
**Specification and approval of welding
procedures for metallic materials —**

Part 11:

Welding procedure specification for laser beam
welding

iTeh STANDARD PREVIEW

*Descriptif et qualification d'un mode opératoire de soudage pour les
matériaux métalliques —*
(standard.iteh.ai)

Partie 11: Descriptif d'un mode opératoire de soudage par faisceau laser

ISO 9956-11:1996

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>



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.

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.

International Standard ISO 9956-11 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).

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

ISO 9956 consists of the following parts, under the general title *Specification and approval of welding procedures for metallic materials*:

- *Part 1: General rules for fusion welding*
- *Part 2: Welding procedure specification for arc welding*
- *Part 3: Welding procedure tests for the arc welding of steels*
- *Part 4: Welding procedure tests for the arc welding of aluminium and its alloys*
- *Part 5: Approval by using approved consumables for arc welding*
- *Part 6: Approval related to previous experience*

© ISO 1996

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet: central@isocs.iso.ch
X.400: c=ch; a=400net; p=iso; o=isocs; s=central

Printed in Switzerland

- *Part 7: Approval by a standard welding procedure for arc welding*
- *Part 8: Approval by a pre-production welding test*
- *Part 10: Welding procedure specification for electron beam welding*
- *Part 11: Welding procedure specification for laser beam welding*
- *Part 12: Welding procedure test for arc welding of cast steels*

Annexes A and ZZ of this part of ISO 9956 are for information only.

Annex ZZ provides a list of corresponding International and European Standards for which equivalents are not given in the text.

iTeh STANDARD PREVIEW **(standards.iteh.ai)**

ISO 9956-11:1996

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

Contents	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Definitions	1
3.1 slope up	1
3.2 slope down	1
3.3 working distance	2
3.4 tacking pass	2
3.5 weld pass	2
3.6 cosmetic pass	2
3.7 overlap	2
3.8 back or front support	2
3.9 focal length	2
3.10 focal spot	3
4 Technical contents of welding procedure specification (WPS)	3
4.1 General	3
4.2 Related to the manufacturer	3
4.3 Related to the parent materials	3
4.4 Welding process	4
4.5 Joint design	4
4.6 Welding position	4
4.7 Joint preparation	4
4.8 Welding technique	4
4.9 Jigs, fixtures and tooling	4
4.10 Backing	4
4.11 Equipment used	5
4.12 Filler or added material(s) (if any)	6
4.13 Welding parameters	6
4.14 Thermal conditions	7
4.15 Operations after welding	7
Annex A (informative) Welding procedure specification for laser beam welding (process 751)	8

Foreword

The text of EN ISO 9956-11:1996 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 March 1997, and conflicting national standards shall be withdrawn at the latest by March 1997.

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

iTeh STANDARD PREVIEW (standards.iteh.ai)

ISO 9956-11:1996

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

iTeh STANDARD PREVIEW
This page intentionally left blank
(standards.iteh.ai)

ISO 9956-11:1996

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

1 Scope

This European Standard specifies requirements for the content of welding procedure specifications for laser beam welding processes.

Variables listed in this European Standard are those influencing the metallurgy, mechanical properties, the geometry of the assembly and other service related properties.

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.

EN 288-1	Specification and approval of welding procedures for metallic materials - Part 1: General rules for fusion welding
EN 439	Welding consumables - Shielding gases for arc welding and cutting
EN 24063	Welding, brazing, soldering and braze welding of metals - Nomenclature of processes and reference numbers for symbolic representation on drawings (ISO 4063:1992)
prEN ISO 6947	Welds - Working positions - Definitions of angles of slope and rotation (ISO 6947:1990)
ISO 11145	Optics and optical instruments - Lasers and laser related equipment - Terminology, symbols and units of measure for the specification and testing of lasers and laser assemblies

3 Definitions

For the purpose of this standard, the following definitions apply in addition of those given in EN 288-1 and in ISO 11145 :

3.1 slope up

The controlled increase of the beam power at the beginning of welding.

3.2 slope down

The controlled decrease of the beam power at the end of welding. The slope down region is the region on the workpiece in which the effects of slope down occur. It can consist of one or two areas, depending on the selected welding mode :

a) in full penetration welding :

- a region where beam penetration is still complete ;
- a region where penetration is partial or decreasing.

b) in partial penetration welding :

- a region where penetration decreases continuously.

