INTERNATIONAL STANDARD

ISO 14744-2

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Welding — Acceptance inspection of electron beam welding machines —

Part 2: Measurement of accelerating voltage characteristics

Soudage — Essais de réception des machines de soudage par faisceau d'électrons —

Partie 2: Mesure des caractéristiques de la tension d'accélération

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 14744 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 14744-2 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

ISO 14744 consists of the following parts, under the general title *Welding — Acceptance inspection of electron beam welding machines*:

— *Part 1: Principles and acceptance conditions*

— *Part 2: Measurement of accelerating voltage characteristics*

— *Part 3: Measurement of beam current characteristics*

— *Part 4: Measurement of welding speed*

— *Part 5: Measurement of run-out accuracy*

— *Part 6: Measurement of stability of spot position*

Contents

Foreword

The text of EN ISO 14744-2:2000 has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2000, and conflicting national standards shall be withdrawn at the latest by October 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This draft European Standard is composed of the six following parts:

– Part 1: Principles and acceptance conditions;
– Part 2: Measurement of accelerating voltage characteristics;
– Part 3: Measurement of beam current characteristics;
– Part 4: Measurement of welding speed;
– Part 5: Measurement of run-out accuracy;
– Part 6: Measurement of stability of spot position.

1 Scope

This standard is intended for use when the characteristics of the accelerating voltage of electron beam welding machines complying with EN ISO 14744-1 is to be measured in connection with an aceptance inspection. It provides essential information on the procedure and apparatus to be used for making the measurements.

The accelerating voltage is one of the significant parameters in electron beam welding. When accelerating the electrons, the voltage should be stable and reproducible within given short-term and long-term limits. The purpose of the measurement is thus to check whether the variations in accelerating voltage are within specified limits.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 14744-1:2000
Welding – Acceptance inspection of electron beam welding machines – Part 1: Principles and acceptance conditions (ISO 14744-1 : 2000)

EN ISO 14744-3
Welding – Acceptance inspection of electron beam welding machines – Part 3: Measurement of beam current caracteristics (ISO 14744-3 : 2000)

3 Terms and definitions

For the purposes of this European Standard, the following term and definition applies,

3.1
accelerating voltage

difference in electrical potential between the cathode and anode of the beam generator in the electron gun.

4 Test arrangement

4.1 General

The voltages usually present during electron beam welding at the output of the high-voltage generator, at the end of the high-voltage cable and in the beam generator cannot be safely measured without the use of special equipment.

Since, generally, only the manufacturers of welding machines or high-voltage units have appropriate equipment at their disposal, it has proved expedient to measure the accelerating voltage at the manufacturer's works.

NOTE Attention should be paid to electrical safety levels during testing at high voltages and the need for appropriately trained/qualified personnel to carry out tests.

Apart from these safety aspects, the test equipment shall also be capable of measuring the accelerating voltage over the entire range of beam current setting, i.e. with the welding parameters set to conform to actual welding conditions.

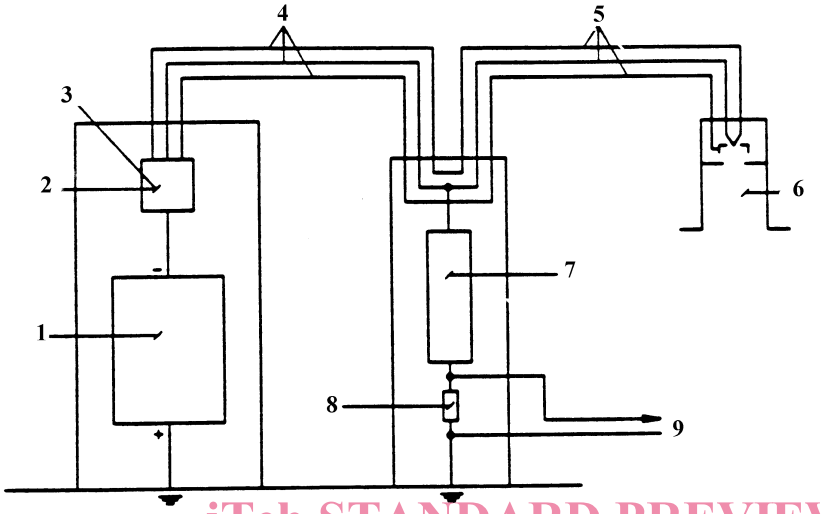
The main purpose of the following descriptions and illustrations of test arrangements is to enable uniform high-voltage measurements on electron beam welding machines to be made rather than to provide complete circuit diagrams.

