DRAFT INTERNATIONAL STANDARD

ISO/DIS 15618-1

ISO/TC **44**/SC **11** Secretariat: **ANSI**

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Qualification testing of welders for underwater welding —

Part 1:
Diver-welders for hyperbaric wet welding

Épreuve de qualification des soudeurs pour le soudage sous l'eau —

Partie 1: Scaphandriers soudeurs pour le soudage hyperbare en pleine eau

ICS: 25.160.01

ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

To expedite distribution, this document is circulated as received from the committee secretariat. ISO Central Secretariat work of editing and text composition will be undertaken at publication stage.

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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 15618-1 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 11, *Qualification requirements for welding and allied processes personnel*.

This second edition cancels and replaces the first edition (ISO 15618-1:2001).

ISO 15618 consists of the following parts, under the general title *Qualification testing of welders for underwater welding*:

— *Part 1: Welder-diver for hyperbaric wet welding*

— *Part 2: Welder-divers and welding operators for hyperbaric dry welding*

Annexes A and B of this part of ISO 15618 are for information only.

Introduction

This standard covers the principles to be observed in the qualification testing of welder-diver performance for the fusion welding of steels in a hyperbaric wet environment.

The ability of the welder-diver to follow verbal or written instructions and testing of his skill are therefore important factors in ensuring the quality of the welded product.

Testing of skill to this standard depends on welding methods in which uniform rules and test conditions are complied with, and standard test pieces are used.

The principle of this International Standard is that a qualification test qualifies a welder-diver not only for the conditions used in the test, but also for all other conditions which are considered easier to weld in accordance with this International Standard. It is presumed that the welder-diver has received training and/or has industrial practice within the range of qualification.

This standard is intended to provide the basis for the mutual recognition by examining bodies for qualification relating to the welder-diver's competence in the various fields of application. Tests should be carried out in accordance with this standard unless additional tests are specified by the relevant application standard when these should be applied.

The welder-diver's skill and job knowledge continue to be approved only if the welder-diver is working with reasonable continuity on welding work within the extent of qualification.

Qualification testing of welders for underwater welding — Welder-divers for hyperbaric wet welding

1 Scope

This standard specifies essential requirements, ranges of qualification, test conditions, acceptance requirements and certification for the qualification testing of welder-diver performance.

This standard is applicable for hyperbaric wet welding on steel.

The recommended format for the certificate of qualification testing is given in Annex A.

During the qualification test the welder-diver may be required to show adequate job knowledge of the welding processes, materials and safety requirements for which he is to be qualified, information on these aspects is given in Annex B.

The welding processes referred to in this standard include those fusion welding processes which are designated as manual or partly mechanised welding. It does not cover fully mechanised and fully automatic processes (see 5.2).

All new qualifications shall be in accordance with this standard from the date of issue.

However, this standard does not invalidate previous welder-diver qualifications made to former national standards or specifications, providing the intent of the technical requirements is satisfied and the previous qualifications are relevant to the application and production work on which they are employed.

The certificate of qualification testing is issued under the sole responsibility of the examiner or examining body.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 857-1, *Welding and allied processes — Vocabulary — Part 1: Metal welding processes*

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

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

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

ISO 15609-1, *Specification and qualification of welding procedures for metallic materials — Welding procedure specification — Part 1: Arc 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 15608, *Welding — Guidelines for a metallic material grouping system*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions and the definitions in ISO 15609-1 apply.

3.1
welder-diver
a person who performs the welding under hyperbaric conditions

3.2
hyperbaric wet welding
the process of welding in a wet environment in excess of surface pressure with no mechanical barrier between the arc and the water

3.3
examiner
person appointed to verify compliance with the applicable standard

Note 1 to entry A certified examiner or certified bodies according to national or international standards/ regulations.

Note 2 to entry In certain cases, an external independent examiner can be required.

[ISO/TR 25901:2007, 2.119, modified Note 1 to entry added]

3.4
examining body
organization appointed to verify compliance with the applicable standard

NOTE In certain cases, an external independent examining body can be required.

[ISO/TR 25901:2007, 2.120]

4 Symbols and abbreviations

4.1 General

Where the full wording is not used, the following symbols and abbreviations shall be used when completing the test certificate (see Annex A).

