
**Acceptance tests for Nd:YAG laser beam
welding machines — Machines with
optical fibre delivery —**

**Part 2:
Moving mechanism**

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*Essais de réception pour les machines de soudage par faisceau laser
Nd:YAG — Machines avec transport de faisceau par fibre optique —*

Partie 2: Mécanisme de positionnement

ISO 22827-2:2005

<https://standards.iteh.ai/catalog/standards/sist/d2e78b93-f92-44cb-b105-426157f79de0/iso-22827-2-2005>



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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 22827-2 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Unification of requirements in the field of metal welding*.

ISO 22827 consists of the following parts, under the general title *Acceptance tests for Nd:YAG laser beam welding machines — Machines with optical fibre delivery*:

— Part 1: *Laser assembly*

[ISO 22827-2:2005](https://standards.iteh.ai/catalog/standards/sist/d2e78b93-f92-44cb-b105-426157f79de0/iso-22827-2-2005)

— Part 2: *Moving mechanism*

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Introduction

Requests for official interpretations of any aspect of this part of ISO 22827 should be sent to the Secretariat of ISO/TC 44/SC 10 via the member body in the user's country, a complete listing of which can be found at www.iso.org.

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Acceptance tests for Nd:YAG laser beam welding machines — Machines with optical fibre delivery —

Part 2: Moving mechanism

1 Scope

This part of ISO 22827 covers acceptance testing of equipment for 2D manipulation and also, to some extent, movements along the Z-axis.

NOTE Welding robots and similar 3D equipment for manipulation are covered by other standards, notably ISO 9283.

This part of ISO 22827 specifies two methods for the testing of the accuracy of the moving mechanism. The first method (type 1 test) provides a test method capable of classification of the moving mechanism rigorously according to the required accuracy. The second method (type 2 test) provides a simpler method for testing the moving mechanism by marking. The selection of the test method is optional. However, for large-size laser beam welding machines, such as a laser beam welding machine using 2D moving optics or an X-Y table, the type 2 test is applicable.

This part of ISO 22827 is not applicable for welding cells with manual positioning of the welding head and/or the component, and for fixed-position welding without the moving mechanism.

The requirements can also be applied as a part of verification testing as part of maintenance, as appropriate.

If modifications are made to a laser beam machine (rebuilding, repairs, modifications to the operating conditions, etc.) that have an effect on the acceptance testing, a repeat test may be necessary to cover the machine parameters affected by such modifications.

NOTE The beam generating system, the optical delivery system and the devices for shielding and assist gasses are covered in ISO 22827-1.

This part of ISO 22827 can be applied to a part of the acceptance conditions for the delivery of the laser beam welding machine.

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 230-2, *Test code for machine tools — Part 2: Determination of accuracy and repeatability of positioning numerically controlled axes*

ISO 15616-2:2003, *Acceptance tests for CO₂-laser beam machines for high quality welding and cutting — Part 2: Measurement of static and dynamic accuracy*

ISO/TS 17477:2003, *Acceptance tests for CO₂-laser beam machines for welding and cutting using 2D moving optics type*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1 positioning accuracy
precision and repeatability of positioning of the part in motion (work piece, optics, etc.) along a translation or rotation axis

NOTE The following characteristics can be distinguished in accordance with ISO 230-2:

- mean reversal value of an axis: arithmetic mean of the reversal values at all target positions along or around the axis;
- unidirectional and bidirectional repeatability of positioning of an axis: maximum value of the repeatability of positioning at any position along or around the axis and under the conditions specified in ISO 230-2;
- bidirectional accuracy of positioning of an axis: maximum difference between the extreme values of the positional deviations regardless of the position and the direction of motion [ISO 15616-2:2003].

3.2 trajectory accuracy
trajectory deviation between the required path and the realised or marked path.

4 Environmental conditions

Laser beam welding machines shall be installed in welding cells, also including equipment for manipulation of the welding head and/or the component to be welded.

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5 Test of accuracy of the moving mechanism

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5.1 Type 1 test

5.1.1 Classification of the moving mechanism

The moving mechanism for the laser beam welding system is classified as follows:

- A: Very high accuracy welding
- B: High accuracy welding
- C: Ordinary welding
- D: Low accuracy welding

The designation of the classes is arbitrary to some degree. Selection of the required class has to be done during production planning and the class specified in the welding-procedure specification.

Detailed testing of the moving table or rotating fixtures shall be carried out either without a load or with a load (maximum load). When the moving system is provided with a beam-moving axis, this shall be tested.

The positioning accuracy shall be measured in accordance with 5.1.2.

The dynamic trajectory accuracy shall be measured in accordance with 5.1.3.

5.1.2 Inspection of positioning accuracy

The range of repeatability and positioning accuracy of the Nd:YAG laser beam welding machines shall be in accordance with Table 1, according to the classification of the moving mechanism.

Testing shall be carried out at the maximum travelling speed specified in the manufacturer's specification for welding operations. The measured value of accuracy shall be within the range shown in Table 1. At least three measurements shall be taken and averaged.

When the table length is in 1 m or longer, the positioning accuracy shall be measured at every 1 m in span of the movement. Inspection shall be carried out for the X-and Y-coordinates.

Table 1 — Range of repeatability and positioning accuracy

Item	Acceptance criteria for class			
	A	B	C	D
Positioning repeatability				
— unidirectional	± 0,01 mm	± 0,01 mm	± 0,02 mm	± 0,2 mm
— bidirectional	± 0,02 mm	± 0,04 mm	± 0,06 mm	± 0,4 mm
Positioning accuracy	± 0,05 mm/m	± 0,1 mm/m	± 0,2 mm/m	± 0,4 mm/m

The positioning accuracy shall be measured only after verifying that the travelling speed range is within the requirement shown in Table 2.

The positioning accuracy and position repeatability shall be measured based on ISO 230-2 or ISO/TS 17477. However, a simplified test method can be used if specified in the specification.

The inspection shall include that of the working axis or rotating fixtures of the moving table under no load condition. Positioning accuracy of the optical axis of the moving beam shall be tested if the moving beam is used.

The travelling speed accuracy shall be tested at maximum and minimum travelling speeds, as specified in the specification for welding operations. The measured values shall be within the range specified in Table 2. The manufacturer's specification may include a preferred travelling speed for welding operations. The measured value of the preferred travelling speed shall be within the range specified in Table 2.

Table 2 — Range of travelling speed accuracy

Item	Acceptance criteria for class			
	A	B	C	D
Maximum travel speed	± 2 %	± 2 %	± 4 %	± 10 %
Minimum travel speed	± 5 %	± 5 %	± 10 %	± 10 %
Preferred speed accuracy	± 1 %	± 1 %	± 2 %	± 5 %

The passing points for speed measurements shall be marked in the equal-velocity running range within the maximum table size, and the time for passing the distance between the passing points shall be measured.

5.1.3 Inspection of trajectory accuracy

The trajectory accuracy has to be measured in accordance with ISO 15616-2:2003, Clause 5, or measured as the deviation from intersection in accordance with ISO/TS 17477:2003, 5.2.

The limits for the measured values are given in Table 3.