INTERNATIONAL STANDARD

ISO 14744-5

First edition
2000-04-15

Welding — Acceptance inspection of electron beam welding machines —

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

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

Partie 5: Mesure de la précision géométrique

Reference number
ISO 14744-5:2000(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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 14744-5 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 14744-5:2000 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 run-out accuracy of the moving parts of electron beam welding machines complying with EN ISO 14744-1 is to be measured in connection with an acceptance inspection. It provides information on the procedure and apparatus to be used for making the measurements. Given the great variety of electron beam welding machines, the scope of measurements required for acceptance inspection purposes should be specified separately for the machine concerned.

Run-out accuracy as defined here is a systematic error and thus counts as one of the parameters by which the performance of a machine tool can be characterized. Other factors influencing performance (e.g. dynamic forces, vacuum level, positioning accuracy of CNC machines) and methods of statistical evaluation are not covered in this standard.

Electron beam welding involves movement of the workpiece and/or of the electron gun. Successful welding presupposes that this movement is effected by the devices concerned (e.g. work table and rotating fixture) with a given degree of accuracy. The purpose of the measurement is thus to check whether and to what extent the required run-out accuracy is maintained.

2 Normative reference

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)

3 Terms and definitions

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

3.1
Run-out accuracy

maximum deviation measured within the work space used for welding at right angles to the direction of feed in the X, Y and Z directions, or, in the case of rotation of the workpiece, by the axial and radial run-out

NOTE Run-out accuracy is also a function of the deviation of the actual spot position from the desired position in the beam axis, referred to the weld point on the workpiece surface, in so far as this deviation is due to the positioning devices.

The run-out of each individual axis shall be measured to provide a guide to the overall run-out accuracy of the beam relative to the joint axis.

In cases where a number of axes operate together during welding, special measurement procedures should be specified.

4 Test arrangement and procedures

4.1 General

Unless otherwise specified, acceptance testing of run-out accuracy is normally performed with a vented work chamber.

4.2 Scope of measurement

Measurements shall be made in all significant directions and axes under the loading conditions specified in 6.4 of EN ISO 14744-1:2000.

4.3 Instruments and instructions for their use

Measurements shall be made with instruments, such as mechanical instruments, optical instruments (laser instrument) or inductive displacement transducers, permitting measurements to be made with an accuracy corresponding to the limiting values specified in EN ISO 14744-1. The response time of the measurement instrument shall be compatible with the feed rate of the positioning device.

Table 1 provides recommendations of the apparatus and procedures which may be used when measuring the run-out accuracy of the work table or of the electron gun movement and the rotating fixture. In any case, the measurement procedures and limit deviations have to be agreed and specified.

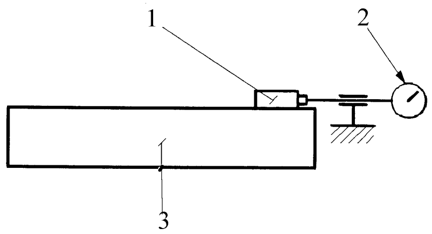
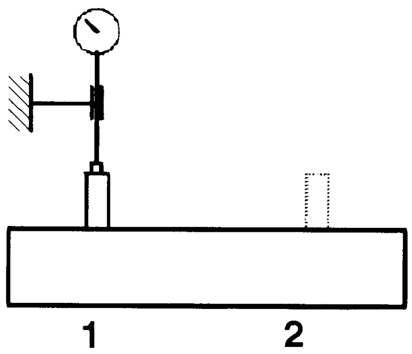
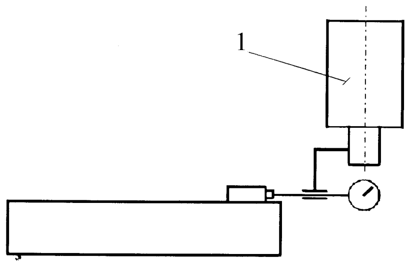
In cases where the electron gun moves in both X and Y directions, measurements in the Z direction will also be necessary as these permit the parallelism between the XY-plane of the electron gun movement and the XY-plane of the work table to be checked.

In the case of rotating fixtures it should also be noted that, in cases where the rotational axis is horizontal, the run-out accuracy is not only influenced by the maximum permissible workpiece loading but also by the tilting moment and by any unequal distribution of the mass.

