
Popis in kvalifikacija varilnih postopkov za kovinske materiale - Preskus varilnega postopka - 5. del: Obločno varjenje titana, cirkonija in njihovih zlitin (ISO/DIS 15614-5:2022)

Specification and qualification of welding procedures for metallic materials - Welding procedure test - Part 5: Arc welding of titanium, zirconium and their alloys (ISO/DIS 15614-5:2022)

Anforderung und Qualifizierung von Schweißverfahren für metallische Werkstoffe - Schweißverfahrensprüfung - Teil 5: Lichtbogenschweißen von Titan, Zirkonium und ihren Legierungen (ISO/DIS 15614-5:2022)

Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques - Épreuve de qualification d'un mode opératoire de soudage - Partie 5: Soudage à l'arc sur titane, zirconium et leurs alliages (ISO/DIS 15614-5:2022)

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77.120.50	Titan in titanove zlitine	Titanium and titanium alloys

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Part 5: Arc welding of titanium, zirconium and their alloys

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Partie 5: Soudage à l'arc sur titane, zirconium et leurs alliages

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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

This second edition cancels and replaces the first edition (ISO 15614-5:2004), which has been technically revised.

Any feedback, question or request for official interpretation related to any aspect of this document should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body. A complete listing of these bodies can be found at www.iso.org/members.html. Official interpretations, where they exist, are available from this page: <https://committee.iso.org/sites/tc44/home/interpretation.html>.

The main changes compared to the previous edition are as follows:

- editorial revised;
- normative references updated.

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

Introduction

All new welding procedure tests are to be carried out in accordance with this document from the date of its issue. However, this document does not invalidate previous welding procedure tests made to former national standards or specifications or previous issues of this document.

Where additional tests have to be carried out to make the qualification technically equivalent, it is only necessary to do the additional tests on a test piece which should be made in accordance with this document.

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

Part 5: Arc welding of titanium, zirconium and their alloys

1 Scope

This document is part of a series of standards, details of this series are given in ISO 15607:2019, Annex A.

This document specifies how a preliminary welding procedure specification is qualified by welding procedure tests.

This document defines the conditions for the execution of welding procedure tests and the qualification range for welding procedures for all practical welding operations within the range of variables listed in [Clause 8](#).

Tests shall be carried out in accordance with this standard. Additional tests may be required by application standards.

This standard applies to the arc welding of titanium, zirconium and their alloys in all product forms. Arc welding is covered by the following processes in accordance with ISO 4063:

131 – metal inert gas welding, MIG welding;

141 – tungsten inert gas welding, TIG welding;

15 – plasma arc welding.

The principles of this document may be applied to other fusion welding processes.

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 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

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

ISO 9606-5, *Approval testing of welders — Fusion welding — Part 5: Titanium and titanium alloys, zirconium and zirconium alloys*

ISO 14175, *Welding consumables — Gases and gas mixtures for fusion welding and allied processes*

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ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials*

ISO/TR 15608, *Welding — Guidelines for a metallic materials grouping system*

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding*

ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test*

ISO 17636 (all parts), *Non-destructive testing of welds — Radiographic testing*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 25901 (all parts) and ISO 15607 apply.

ISO and IEC maintain terminological 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 preliminary welding procedure specification shall be prepared in accordance with ISO 15609-1.

5 Welding procedure test

The welding and testing of test pieces shall be in accordance with [Clauses 6](#) and [7](#).

The welder or welding operator who undertakes the welding procedure test satisfactorily in accordance with this document is qualified for the appropriate qualification range in accordance with ISO 9606-5 or ISO 14732 providing that the relevant testing requirements are met.

6 Test pieces**6.1 General**

The welded joint to which the welding procedure will relate in production shall be represented by making a standardized test piece or pieces, as specified in [6.2](#). Where the production/joint geometry requirements do not represent the standardized test pieces as shown in this document, ISO 15613 shall be used.

6.2 Shape and dimensions of test pieces**6.2.1 General**

The length or number of test pieces shall be sufficient to allow all required tests to be carried out.

