



SLOVENSKI STANDARD SIST EN ISO 14744-1:2001

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**Varjenje - Prezemni preskusi strojev za varjenje z elektronskim snopom - 1. del:
Osnovni pojmi in prevzemni pogoji (ISO 14744-1:2000)**

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

Schweißen - Abnahmeprüfung von Elektronenstrahl-Schweißmaschinen - Teil 1: Grundlagen und Abnahmebedingungen (ISO 14744-1:2000)

Soudage - Essais de réception des machines de soudage par faisceau d'électrons - Partie 1: Principes et conditions de réception (ISO 14744-1:2000)

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25.160.30 Varilna oprema Welding equipment

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 14744-1

April 2000

ICS 25.160.00

English version

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

Soudage - Essais de réception des machines de soudage par faisceau d'électrons - Partie 1: Principes et conditions de réception (ISO 14744-1:2000)

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This European Standard was approved by CEN on 3 January 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

	Page
Foreword	3
Introduction	4
1 Scope	4
2 Normative references	4
3 Symbols	5
4 Conditions for acceptance inspection	5
4.1 General	5
4.2 Installation of electron beam welding machine	5
4.3 Power source	5
4.4 Safety precautions	5
4.5 Operating instructions	6
4.6 Instruments	6
5 Principles of acceptance inspection	6
5.1 Setting range	6
5.2 Normal acceptance	6
5.3 Limited or more extensive acceptance inspection	7
5.4 Record of inspection results	7
6 Acceptance inspection	7
6.1 General	7
6.2 Accelerating voltage, beam current and lens current	8
6.3 Welding speed	8
6.4 Run-out accuracy	8
6.5 Stability of spot position	9
7 Supplementary acceptance inspections	9
Annex A (informative) Procedures for inspection of pressure rise rate and leak rate	10
Annex B (informative) Specification of a weld test of penetration deviation	11
Bibliography	12

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Foreword

The text of EN ISO 14744-1:2000 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.

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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) 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.

1 Scope

The main purpose of this standard is to provide requirements for acceptance inspection of electron beam welding machines preferably when first installed on the user's premises. This standard can (in full or in part) 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.

If modifications are made to an electron beam welding machine (rebuilding, repairs, modification to the operating conditions etc.) such as may have an effect on the acceptance inspection, repeat tests can be necessary covering the machine parameters affected by such modifications.

If a welding machine that has already been accepted is dismantled (e.g. in order to change its location), such tests would involve verification according to the requirements in clauses 4, 6.2 to 6.4 and 7.

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 14744-2

Welding – Acceptance inspection of electron beam welding machines – Part 2: Measurement of accelerating voltage characteristics (ISO 14744-2 : 2000)

EN ISO 14744-3

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

EN ISO 14744-4

Welding – Acceptance inspection of electron beam welding machines – Part 4: Measurement of welding speed (ISO 14744-4 : 2000)

EN ISO 14744-5

Welding – Acceptance inspection of electron beam welding machines – Part 5: Measurement of run-out accuracy (ISO 14744-5 : 2000)

EN ISO 14774-6:2000

Welding – Acceptance inspection of electron beam welding machines – Part 6: Measurement of stability of spot position (ISO 14744 : 2000)

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3 Symbols

For the purposes of this standard, the following symbols apply:

$a_x; a_y; a_z$	deviation of electron beam axis from weld groove centre or of beam focus from groove centre on weld surface in X , Y or Z direction of feed, as a measure of the run-out accuracy, in mm;
A_W	work distance, in mm;
A_F	focal distance, in mm;
D	diameter of a circumference weld seam in mm or cm;
I_L	lens current, in mA;
$I_{L \max}$	lens current at $U_{A \max}$ and for $A_{F \min}$, in mA;
$I_{L \min}$	lens current at $U_{A \min}$ and for $A_{F \max}$, in mA;
I_B	beam current, in mA;
$I_{B \max}$	maximum beam current, corresponding to $U_{A \max}$ and $U_{A \min}$ respectively, in mA;
m	loading of work table or of rotating fixture resulting from workpiece mass including that of any clamping device, in kg;
n	speed of rotating fixture, in min^{-1} ;
U_A	indicated accelerating voltage, in kV;
$U_{A \max}$	maximum indicated accelerating voltage within the setting range, in kV;
$U_{A \min}$	minimum indicated accelerating voltage within the setting range, in kV;
U_a	monitored voltage for measuring the accelerating voltage, in mV;
U_b	monitored voltage for measuring the beam current, in mV;
U_v	monitored voltage for measuring the welding speed, in mV;
v	welding speed, in mm/s, cm/min or m/min;
Q	pressure rise rate, in $\text{Pa} \cdot \text{dm}^3/\text{s}$, or $\text{mbar} \cdot \text{l/s}$

4 Conditions for acceptance inspection

4.1 General

Acceptance inspection shall be performed after installation of the welding machine, prior to production. However, measurement of accelerating voltage may be performed prior to delivery of the welding machine in accordance with EN ISO 14744-2.

