being generally greater than 7V/100A.

2.2 Altitude and temperature conditions

This International Standard applies to power sources for use under the following conditions :

2.2.1 Altitude

In the absence of any information regarding height above sea level at which the equipment is intended to work in ordinary service, the altitude is assumed not to exceed 1 000 m.

2.2.2 Temperature of the cooling medium

In the absence of any information to the contrary, it is assumed that, in the case of air-cooled power sources, none of the following temperature limits is exceeded :

— maximum ambient air temperature	40 °C
— daily average ambient air temperature	30 °C
— yearly average ambient air temperature	20 °C
— minimum ambient air temperature	— 10 °C

NOTE — Different conditions of altitude and temperature may be agreed between the manufacturer and user.

3 References

ISO 7000, *Graphic symbols — Index, survey and compilation of the single sheets.*¹⁾

IEC Publication 34-1, *Rotating electrical machines — Part 1 : Rating and performance.*

IEC Publication 76, *Power transformers.*

IEC Publication 85, *Recommendations for the classification of materials for the insulation of electrical machinery and apparatus in relation to their thermal stability in service.*

IEC Publication 529, *Classification of degrees of protection provided by enclosures.*

4 Definitions²⁾

4.1 operating conditions : All quantities defining the performance of a machine, an appliance or a network.

4.2 rated : qualifying term applied to a quantity which is used in the specification of the power source.

4.3 duty : A schedule of the loads on a machine or apparatus taking account of their respective duration and sequence.

4.4 uninterrupted duty at periodically intermittent loads : A series of identical cycles, each comprising one on-load period and one no-load period.

4.5 duty cycle³⁾ (symbol X) : The ratio of the duration of operation under load to the duration of the complete cycle. This ratio, lying between 0 and 1, may be expressed as a percentage.

NOTES

1) In this International Standard, the word load is to be understood as a constant resistive load having a power factor of not less than 0,99.

2) In this International Standard, the duration of the cycle has been fixed at 5 min.

4.6 conventional welding current (symbol I_2) : Current in amperes delivered by a power source to a practically non-inductive resistance load (see note 1 in 4.5).

4.7 load voltage : The voltage between the output terminals of a power source, i.e. those to which the electrode and return lead are connected, when a specified current is flowing through a practically non-inductive resistance load (see note 1 in 4.5).

4.8 conventional load voltage (symbol U_2) : The voltage in volts at the output terminals of a power source, bearing a linear relationship to the conventional welding current such that it is :

4.8.1 For manual arc welding with covered electrodes

$$U_2 = 20 + 0,04 I_2$$

up to 44 V at 600 A. For currents above 600 A, the conventional load voltage shall remain constant at 44 V.

4.8.2 For TIG welding process

$$U_2 = 10 + 0,04 I_2$$

up to 34 V at 600 A. For currents above 600 A, the conventional load voltage shall remain constant at 34 V.

4.9 conventional operating welding conditions : Operating conditions defined by a conventional welding current and the corresponding conventional load voltage.

4.10 conventional welding duty : A periodic duty with a duty cycle of 0,6, comprising cycles of 5 min duration, a complete cycle consisting of a period of 3 min under the conventional operating welding conditions followed by a period of 2 min of no-load operation.

4.11 rated welding current : The maximum value of the conventional welding current in amperes at the conventional load voltage in volts at which the power source meets the requirements of this International Standard when operated at the conventional welding duty.

4.12 rated short-circuit current : The current in amperes obtained at the maximum setting of the welding power source when operating into an external circuit having a total resistance between 0,008 and 0,01 Ω .

4.13 rated maximum current : The maximum value of the current in amperes which can be obtained at the conventional load voltage at the maximum setting.

4.14 duty at rated maximum current : Uninterrupted duty at periodical intermittent loads (see 4.4) related to the rated maximum current at a duty cycle within the permissible temperature rise (see 6.1.2).

