INTERNATIONAL STANDARD

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

Part 6: Arc and gas welding of copper 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 6: Soudage à l'arc et aux gaz du cuivre et de ses alliages

Reference number
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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 15614-6 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding*, 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).

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: Fusion and pressure welding of non-alloyed and low-alloyed cast irons*

— *Part 4: Finishing welding of aluminium castings*

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

— *Part 6: Arc and gas welding of copper and its alloys*

— *Part 7: Overlay welding*

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

— *Part 9: Underwater hyperbaric wet welding*

— *Part 10: Hyperbaric dry welding*

— *Part 11: Electron and laser beam welding*

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

— *Part 13: Resistance butt and flash welding*

Introduction

ISO 15614 is part of a series of standards. Details of this series are given in ISO 15607:2003, Annex A.

Requests for official interpretations of any aspect of this part of ISO 15614 should be directed to the Secretariat of ISO/TC 44/SC 10 via your national standards body, a complete listing of which can be found at www.iso.org.

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

Part 6: Arc and gas welding of copper and its alloys

1 Scope

This part of ISO 15614 specifies how a preliminary welding procedure specification is qualified by welding procedure tests. It applies to the arc and gas welding of copper and copper alloys in all product forms.

This part of ISO 15614 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 9.

This part of ISO 15614 is applicable to all new welding procedures. However, it does not invalidate previous welding procedure tests made to former national standards or specifications. 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 made in accordance with this part of ISO 15614.

Additional tests may be required by application standards.

The principles of this part of ISO 15614 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.

ISO 3452, *Non-destructive testing — Penetrant testing — General principles*

ISO 4063:1998, *Welding and allied processes — Nomenclature of processes and reference numbers*

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

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

ISO 6520-1, *Welding and allied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding*

ISO 6947, *Welds — Working positions — Definitions of angles of slope and rotation*

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

ISO 9606-3, *Approval testing of welders — Fusion welding — Part 3: Copper and copper alloys*

ISO 10042:2005, *Welding — Arc-welded joints in aluminium and its alloys — 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 of resistance weld setters for fully mechanized and automatic welding of metallic materials*

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

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

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

ISO 15609-2, *Specification and qualification of welding procedure for metallic materials — Welding procedure specification — Part 2: Gas welding*

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

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 17659, *Welding — Multilingual terms for welded joints with illustrations*

3 Terms and definitions

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

4 Welding processes

Arc and gas welding are covered by the following processes in accordance with ISO 4063:1998.

111 manual metal arc welding;

131 metal inert gas welding, MIG welding;

141 tungsten inert gas welding, TIG welding;

15 plasma arc welding;

311 oxy-acetylene welding.

5 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with ISO 15609-1 or ISO 15609-2.

6 Welding procedure test

The making and testing of test pieces shall be in accordance with Clauses 7 and 8.

The welder or welding operator who undertakes the welding procedure test satisfactorily, in accordance with this part of ISO 15614, is qualified for the appropriate range of qualification given in ISO 9606-3 or ISO 14732 providing that the relevant testing requirements are met.

7 Test piece

7.1 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 7.2. Where the production/joint geometry requirements do not represent the standardized test pieces as shown in this part of ISO 15614, ISO 15613 shall be used.

7.2 Shape and dimensions of test pieces

7.2.1 General

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

Additional test pieces, or test pieces longer than the minimum size, may be prepared in order to allow for extra testing and/or for re-testing specimens (see 8.6).

For all test pieces except branch connections (see Figure 5) and fillet welds (see Figure 4), the material thickness, *t*, shall be the same for both plates/pipes to be welded.

If required by the application standard, the direction of plate rolling shall be marked on the test piece.

The thickness and/or outside pipe diameter of the test pieces shall be selected in accordance with 9.3.2.1 to 9.3.2.4.

The shape and minimum dimensions of the test piece shall be as given in 7.2.2 to 7.2.6.

7.2.2 Butt joint in plate with full penetration

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

7.2.3 Butt weld between plates with raised edges

The test piece shall be prepared in accordance with Figure 2.

7.2.4 Butt joint in pipe with full penetration

The test piece shall be prepared in accordance with Figure 3.

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

7.2.5 T-joint

The test piece shall be prepared in accordance with Figure 4.

This may be used for fully penetrated butt welds or fillet welds.

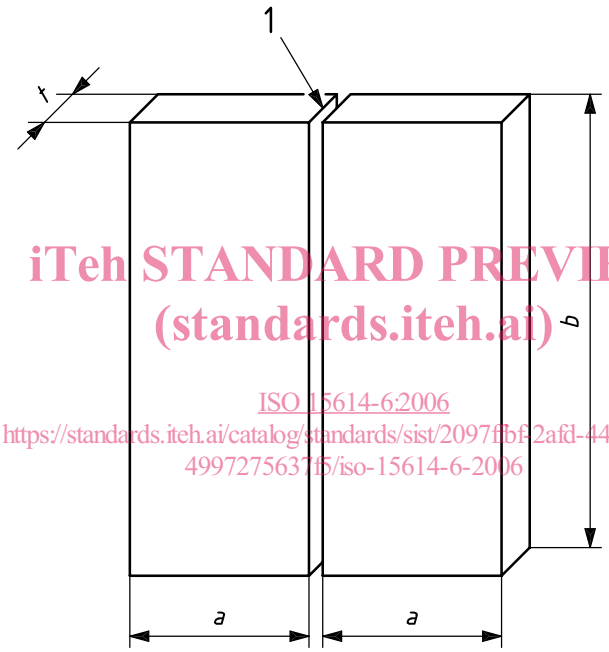
7.2.6 Branch connection

The test piece shall be prepared in accordance with Figure 5. The angle α is the minimum to be used in production. This may be used for fully penetrated joints (set-on or set-in or set-through joint, and for fillet welds).