4.2 Installation of electron beam welding machine

Electron beam welding machines shall be installed so that acceptance inspection and machine performance are not interfered with by vibration or by electrical or magnetic fields.

4.3 Power source

The power source for electron beam welding machines shall be an electrical mains system with voltage fluctuations not exceeding $\pm 10\%$.

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4.4 Safety precautions

This standard does not cover inspection of safety devices and other safety aspects.

NOTE Machines for electron beam welding have several features which assure safe operation. The electron beam generates X-rays during welding and the work chamber walls, the work chamber windows and other parts have to reduce the radiation outside the machine to low safe levels so as to permit operators and other personnel to work safely close to the machine. The parts of the machine subject to high-voltages should, of course, be protected and inaccessible when under high tension.

Some of the features which assure safe operation may have to be tested after installation of the machine, prior to any use of the machine in production. Any such test is, however, outside the scope of this standard. The tests have to be specified by the supplier of the machine.

It is also important to consider that the design of machines for electron beam welding, protection against x-rays etc., are subject to several legal requirements at the European level (e.g. directives for machines, EMC, low voltage equipment) and also supplementary national requirements in at least some countries. See also EN 60204-1.

4.5 Operating instructions

The operating instructions for the electron beam welding machine shall be complied with.

4.6 Instruments

The accuracy of all instruments for measurement have to be compatible with the limit deviations specified in this standard, see table 1.

The procedures for measurement are such that it is possible to use calibrated and traceable instruments for measurement, if required by contract.

5 Principles of acceptance inspection

5.1 Setting range

It is to be specified for which setting range of the machine the acceptance inspection is to be carried out, giving setting ranges for the following parameters:

- accelerating voltage;
- beam current;
- lens current;
- welding speed in all primary welding directions;

Other parameters necessary for proper control of the welding machine shall also be specified, e.g.:

- focal distance;
- loading resulting from workpiece and fixture mass;
- pressure rise rate and leak rate in work chamber (if necessary).

5.2 Normal acceptance

According to this standard normal acceptance inspection of the welding machine for the intended machine setting shall be deemed to have been provided if the limit deviations given in table 1 are not exceeded.

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Table 1 - Limit deviations for machine parameters and characteristics

Parameters and characteristics	Limit deviations of the measured value
Accelerating voltage: ripple stabilization reproducibility	2 % (peak-to-peak value) ±1 % ±1 %
Beam current: ripple stabilization reproducibility	5 % (peak-to-peak value) ±1 % ±1 %
Lens current: ripple stabilization reproducibility	0,5 % (peak-to-peak value) ±0,5 % ±0,5 %
Welding speed: short-term stability: v_{\max} $v_{\min} = 0,1 v_{\max}$ long-term stability reproducibility	±2 % ±5 % ±1 % ±1 %
Run-out accuracy, longitudinal and circumferential welds	±0,05 mm. Unless otherwise agreed, requirements may be relaxed for welding of large pieces
Stability of spot position in the plane perpendicular to the beam axis	±0,1 mm at a focal distance of 300 mm
Pressure rise rate and leak rate	To be agreed
Welding penetration deviation	To be agreed

The limit deviations given in table 1 relate to the mean of the measured values concerned, unless otherwise specified. The limit deviations relate to the use of normal electron beam welding machines for normal applications. Alternative deviations may be agreed by contract for special machines or special applications.

5.3 Limited or more extensive acceptance inspection

If the requirements given in table 1 are met only for a part of the specified setting range, the acceptance inspection shall only be deemed to apply to that part.

The acceptance inspection may also be extended to cover accessory equipment for which no requirements are given in table 1, any additional requirements being specified separately.

Any departures from a normal acceptance inspection (including the resulting changes to the scope of testing) shall be stated in the test report.

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5.4 Record of inspection results

All inspection results shall be recorded.

6 Acceptance inspection

6.1 General

The acceptance inspection specified below is applicable for general applications for electron beam welding machines. Alternative conditions may be agreed for special applications. However, the applicability of limit deviations specified in table 1 have to be assessed for such special applications.