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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

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

Partie 1: Soudage à l'arc et aux gaz des aciers et soudage à l'arc du nickel et des alliages de nickel

Reference number
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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 on 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 the following URL: 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 15614-1:2004), which has been technically revised. It also incorporates the Amendments ISO 15614-1:2004/Amd 1:2008 and ISO 15614-1:2004/Amd 2:2012 and the Technical Corrigendum ISO 15614-1:2004/Cor. 1:2005.

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

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 of these bodies can be found at www.iso.org.

This corrected version of ISO 15614-1:2017 incorporates the following corrections:

— in Table 5, the value “10-5” has been added for test piece material A of group 10 for test piece material B of group 5;

— Figure 6 has been updated to match the Key.

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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.

Two levels of welding procedure tests are given in order to permit application to a wide range of welded fabrication. They are designated by levels 1 and 2.

Level 1 is based on requirements of ASME Section IX and level 2 is based on the previous issues of this document.

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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

1 Scope

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

This document applies to production welding, repair welding and build-up welding.

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 qualification of this document.

The primary purpose of welding procedure qualification is to demonstrate that the joining process proposed for construction is capable of producing joints having the required mechanical properties for the intended application.

Two levels of welding procedure tests are given in order to permit application to a wide range of welded fabrication. They are designated by levels 1 and 2. In level 2, the extent of testing is greater and the ranges of qualification are more restrictive than in level 1.

Procedure tests carried out to level 2 automatically qualify for level 1 requirements, but not vice-versa.

When no level is specified in a contract or application standard, all the requirements of level 2 apply.

This document applies to the arc and gas welding of steels in all product forms and the arc welding of nickel and nickel alloys in all product forms.

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

111 — manual metal arc welding (metal-arc welding with covered electrode);

114 — self-shielded tubular-cored arc welding;

12 — submerged arc welding;

13 — gas-shielded metal arc welding;

14 — gas-shielded arc welding with non-consumable electrode;

15 — plasma arc welding;

311 — oxy-acetylene welding.

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

NOTE A former process number does not require a new qualification test according to this document.

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

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It is also possible to create a new WPQR (welding procedure qualification record) range of qualification according to this edition based on the existing qualified WPQR, provided the technical intent of the testing requirements of this document has been satisfied. Where additional tests have to be carried out to make the qualification technically equivalent, it is only necessary to perform the additional test on a test piece.

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 148-1, *Metallic materials — Charpy pendulum impact test — Part 1: Test method*

ISO 3452-1, *Non-destructive testing — Penetrant testing — Part 1: General principles*

ISO 4063, *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 5817, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections*

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

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

ISO 9015-1, *Destructive tests on welds in metallic materials — Hardness testing — Part 1: Hardness test on arc welded joints*

ISO 9016, *Destructive tests on welds in metallic materials — Impact tests — Test specimen location, notch orientation and examination*

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

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

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

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

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

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*

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

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

ISO/TR 18491, *Welding and allied processes — Guidelines for measurement of welding energies*

ISO/TR 20172, *Welding — Grouping systems for materials — European materials*

ISO/TR 20173, *Welding — Grouping systems for materials — American materials*

ISO/TR 20174, *Welding — Grouping systems for materials — Japanese materials*

ISO/TR 25901 (all parts), *Welding and allied processes — Vocabulary*

3 Terms and definitions

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

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

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

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

3.1
run out length
length of a run produced by the melting of a covered electrode

Note 1 to entry: See ISO/TR 17671-2.

3.2
build-up welding
addition of weld metal to obtain or restore required dimensions

4 Preliminary welding procedure specification (pWPS)

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

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 according to the relevant national/international standard being applied, provided that the relevant testing requirements of that standard 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 standard test piece or pieces, as specified in 6.2.

If required by the application standard, the direction of plate rolling shall be marked on the test piece when impact tests are required to be taken in the Heat Affected Zone (HAZ) and shall be mentioned in the impact test report.

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