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

Part 9: Underwater hyperbaric wet welding

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

Partie 9: Soudage hyperbare en pleine eau

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Foreword

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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. Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

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Introduction

The primary purpose of welding procedure qualification is to demonstrate that the joining process proposed for construction, including preliminary and subsequent treatment, is capable of producing joints having the necessary mechanical properties and conforming to the non-destructive testing (NDT) requirements for the intended application.

Before a particular welding procedure is used in production, the manufacturer should determine and document the suitability of the welding procedure specification (WPS) to produce a weld of the required quality.

In this document, the term "welding procedure specification" comprises all the activities which influence the welding result, such as preparation, welding parameters, and post treatment.

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

Part 9: Underwater hyperbaric wet welding

1 Scope

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

This document is applicable to production welding and repair welding.

This document is applicable to fusion welding of steels covered by groups 1, 2, 3 and 8 in accordance with ISO 15608 in a hyperbaric wet environment.

This document is applicable to the following welding processes, in accordance with ISO 4063:2023, applicable in hyperbaric wet environments:

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

— 114 self-shielded tubular-cored arc welding.

The principles of this document can be applied to other steel groups and fusion welding processes not listed.

This document specifies three weld quality levels, A, B, and Z in order to permit application to a wide range of weldments. Each weld quality level defines a set of criteria for weldment properties that are established during qualification.

This document does not address the selection of the weld quality level to meet the requirements of a particular application.

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

ISO 5178, *Destructive tests on welds in metallic materials — Longitudinal tensile test on weld metal in fusion welded joints*

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

ISO 6947:2019, *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*

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

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

ISO 9018, *Destructive tests on welds in metallic materials — Tensile test on cruciform and lapped joints*

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

ISO 15618-1, *Qualification testing of welders for underwater welding — Part 1: Hyperbaric wet welding*

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 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*

ISO/TR 25901-1, *Welding and allied processes — Vocabulary — Part 1: General terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 25901-1 and the following apply.

ISO and IEC maintain terminology 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
hyperbaric wet welding
process of welding in a wet environment in excess of surface pressure with no mechanical barrier between the arc and the water

[SOURCE: ISO 15618-1:2016, 3.2]

3.2
essential variable
welding parameter that requires qualification

[SOURCE: ISO/TR 25901-1:2016, 2.4.4]

3.3
non-essential variable
welding parameter addressed in the *welding procedure specification* (3.8) but not requiring qualification

[SOURCE: ISO/TR 25901-1:2016, 2.4.5]

3.4
examiner
person who has been appointed to verify conformity to the applicable standard

Note 1 to entry: In certain cases, an external independent examiner can be required.

[SOURCE: ISO/TR 25901-1:2016, 2.5.29, modified — "compliance" replaced with "conformity" in definition.]

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3.5
examining body
organization that has been appointed to verify conformity to the applicable standard

Note 1 to entry: In certain cases, an external independent examining body can be required.

[SOURCE: ISO/TR 25901-1:2016, 2.5.30, modified — "compliance" replaced with "conformity" in definition.]

3.6
preliminary welding procedure specification
pWPS
document containing the required variables of the *welding procedure specification* (3.8) which has to be qualified

[SOURCE: ISO/TR 25901-1:2016, 2.5.6]

3.7
welding procedure qualification record
WPQR
record comprising all necessary data needed for qualification of a *preliminary welding procedure specification* (3.8)

[SOURCE: ISO/TR 25901-1:2016, 2.5.12]

3.8
welding procedure specification
WPS
document that has been qualified and provides the required variables of the welding procedure to ensure repeatability during production welding

[SOURCE: ISO/TR 25901-1:2016, 2.5.4]

3.9
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[SOURCE: ISO 9000:2015, 3.8.12 modified — Note 1 to entry to Note 3 to entry have been deleted.]

4 Qualification of welding procedure specifications

4.1 General

The welded joint to which the welding procedure will relate to in production shall be represented by making a standard test piece or test pieces, as specified in Clause 9.

A preliminary welding procedure specification (pWPS) shall be prepared in accordance with ISO 15609-1. The pWPS shall specify the relevant variables given in Table 2.

Where the joint requirements and/or dimensions of the test piece are not covered by the standard test pieces given in this document, ISO 15613 can be used (excluding 7.1 c)). Project specific test pieces shall be specified and agreed between the contracting parties.

Table A.1 gives information on the different phases and parties involved in welding procedure qualification.

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