INTERNATIONAL STANDARD

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

Part 2: Arc welding of aluminium and its alloys

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

Partie 2: Soudage à l'arc de l'aluminium et de ses alliages

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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 15614-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/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 document, read "...this European Standard..." to mean "...this International Standard...".

ISO 15614 consists of the following parts, under the general title *Specification and qualification of welding procedures for metallic materials — Welding procedure test*:

- *Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*
- *Part 2: Arc welding of aluminium and its alloys*
- *Part 3: Arc welding of cast iron*
- *Part 4: Finishing welding of aluminium castings*
- *Part 5: Arc welding of titanium, zirconium and their alloys*
- *Part 6: Arc welding of copper and its alloys*
- *Part 7: Corrosion resistant overlay, cladding restore and hardfacing*
- *Part 8: Welding of tubes to tube-plate joints*
- *Part 9: Arc underwater hyperbaric wet welding*
- *Part 10: Underwater hyperbaric dry welding*
- *Part 11: Electron and laser beam welding*
- *Part 12: Spot, seam and projection welding*
- *Part 13: Resistance butt and flash welding*

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

For the purposes of this part of ISO 15614, the CEN annex regarding fulfilment of European Council Directives has been removed.

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Foreword

This document (EN ISO 15614-2:2005) has been prepared by Technical Committee CEN/TC 121 “Welding”, the secretariat of which is held by DIN.

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 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

This document supersedes EN 288-4:1992.

EN ISO 15614 consists of the following parts, under the general title *Specification and qualification of welding procedures for metallic materials — Welding procedure test*:

— *Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys*

— *Part 2: Arc welding of aluminium and its alloys*

— *Part 3: Welding procedure tests for the arc welding of casts iron* [1)]

— *Part 4: Finishing welding of aluminium castings* [1)]

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

— *Part 6: Arc welding of copper and its alloys* [1)]

— *Part 7: Overlay welding* [1)]

— *Part 8: Welding of tubes to tube-plate joints*

— *Part 10: Hyperbaric dry welding* [1)]

— *Part 11: Electron and laser beam welding*

— *Part 12: Spot, seam and projection welding*

— *Part 13: Resistance butt and flash welding* [1)]

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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1) To be published.

Introduction

All new welding procedure tests are to be carried out in accordance with this document from the date of this issue.

However, this document does not invalidate previous welding procedure tests made to former 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.

Requests for official interpretations of 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 which can be found at www.iso.org.

1 Scope

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

This document is part of a series of standards, details of this series are given in EN ISO 15607:2003, Annex A.

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

This document applies to the arc welding of wrought and cast aluminium and its alloys. In this document the term aluminium stands for aluminium and for aluminium alloys.

This document does not apply to finishing welding of aluminium castings which is dealt by prEN ISO 15614-4.

Arc welding of aluminium is covered by the following welding processes in accordance with EN ISO 4063:

— 131 : metal inert gas welding (MIG welding);

— 141 : tungsten inert gas welding (TIG welding);

— 15 : plasma arc welding.

NOTE Specific service, material or manufacturing conditions may require more comprehensive testing than is specified by this document (see 7.1).

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

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.

EN 515, *Aluminium and aluminium alloys — Wrought products — Temper designations.*

EN 571-1, *Non destructive testing — Penetrant testing — Part 1: General principles.*

EN 1714, *Non-destructive examination of welds — Ultrasonic examination of welded joints.*

EN ISO 6947, *Welds — Working positions — Definitions of angles of slope and rotation (ISO 6947:1993).*

EN ISO 9606-2, *Qualification test of welders — Fusion welding — Part 2: Aluminium and aluminium alloys (ISO 9606-2:2004).*

EN ISO 15607:2003, *Specification and qualification of welding procedures for metallic materials — General rules (ISO 15607:2003).*

EN ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc welding (ISO 15609-1:2004).*

EN ISO 15613, *Specification and qualification of welding procedures for metallic materials — Qualification based on pre-production welding test (ISO 15613:2004).*

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

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

ISO 9017, *Destructive tests on welds in metallic materials — Fracture test.*

ISO 10042, *Arc-welded joints in aluminium and its weldable alloys — Guidance on quality levels for imperfections.*

ISO 14175, *Welding consumables — Shielding gases for arc welding and cutting.*

ISO 14732, *Welding personnel — Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials.*

ISO 17635, *Non-destructive testing of welds –— General rules for fusion welds in metallic materials .*

ISO 17636, *Non-destructive testing of welds —Radiographic testing of fusion-welded joints.*

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.*

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

ISO/TR 17671-1, *Welding — Recommendations for welding of metallic materials — Part 1: General guidance for arc welding.*

ISO/TR 17671-4, *Welding — Recommendations for welding of metallic materials — Part 4: Arc welding of aluminium and aluminium alloys.*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 15607:2003 and the following apply.

3.1
finishing welding
welding carried out during production in order to remove casting defects and core openings to ensure the agreed quality of castings

4 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with EN ISO 15609-1. It shall specify the tolerance for all the relevant parameters.

Guidance for the welding of aluminium is given in ISO/TR 17671-1 and ISO/TR 17671-4.

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 range of qualification in accordance with EN ISO 9606-2 or ISO 14732, providing that the relevant testing requirements are met.

6 Test piece

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, the use of EN ISO 15613 shall be required.

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 7.6).

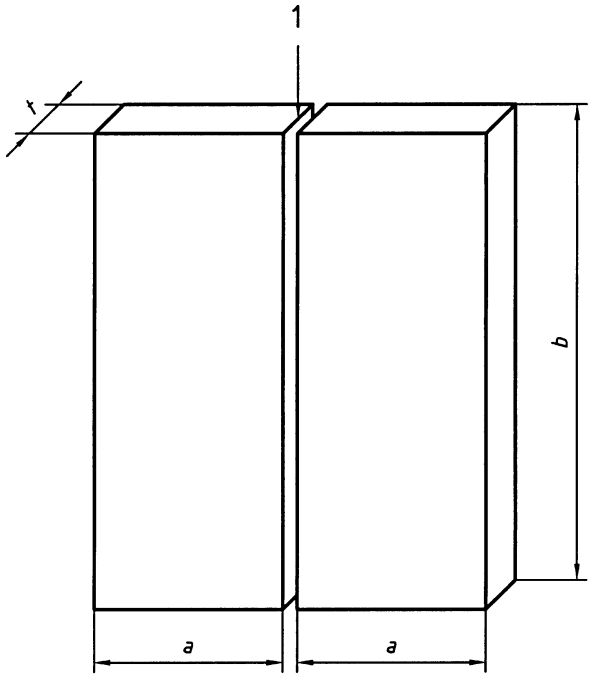
For all test pieces except branch connections (see Figure 4) and T-joints (see Figure 3) the material thickness, t, shall be the same for both plates/pipes to be welded. If required by the application standard, the direction of working, e.g. for extrusion, shall be marked on the test piece.

The material thickness and/or pipe outside 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 piece shall be as follows:

6.2.2 Butt joint in plate with full penetration

The test piece shall be prepared in accordance with Figure 1.



Key

1 Joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)
a Minimum value 150 mm (transverse bend test specimens may require a larger *a*, see 7.4)
b Minimum value 300 mm
t Material thickness

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

6.2.3 Butt joint in pipe with full penetration

The test piece 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".