4.2 Test piece

a design/throat thickness
BW butt weld
D outside pipe diameter
FW fillet weld
P plate
s penetration depth
t material thickness of test piece (plate or wall thickness)
T pipe
z leg length of fillet weld

4.3 Filler materials and fluxes

A acid covering
B basic covering or electrode core — basic
R rutile covering
RA rutile — acid covering
RB rutile basic covering
RC rutile cellulosic covering
RR rutile thick covering
Z electrode core

Other filler materials and fluxes may be used by agreement.

4.4 Miscellaneous

bs welding from both sides
gg back gouging or back grinding of welds
mb welding with backing material
ml multi-layer
sl single-layer
ss single-side welding
wd water depth
sw salt water
fw fresh water
as aqueous solution

5 Essential variables for qualification testing

5.1 General

The criteria specified in this clause shall be examined in order to identify the ability of the welder-diver in these areas. Each criterion is considered to be a significant factor in the qualification testing. The welder-diver qualification test shall be carried out on standard test pieces.

Welder-diver's shall be qualified according to a welding procedure specification (see ISO 15609-1).

5.2 Welding processes

Welding processes are defined in ISO 857-1 and reference numbers of welding processes for symbolic representation are listed in ISO 4063.

This standard covers the following welding processes applicable in hyperbaric wet environment:

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

— 114 self-shielded tubular-cored arc welding;

Other fusion welding processes may be used by agreement.

5.3 Joint types (butt and fillet welds)

Test pieces shall be produced for butt weld (BW) and fillet weld (FW) in plates (P) or pipes[1)] (T) for qualification tests in accordance with 7.3.

5.4 Material groups

The designation of steel groups of material as defined in ISO/TR 15608 shall apply.

This standard primarily applies to the following material groups according to ISO/TR 15608: 1 and 8.

Other steel groups may be used by agreement.

5.5 Filler materials and fluxes

In most qualification tests the filler metal is similar to the parent metal. When a welder-diver's test has been carried out using a filler material/flux combination suitable for a certain material group, this test will only confer qualification of the welder-diver to use those consumables (filler material/flux combination) for other materials from the same material group.

Only electrodes designed for hyperbaric wet welding shall be used.

NOTE Certified filler materials for wet welding according to national/international standards may apply.

If there is no national/international standard for wet welding filler material available the filler material shall be qualified according to a customer approved WPS for hyperbaric wet welding.

5.6 Dimensions

The welder-diver qualification test shall be based on the thickness of the material (i.e. plate thickness or wall thickness of pipe) and pipe diameters which the welder-diver will use in production. A range of qualification is listed for each of the ranges of plate thickness and pipe wall thickness or pipe diameter as specified in Tables 1 and 2.

The thicknesses and diameters given in Table 1 and 2 are nominal values and not intended to be measured precisely.

1) The word „pipe“, alone or in combination, is used to mean „pipe“, „tube“ or „hollow section“.

Table 1 — Test piece thickness (plate or pipe) and range of qualification

Test piece thickness t mm	Range of qualification for butt welds	Range of qualification for fillet welds
$t < 6$	$\geq t$ (max.6 mm)	$\geq t$ (max.6 mm)
$6 \leq t < 12$	0,8 t to 2 t (min. 6 mm)	≥ 6 mm
$t \geq 12$	0,5 t to 1,5 t	

Table 2 — Test piece diameter and range of qualification

Test piece diameter D[a] mm	Range of qualification
$D \leq 100$	0,7 D to 2 D
$100 < D \leq 300$	0,5 D to 2 D (min. 75 mm)
$D > 300$	> 0,5 D
[a] For structural hollow sections „D“ is the dimension of the smallest side.	

5.7 Welding positions

The welding positions shall be as detailed in ISO 6947.

5.8 Hyperbaric environment

The welder-diver qualification test shall be carried out under actual or simulated hyperbaric conditions in fresh water (fw) or salt water (sw). The type of water (fw or sw) is a non-essential variable.

For other aqueous solution (as) the welder-diver shall be qualified based on a welding procedure specification (see ISO 15609-1).

5.9 Visibility

The visibility during the qualification test shall be equal to or greater than 300 mm.

If the visibility under water during production is less than 300 mm an additional onsite confirmation test weld shall be performed. The confirmation test weld (fillet weld or butt weld) shall be agreed between the contracting parties and shall meet the visual inspection criteria of this standard.

If the qualification test is performed with a visibility less than 300 mm, the welder-diver is qualified for the actual visibility and greater.

6 Range of qualification

6.1 General

The range of qualification for each type of test is given in the relevant subclauses and tables. In these tables the range of qualification is indicated in the same horizontal line.