3.3 working distance

The distance between the surface of the workpiece and a standard reference point of the equipment which is traceable to the true focusing lens or mirror centre.

3.4 tacking pass

The pass made to hold the parts to be welded in proper alignment until the final welds are made.

NOTE : This may be produced by a continuous or discontinuous pass with partial penetration.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.5 weld pass

[ISO 9956-11:1996](https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996)

The pass ensuring fusion to the required depth.

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

3.6 cosmetic pass

Superficial remelting of the weld in order to enhance its appearance.

NOTE : This pass is made with a defocused or oscillating beam.

3.7 overlap

That portion of the weld pass remelted prior to the slope down.

3.8 back or front support

A plate placed against the workpiece on either the back or front face of the joint in order to retain the molten weld metal.

3.9 focal length

The distance between the centre of the focusing lens or mirror and the focal spot.

3.10 focal spot

The part of the beam beyond the focusing system where the beam comes to a minimum cross-sectional area.

4 Technical contents of welding procedure specification (WPS)

4.1 General

The welding procedure specification (WPS) shall give details of how a welding operation is to be performed and shall contain all relevant information about the welding work.

Welding procedure specifications may cover a certain range of thicknesses of the joined parts and may also cover a range of parent metals and even filler metals. Some manufacturers may additionally prefer to prepare work instructions for each specific job as part of the detailed production planning.

Information listed below is adequate for most welding operations. For some applications it may be necessary to supplement or reduce the list. The relevant information shall be specified in the WPS.

Ranges and tolerances, according to the manufacturer's experience, shall be specified when appropriate.

An example of the WPS-format is shown in annex A.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO 9956-11:1996](https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996)

<https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>

4.2 Related to the manufacturer

4.2.1 Identification of the manufacturer

4.2.2 Identification of the WPS

4.2.3 Reference to the welding procedure approval record (WPAR) or other documents, as required

4.3 Related to the parent materials

4.3.1 Grades

Identification of the parent materials (and backing plates, if any), preferably by reference to an appropriate standard, and for information type of product (rolled, forged, cast, etc.) shall be provided.

A WPS may cover a group of materials.

4.3.2 Material dimensions

The following dimensions shall be provided :

- the thickness range of the joint ;
- the range of workpiece outside diameters.

4.4 Welding process

The welding process is 751 according to EN 24063.

4.5 Joint design

A sketch of the joint design showing configuration, dimensions and tolerances shall be provided.

4.6 Welding position

The welding positions shall be designated as specified in EN ISO 6947.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

4.7 Joint preparation

The following regarding joint preparation shall be provided :

- joint preparation method, cleaning, degreasing, etc. ;
- protection of joint preparation (if necessary).

4.8 Welding technique

The welding technique sketch shall show details of all weld passes (tacking pass, welding pass, cosmetic pass).

4.9 Jigs, fixtures and tooling

The methods to be used for workpiece fixturing shall be described (including manual tack welding, if used).

4.10 Backing

4.10.1 Back and/or front support

Type(s) and dimensions (if any) shall be provided.

4.10.2 Gas backing

The following information shall be provided :

- classification, type and, if necessary, supplier and trade name.
- gas flow rate, if required

4.11 Equipment used

Identification of any equipment shall be provided.

4.11.1 Laser welding equipment

The following information shall be provided :

- type (for example YAG or CO₂), model, make ;
- nominal power ;
- continuous wave or pulsed ;
- number of lasers combined ;
- nominal values for the following parameters shall be specified :
 - a) beam mode ; <https://standards.iteh.ai/catalog/standards/sist/47c24d4a-518a-4a9b-9b00-99f4cc83b78b/iso-9956-11-1996>
 - b) beam divergence ;
 - c) wave length ;
 - d) beam polarisation.

4.11.2 Beam delivery and focusing system

The following information shall be provided :

- method of transmission (fibres, mirrors, including beam collimators, if used) ;
- distance from beam source to focusing system, if necessary ;
- beam diameter on entrance to focusing system ;
- the beam transmission and focusing system ;
- focal length ;
- nominal focal point size.