7.3 Welding of test pieces

The 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

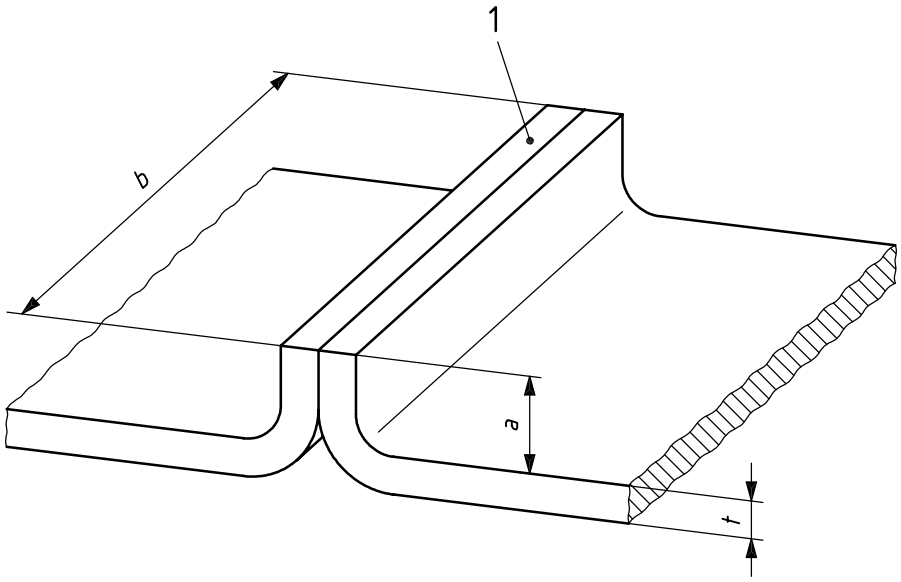
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)

a minimum value 150 mm

b minimum value 300 mm

t material thickness

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



Key

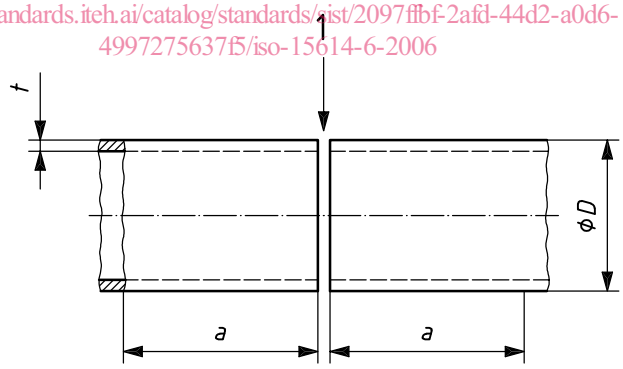
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS) or as shown in ISO 17659

a minimum value 100 mm

b minimum value 300 mm

t material thickness

Figure 2 — Butt welds between plates with raised edges



Key

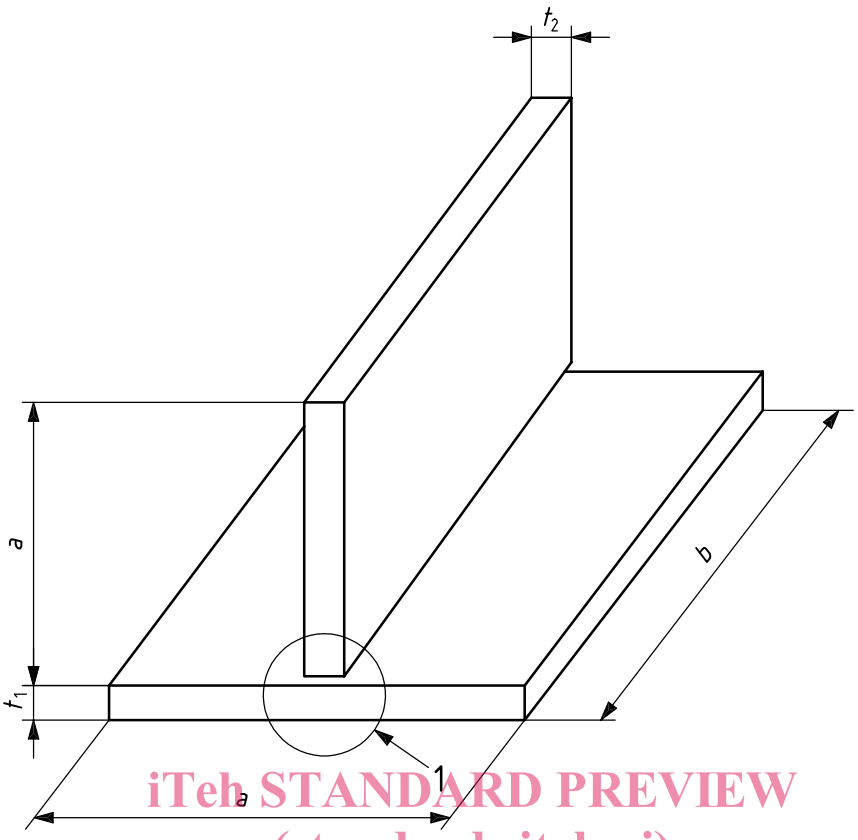
1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)

a minimum value 150 mm

D outside pipe diameter

t material thickness

Figure 3 — Test piece for a butt joint in pipe with full penetration



Key

1 joint preparation and fit-up as detailed in the preliminary Welding Procedure Specification (pWPS)

a minimum value 150 mm

b minimum value 300 mm

t_1, t_2 material thicknesses

Figure 4 — Test piece for a T-joint