International Standard

ISO 15614-11

Specification and qualification of welding procedures for metallic materials — Welding procedure test —

Part 11: Electron and laser beam welding

Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques — Épreuve de qualification d'un mode opératoire de soudage —

Partie 11: Soudage par faisceau d'électrons et par faisceau laser

Second edition
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 10, *Quality management in the field of welding*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 15614-11:2002), which has been technically revised.

The main changes are as follows:

— normative references updated and ISO 15607 moved to Bibliography;

— acceptance level changed to quality level in accordance with the ISO 13919-1 and ISO 13919-2;

— terminology aligned with that used in other parts of the ISO 15614 series, where appropriate;

— figures updated and corrected, including symbols and keys;

— Tables 1 to 4 revised;

— 6.2 reformatted and revised;

— Clause 7 revised.

A list of all parts in the ISO 15614 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This corrected version of ISO 15614-11:2025 incorporates the following corrections:

— In Table 2, corrected superscript "Ultrasonic Testing (UT)[h]" to "Ultrasonic Testing (UT)[g]".

Introduction

All new welding procedure tests are intended to be carried out in accordance with this document. However, this document does not invalidate previous welding procedure tests made to former national standards or specifications or previous editions of this document.

Where additional tests have to be carried out to make a qualification technically equivalent, these should be done on a test piece which is made in accordance with this document.

Specification and qualification of WPSs that were made in accordance with previous editions of this document can be used for any application for which the current edition is specified. In this case, the ranges of qualification of previous editions remain applicable.

It is possible to create a new welding procedure qualification record (WPQR) range of qualification according to this edition based on an existing qualified WPQR, provided the technical intent of the testing requirements of this document have been satisfied.

Specification and qualification of welding procedures for metallic materials — Welding procedure test —

Part 11: Electron and laser beam welding

1 Scope

This document specifies requirements for qualification testing of welding procedure specifications (WPSs) for electron or laser beam welding.

This document applies to metallic materials, irrespective of the shape of the parts, their thicknesses, the manufacturing method (e.g. rolling, forging, casting, sintering) or their heat treatment. It covers both the production of new parts and repair work.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 4136, *Destructive tests on welds in metallic materials — Transverse tensile test*

ISO 5173, *Destructive tests on welds in metallic materials — Bend tests*

ISO 6947, *Welding and allied processes — Welding positions*

ISO 9015-2, *Destructive tests on welds in metallic materials — Hardness testing — Part 2: Microhardness testing of welded joints*

ISO 13588, *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology*

ISO 13919-1, *Electron and laser-beam welded joints — Requirements and recommendations on quality levels for imperfections — Part 1: Steel, nickel, titanium and their alloys*

ISO 13919-2, *Electron and laser-beam welded joints — Requirements and recommendations on quality levels for imperfections — Part 2: Aluminium, magnesium and their alloys and pure copper*

ISO/DIS 15608[1)], *Welding — Grouping system for metallic materials*

ISO 15609-3:2004, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 3: Electron beam welding*

ISO 15609-4:2009, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 4: Laser beam welding*

ISO 17636-1, *Non-destructive testing of welds — Radiographic testing — Part 1: X- and gamma-ray techniques with film*

1) Under preparation. Stage at the time of publication: ISO/DIS 15608:2025.

ISO 17636-2, *Non-destructive testing of welds — Radiographic testing — Part 2: X- and gamma-ray techniques with digital detectors*

ISO 17637, *Non-destructive testing of welds — Visual testing of fusion-welded joints*

ISO 17638, *Non-destructive testing of welds — Magnetic particle testing*

ISO 17639, *Destructive tests on welds in metallic materials — Macroscopic and microscopic examination of welds*

ISO 17640, *Non-destructive testing of welds — Ultrasonic testing — Techniques, testing levels, and assessment*

ISO 20601, *Non-destructive testing of welds — Ultrasonic testing — Use of automated phased array technology for thin-walled steel components*

