International Standard

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Specification and qualification of welding procedures for production welding of steel and nickel-base castings

Descriptif et qualification de modes opératoires de soudage pour le soudage de production des pièces moulées en acier et à base de nickel

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Foreword

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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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This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 11, *Steel castings,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 459/SC 11, *Steel castings and forgings,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 11970:2016), which has been technically revised.

The main changes are as follows:

— appropriate reference standards have been added;

— minor grammatical changes were made.

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.

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Introduction

All welding procedure qualifications for production welding of steel castings are intended to be in accordance with this document.

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, such as ASME Section IX[1] or to previous editions of this document.

Previous procedure qualifications that conform to the range of qualification of Clause 8 are valid under this document.

Where additional tests have to be carried out to complete the qualification, it is only necessary to perform the additional tests to the requirements of Clauses 6 and 7.

In the case of specific service, material or manufacturing conditions, tests more comprehensive than those specified by this document can be specified by the purchaser, in order to gain more information, e.g. longitudinal weld tensile tests, bend tests, chemical analyses, ferrite determination in austenitic stainless steels, elongation after fracture, Charpy V-notch impact tests, and radiographic tests.

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Specification and qualification of welding procedures for production welding of steel and nickel-base castings

1 Scope

This document specifies how a welding procedure specification (WPS) for production welding of steel castings is qualified. Tests are intended to be carried out in accordance with this document, unless additional tests are specified by the purchaser or by agreement between the contracting parties.

This document defines the conditions for the execution of welding procedure qualification tests and the limits of validity of a qualified welding procedure for all practical welding operations within the range of essential variables.

This document applies to the arc welding of steel castings. The principles of this document can be applied to other fusion welding processes subject to agreement between the contracting parties.

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

ISO 4969, *Steel — Etching method for macroscopic examination*

ISO 4986, *Steel and iron castings — Magnetic particle testing*

ISO 4987, *Steel and iron castings — Liquid penetrant testing*

ISO 4992-1, *Steel castings — Ultrasonic testing — Part 1: Steel castings for general purposes*

ISO 4992-2, *Steel castings — Ultrasonic testing — Part 2: Steel castings for highly stressed components*

ISO 4993, *Steel and iron castings — Radiographic testing*

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

ISO 6507-1, *Metallic materials — Vickers hardness test — Part 1: Test method*

ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature*

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 9606-1, *Qualification testing of welders — Fusion welding — Part 1: Steels*

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

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ISO 15609, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification*

3 Terms, definitions and symbols

3.1 Terms and definitions

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

3.1
production welding
all welding carried out during production before final delivery to the purchaser

3.2
joint welding
production welding (3.1) used to weld cast components together or weld cast components to wrought steels

3.3
finishing welding
production welding (3.1) carried out in order to ensure the agreed quality of the casting

4 Preliminary welding procedure specification (pWPS)

A preliminary welding procedure specification shall be prepared. It shall specify the range of all the relevant parameters in accordance with ISO 15609.

5 Welding procedure qualification

The making and testing of test specimens representing the type and the position of welding used in production shall be in accordance with Clauses 6 and 7.

The welder who correctly carries out the welding procedure qualification test in accordance with this document is approved in the corresponding test area in accordance with ISO 9606-1, provided that the required tests in ISO 9606-1 are carried out. Additional welders shall be qualified in accordance with 7.6.

6 Test piece

6.1 General

The test piece can be in accordance with those shown in Figures 1, 2, 3 and 4, unless otherwise agreed upon between producer and purchaser.

Dimensions in these figures are for information only and may be adjusted to meet production and testing requirements.

6.2 Shape and dimensions of test piece

Additional test pieces or longer test pieces than the minimum size may be prepared in order to allow for extra and/or retesting specimens (in accordance with 7.5).

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