
**Welding — Acceptance inspection of
electron beam welding machines —**

**Part 1:
Principles and acceptance conditions**

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

Partie 1: Principes et conditions de réception

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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 2.

The main task of technical committees is to prepare International Standards. 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 the member bodies casting a vote.

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

ISO 14744-1 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*.

This second edition cancels and replaces the first edition (ISO 14744-1:2000) which has been technically revised.

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*

Requests for official interpretations of any aspect of this part of ISO 14744 should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body, a complete listing of which can be found at www.iso.org.

Introduction

Components, failure of which will endanger life, are subject to comprehensive test and acceptance specifications, which, among other things, require production equipment to be of proven type and in accordance with the state of the art. Similarly, in welding practice, standards apply that specify, for example, the required manual skills which a welder must have for controlling the weld.

In welding processes that are not under direct manual control, such as in electron beam welding, requirements for various machine parameters are established. This standard series on acceptance inspection of electron beam welding machines is based on the concept that the production of continuously high-quality welds is ensured if, among other things, the settings, within defined limits, are reproducible during the operating period.

Taking this into account, this standard specifies details of the main machine parameters (accelerating voltage, beam current, lens current and welding speed characteristics) together with deviations permitted in short-term or long-term operation. It also includes requirements regarding the run-out accuracy of the devices positioning the workpiece and regarding the stability of the spot position of the electron beam. Users, manufacturers, research experts and inspection bodies are all agreed that electron beam welding machines complying with the requirements are suitable for welding components subject to acceptance inspection, such as aircraft equipment, pressure vessels, valves, etc., within specified setting ranges, assuming that other conditions (e.g. qualified staff, quality control) are fulfilled.

ISO 14744 [any part(s)] can be referred to in contracts for supply of electron beam welding machines. Further tests are not normally required if proof of satisfactory welding results is provided in the form of routine inspection documentation. However, the requirements of the standard can also be used for inspection as part of maintenance, if required by contract.

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Welding — Acceptance inspection of electron beam welding machines —

Part 1: Principles and acceptance conditions

1 Scope

This part of ISO 14744 specifies requirements for acceptance inspection of electron beam welding machines preferably when first installed on the user's premises.

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.

ISO 17662, *Welding — Calibration, verification and validation of equipment used for welding, including ancillary activities*

3 Symbols and abbreviated terms

For the purposes of this part of ISO 14744, the following symbols apply:

A_F	focal distance, in millimetres
A_W	work distance, in millimetres
$a_x; a_y; a_z$	deviation, in millimetres, of electron beam axis from weld groove centre or of beam focus from groove centre on weld surface in the x -, y - or z -direction of feed, as a measure of the run-out accuracy
D	diameter, in millimetres or in centimetres, of a circumference weld seam
I_B	beam current, in milliamperes
$I_{B \max}$	maximum beam current, in milliamperes, corresponding to $U_{A \max}$ and $U_{A \min}$, respectively
$I_{B \min}$	minimum beam current, in milliamperes, corresponding to $U_{A \max}$ and $U_{A \min}$, respectively
I_L	lens current, in milliamperes
$I_{L \max}$	lens current, in milliamperes, at $U_{A \max}$ and for $A_{F \min}$
$I_{L \min}$	lens current, in milliamperes, at $U_{A \min}$ and for $A_{F \max}$

m	load, in kilograms force, on the work table or on rotating fixture resulting from workpiece mass including that of any clamping device
n	rotational frequency, in reciprocal minutes, of rotating fixture
t_w	time, in seconds, for welding a seam
$t_{w \max}$	maximum time, in seconds, for welding a seam
Q	pressure rise rate, in pascal cubic decimetres per second, or millibar-litres per second
U_A	indicated accelerating voltage, in kilovolts
$U_{A \max}$	maximum indicated accelerating voltage, in kilovolts, within the setting range
$U_{A \min}$	minimum indicated accelerating voltage, in kilovolts, within the setting range
U_a	monitored voltage for measuring the accelerating voltage, in millivolts
U_b	monitored voltage, in millivolts, for measuring the beam current, in millivolts
U_v	monitored voltage, in millivolts, for measuring the welding speed
v	welding speed, in millimetres per second, in centimetres per minute or in metres per minute

4 Conditions for acceptance inspection

4.1 General

Acceptance inspection shall be performed after the first installation or before the first operation of the welding machine. The following tests shall be done:

- accelerating voltage characteristics;
- beam current characteristics;
- lens current characteristics;
- speed characteristics of movement devices;
- run-out accuracy of movement devices;
- stability of spot position.

And the following test may be agreed:

- pressure rise rate.

After changing of equipment location the following test shall be done:

- speed characteristics of movement devices;
- run-out accuracy of movement devices;
- stability of spot position.