Additional test pieces, or longer test pieces than the minimum size, may be prepared in order to allow for extra and/or for re-testing specimens (see [7.7](#)).

For all test pieces, except branch connections (see [Figure 4](#)) and fillet welds (see [Figure 8](#)), the material thickness, t , shall be the same for both plates/pipes to be welded.

The thickness and/or outside pipe diameter of the test pieces shall be selected in accordance with [8.3.2.1](#) to [8.3.2.4](#).

The shape and minimum dimensions of the test pieces shall be as follows:

6.2.2 Butt joint in plate with full penetration

The test pieces shall be prepared in accordance with [Figure 1](#).

6.2.3 Butt joint in pipe with full penetration

The test pieces shall be prepared in accordance with [Figure 2](#).

NOTE The word “pipe”, alone or in combination, is used to mean “pipe”, “tube” or “hollow section” except square or rectangular hollow section.

6.2.4 T-joint

The test pieces shall be prepared in accordance with [Figure 3](#). These may be used for fully penetrated butt welds or fillet welds.

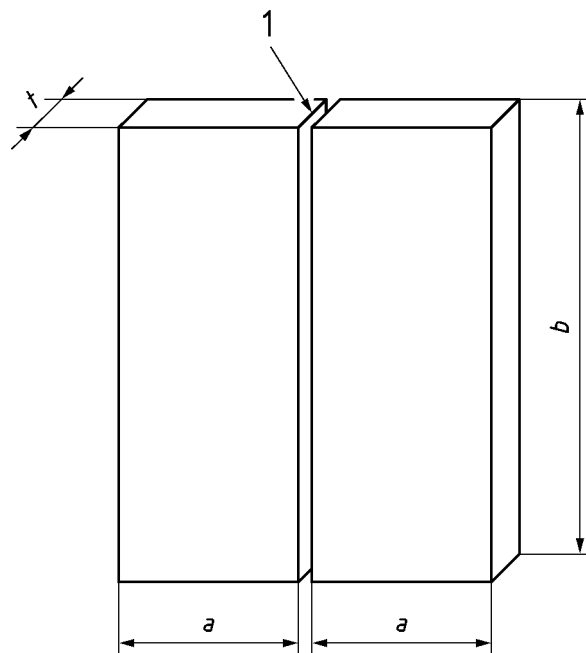
6.2.5 Branch connection (standards.iteh.ai)

The test pieces shall be in accordance with [Figure 4](#). The angle α is the minimum to be used in production. These may be used for fully penetrated joints (set-on or set-in or set-through joint) and for fillet welds.

6.3 Welding of test pieces

Preparation and welding of test pieces shall be carried out in accordance with the pWPS, and under the general conditions of welding in production which they shall represent. Welding positions and limitations for the angle of slope and rotation of the test piece shall be in accordance with ISO 6947. If tack welds are to be fused into the final joint, they shall be included in the test piece.

Welding and testing of the test pieces shall be witnessed by an examiner or examining body.

**Key**

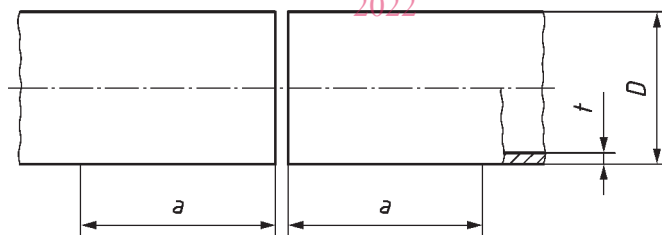
- 1 joint preparation and fit-up as detailed in the pWPS
- a minimum value 150 mm
- b minimum value 300 mm
- t material thickness

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Figure 1 — Test piece for a butt joint in plate with full penetration

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**Key**

- 1 joint preparation and fit-up as detailed in the pWPS
- a minimum value 150 mm
- D outside pipe diameter
- t material thickness

Figure 2 — Test piece for a butt joint in pipe with full penetration