5 Evaluation of measurements

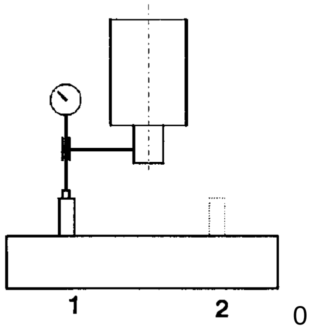
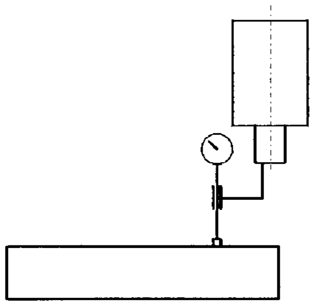
The deviations established by measurement shall be compared with the limiting values specified in EN ISO 14744-1.

Table 1 - Examples of set-ups for measuring the run-out accuracy of the work table, electron gun, or rotating fixture

No	Object	Diagram	Equipment	Procedure
1	Straightness of the X(Y) direction of work table movement in Y(X) direction	 **Key** 1 Straightedge 2 Dial gauge 3 XY - work table	Straightedge Dial gauge	Position straightedge in x(y) direction (e.g. by aligning it with the reference slot of table) and attach dial gauge. Traverse table through entire feed length in the X direction and measure deviations in Y direction, a_y. Then traverse table through entire feed length in the Y direction and measure deviations in X direction, a_x.
2	Straightness of the X(Y) direction of work table movement in Z direction	 0	Straightedge Dial gauge	Set straightedge at position 1 and mount dial gauge. Traverse table through entire feed length in the X(Y) direction and measure deviation in Z direction, a_z. Repeat measurement with straightedge set at position 2.
3	Straightness of the X(Y) direction of electron gun movement in Y(X) direction	 **Key** 1 Electron gun	Straightedge Dial gauge	Position straightedge in X(Y) direction (e.g. by aligning it with the reference slot of table) and attach dial gauge. Traverse electron gun through entire feed length in the X direction and measure deviations in Y direction, a_y. Then traverse electron gun through entire feed length in the Y direction and measure deviations in X direction, a_x.

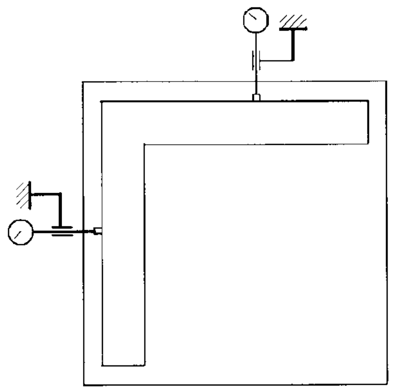
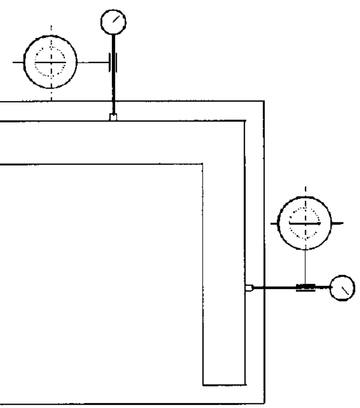
(continued)

Table 1 (continued)

No	Object	Diagram	Equipment	Procedure
4	Straightness of the X(Y) direction of electron gun movement in Z direction		Straightedge Dial gauge	Set straightedge at position 1 and mount dial gauge. Traverse electron gun through entire feed length in the X(Y) direction and measure deviation in Z direction, a_z. Repeat measurement with straightedge set at position 2.
5	Parallelism of the XY-plane of electron gun movement to the X(Y) direction of the work table movement		Dial gauge	Position electron gun at the 4 corner points and centre of the work table. Maintain electron gun in all positions on the same Z-coordinates and measure deviations in Z direction, a_z.

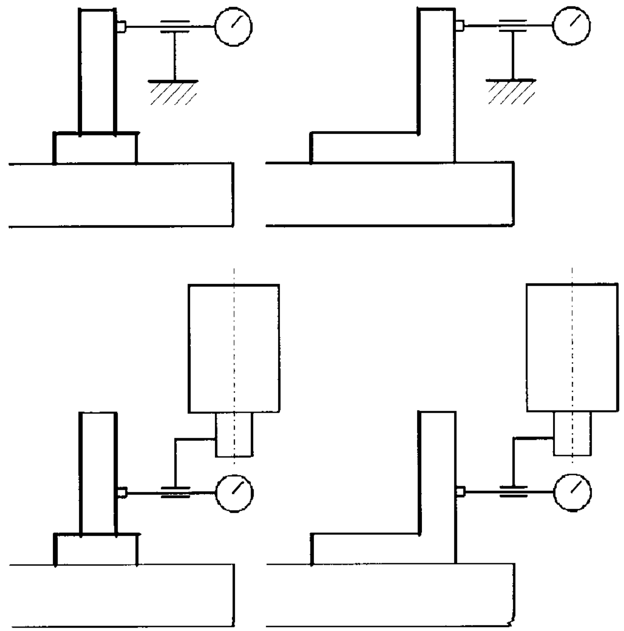
(continued)