4.15 rated minimum current : The minimum value of the current in amperes at the conventional load voltage which can be obtained at the lowest setting.

4.16 no-load voltage (symbol U_0) : When the rated voltage and frequency are supplied through the input terminals of the machine, the voltage in volts, exclusive of any high frequency stabilizing voltage, between the output terminals of the power source when the external circuit is open.

1) At present at the stage of draft.

2) All electrical quantities specified in the definitions are those obtained under steady conditions.

3) The term "duty factor", as used in the ISO and IEC definitions, and the term "duty cycle" are synonymous.

NOTE — This definition applies in the general case where the welding power source is not fitted with a device or system for reducing the no-load voltage. If the power source does have such a device or system, the no-load voltage defined above appears at the output terminals immediately before control action of the time relays or other means whose purpose is to effect a reduction in the voltage when the welding circuit is open.

4.17 type test : A test made on a power source which is representative of other sources, to demonstrate that they comply with specified requirements not covered by tests to which each individual power source is subjected.

NOTE — A power source is considered to be representative of others if it is identical in rating and construction.

5 Requirements for certain equipment

5.1 Motor-generator set

When the motor-generator set is supplied with the rated voltage $U_1 \pm 5\%$, the torque of the motor shall be sufficient to drive the generator giving its maximum power at the highest setting.

The duty cycles indicated for the different welding conditions apply to the motor as well as to the generator, both remaining within the admissible limits of temperature rise (see table 2).

5.2 Power sources incorporating power rectifier assemblies

The requirements of this International Standard, other than those performance requirements applicable to the complete power source, do not apply to the rectifier assemblies associated therewith. These rectifier assemblies shall have characteristics to meet the maximum specified service conditions of the power source without harmful effect.

In addition, power sources containing such rectifier assemblies shall be subjected to, and successfully pass (see 6.2.2.2), the additional tests specified in 7.2.2.

5.3 Power source with internal combustion engine

The nominal speed of rotation of the internal combustion engine shall correspond to the speed at which the generator will supply the maximum rated welding current at the conventional voltage.

When the internal combustion engine is fitted with an automatic speed control, the change in speed under steady state conditions is defined as the difference between the rated speed and the speed under no-load conditions, and shall not exceed 10 % based on the following formula :

$$\frac{n_o - n_n}{n_n} \times 100 \leq 10\%$$

where

n_o is the speed under no-load conditions;

n_n is the rated speed.

The internal combustion engine shall be capable of tolerating load variations between maximum load and no-load without adversely affecting the welding performance of the generator.

NOTES

1 When an idling device is fitted, the speed is automatically reduced to a pre-set value below the rated speed after a predetermined delay when the load is removed.

2 While n_o is the steady state no-load speed, the momentary no-load speed shall not exceed 120 % of the rated speed n_n .

6 Types of test

The heating, commutation and rectifier tests are type tests.

6.1 Heating tests

6.1.1 Principle of heating tests

The load shall be a non-inductive resistance. The terminal voltage shall be maintained at the conventional load voltage within a tolerance of $\pm 5\%$.

Two tests shall be made as follows :

- with rated welding current as defined in 4.11 and at the duty cycle of 0,6,
- with the rated maximum current as defined in 4.13 and at the duty cycle as defined in 4.14.

Test b) may follow test a) without the power source returning to ambient temperature.

In the case of power sources with circuits which carry heavier current under no-load conditions, an additional heating test shall be carried out under no-load conditions and immediately follow test a) or b) without the power source returning to ambient temperature.

6.1.2 Limits of temperature rise

When temperatures are measured under the conditions specified in 7.1 and the following clauses of this International Standard, the limits of temperature rise for static power sources with either natural or forced air cooling and for rotary power sources, shall be defined as follows :

6.1.2.1 Static power source with natural or forced air cooling : see table 1.

6.1.2.2 Rotary power source : see table 2.