4.2 Test devices

A voltage divider shall be connected between the high-voltage unit and the electron gun. Examples are shown in figures 1 and 2.

The extent to which frequency compensation is required depends on the type of high-voltage generator.

The accuracy of test arrangement shall be compatible with the requirements stated in EN ISO 14744-1.

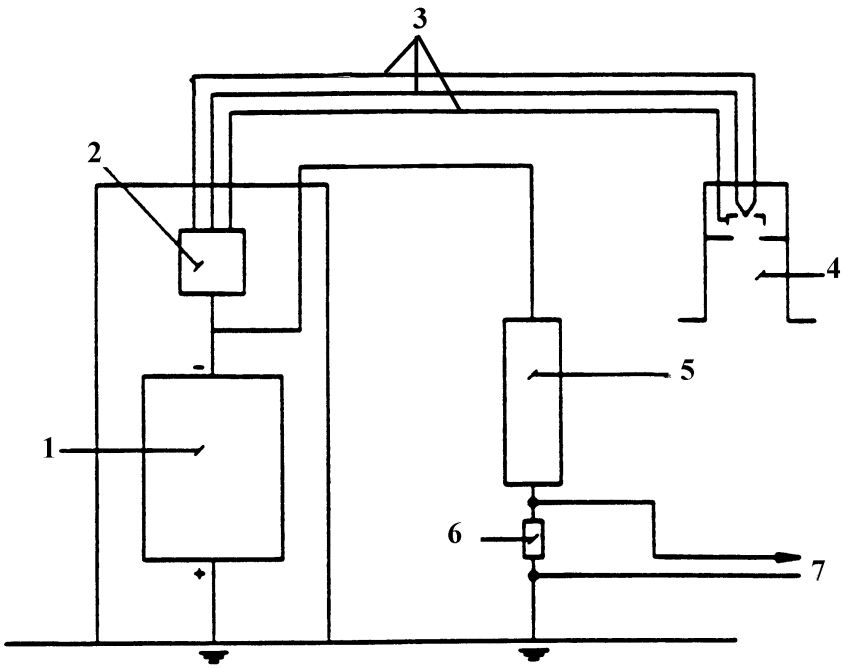


Key

1 High-voltage generator
2 Bias control unit
3 Cathode heating
4 High-voltage cable 1
5 High-voltage cable 2
6 Electron beam gun
7 Frequency-compensated voltage divider 10^4 : 1, $U_{Amax.}$ = 200 kV, R = 200 MΩ
8 R = 20 kΩ measuring resistor
9 To oscilloscope, monitored voltage

Figure 1 - Example A of measurement of U_A using a voltage divider

For a division ratio of 10^4 : 1, for example, an accelerating voltage, U_a, of 150 kV is reduced to a monitored voltage, U_a, of 15 V, which may be supplied to an oscilloscope. As the voltage divider is connected only to one of the cathode heating conductors, a current of 0,75 mA flows to earth for a resistance of 200 MΩ and an accelerating voltage, U_a, of 150 kV.



Key
1 High-voltage generator
2 Cathode heating and bias control unit
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Figure 2 - Example B of a measurement of U_A using a voltage divider

5 Measurement procedure

5.1 General

The measurements shall be carried out with the welding machine set as specified in 6.2 of EN ISO 14744-1:2000. For measuring the accelerating voltage deviations the electron beam have to be switched on too. Therefore, a workpiece of sufficient size or a Faraday cup shall be provided in the work chamber as specified in EN ISO 14744-3.

5.2 Measuring the ripple

An oscilloscope shall be used to determine the maximum range (peak-to-peak value) in the instantaneous value U'_a of the monitored voltage, U_a.

The percentage deviation shall be calculated as follows:

$$\frac{U'_{a\,max} - U'_{a\,min}}{U_a} \cdot 100$$

where $U'_{a\,max}$, $U'_{a\,min}$ and U_a are maximum, minimum and average values observed during the period of observation.