Table 1 (continued)

No	Object	Diagram	Equipment	Procedure
6	Squareness of movement of work table in X and Y directions		Steel square Dial gauge	Place steel square with one leg in X direction of the work table movement. Traverse work table in Y direction and measure deviations from squareness in the X direction along the square.
7	Squareness of electron gun movement in X and Y directions		Steel square Dial gauge	Place steel square with one leg in X direction of the electron gun movement. Traverse in electron gun in Y direction and measure deviations from squareness in the X direction along the square.

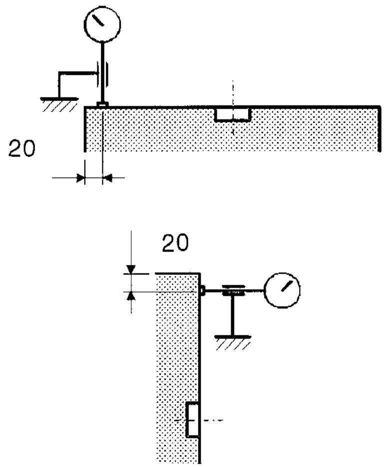
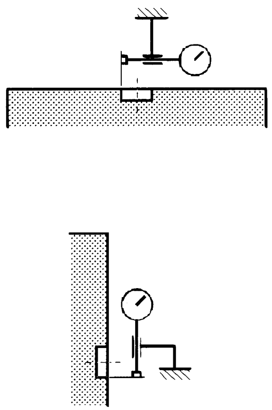
(continued)

Table 1 (continued)

No	Object	Diagram	Equipment	Procedure
8	Squareness of work table surface to movement in Z direction		Cylinder or steel square Dial gauge	Set up cylinder, square and traverse work table or electron gun in Z direction. Measure deviation from squareness in X(Y) direction along the cylinder or square.

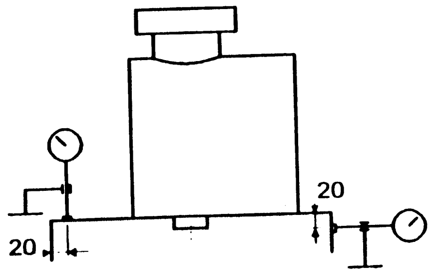
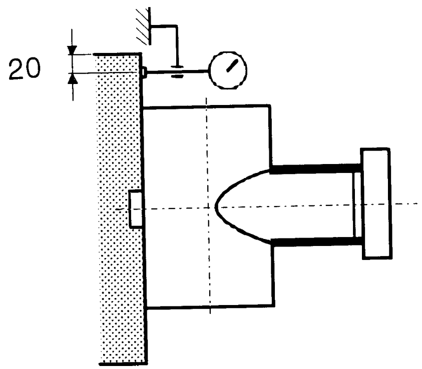
(continued)

Table 1 (continued)

No	Object	Diagram	Equipment	Procedure
9	Axial run-out in horizontal plane or in vertical plane		Dial gauge	Position dial gauge approximately 20 mm away from the outside edge of the face plate, rotate fixture and measure deviation.
10	Radial run-out in horizontal or vertical plane		Dial gauge	Position dial gauge on the central location hole or on the cylinder, rotate fixture and measure deviation.

(continued)

Table 1 (concluded)

No	Object	Diagram	Equipment	Procedure
11	Run-out, in horizontal plane, under load		Dial gauge	Subject rotating fixture (eccentrically) to maximum load. Position dial gauge approximately 20 mm away from the outer edge of face plate. Rotate fixture and measure deviation.
12	Axial run-out, in vertical plane, under load		Dial gauge	Subject rotating fixture to maximum load. Position dial gauge approximately 20 mm away from the outer edge of face plate. Rotate fixture and measure deviation.

ICS 25.160.30

Price based on 8 pages