ISO 22826, *Destructive tests on welds in metallic materials — Hardness testing of narrow joints welded by laser and electron beam (Vickers and Knoop hardness tests)*

ISO/TR 25901-1, *Welding and allied processes — Vocabulary — Part 1: General terms*

ISO 25901-2, *Welding and allied processes — Vocabulary — Part 2: Health and safety*

ISO/TR 25901-3, *Welding and allied processes — Vocabulary — Part 3: Welding processes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 25901-1, ISO 25901-2 and ISO/TR 25901-3 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Preliminary welding procedure specification (pWPS)

A pWPS shall be prepared in accordance with ISO 15609-3 for electron beam welding and ISO 15609-4 for laser beam welding. The pWPS shall specify the tolerances for all the relevant parameters.

A WPS shall be classified as a pWPS until it is qualified in accordance with this document.

The WPS shall give details on how a welding operation is to be performed, including tacking and fixturing.

5 Welding procedure test

The welding and testing of test pieces shall be in accordance with Clauses 6 and 7.

In order to take into account service performance requirements, the acceptance criteria for imperfections shall be made in accordance with quality levels B, C or D in accordance with ISO 13919-1 for steel, nickel, titanium and their alloys or ISO 13919-2 for aluminium, magnesium and their alloys and pure copper.

6 Test piece

6.1 General

The assembly to which the electron or laser beam WPS applies in production shall be represented by one or more standardized test pieces in accordance with 6.2.

6.2 Shape and dimensions of test pieces

6.2.1 General

Unless otherwise specified, the shape and minimum dimensions of the test pieces shall be in accordance with Clause 6. The length of the test piece shall be such as to permit the appropriate number of test specimens as specified in Table 1 to Table 3 to be prepared.

The test pieces shall be large enough to ensure adequate heat distribution and for the removal of non-destructive and/or destructive tests.

When extra testing and/or re-testing specimens are required, then additional test pieces or longer test pieces shall be prepared in accordance with 7.5.

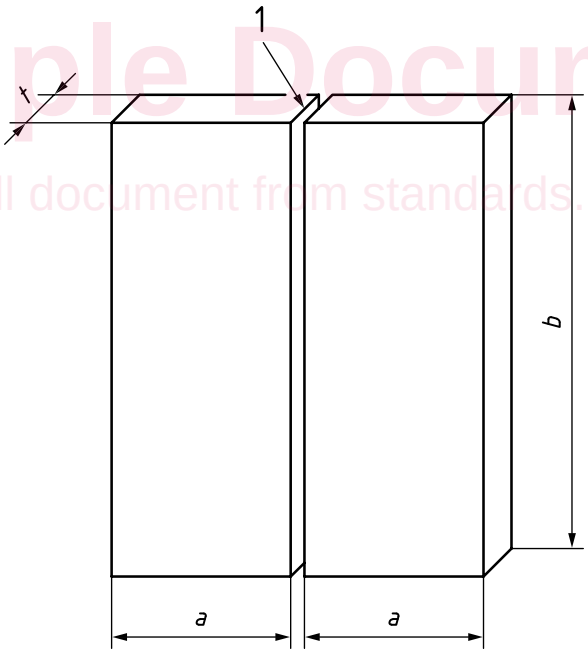
The test piece shall be designed to represent, as far as possible, the component and joint geometry and shall be specified.

For plate material, the principal direction of rolling shall be marked on the test piece, if requested by the application standard or the specification.

The thickness and/or pipe outside diameter of the test pieces shall be selected in accordance with 8.5.2.1 and 8.5.2.2.

6.2.2 Linear butt weld

The test piece shall be in accordance with Figure 1.



Key

1 edge preparation and fit-up as detailed in the pWPS

t thickness of the thinner material in a dissimilar thickness joint

$a = 3t$; minimum value 150 mm

$b = 6t$; minimum value 300 mm

Figure 1 — Test piece for a linear butt weld