



# SLOVENSKI STANDARD SIST EN ISO 15618-2:2003

01-maj-2003

---

## Preskušanje varilcev za podvodno varjenje - 2. del: Podvodni varilci in operaterji za suho varjenje v vodi pod povišanim tlakom (ISO 15618-2:2001)

Qualification testing of welders for under-water welding - Part 2: Diver-welders and welding operators for hyperbaric dry welding (ISO 15618-2:2001)

Prüfung von Schweißern für Unterwasserschweißen - Teil 2: Unterwasserschweißer und Bediener von Schweißanlagen für Trockenschweißen unter Überdruck (ISO 15618-2:2001)

(standards.iteh.ai)

Epreuve de qualification des soudeurs pour le soudage sous l'eau - Partie 2: Scaphandriers soudeurs et opérateurs soudeurs pour le soudage hyperbare en caisson (ISO 15618-2:2001)

**Ta slovenski standard je istoveten z: EN ISO 15618-2:2001**

---

### **ICS:**

03.100.30	Vodenje ljudi	Management of human resources
25.160.10	Varilni postopki in varjenje	Welding processes

**SIST EN ISO 15618-2:2003** en

**iTeh STANDARD PREVIEW**  
**(standards.iteh.ai)**

[SIST EN ISO 15618-2:2003](https://standards.iteh.ai/catalog/standards/sist/904a1814-04a3-470b-865e-ee078bd7aadf/sist-en-iso-15618-2-2003)

<https://standards.iteh.ai/catalog/standards/sist/904a1814-04a3-470b-865e-ee078bd7aadf/sist-en-iso-15618-2-2003>

EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN ISO 15618-2**

December 2001

ICS 25.160.01

English version

**Qualification testing of welders for under-water welding - Part 2:  
Diver-welders and welding operators for hyperbaric dry welding  
(ISO 15618-2:2001)**

Epreuve de qualification des soudeurs pour le soudage  
sous l'eau - Partie 2: Scaphandriers soudeurs et  
opérateurs soudeurs pour le soudage hyperbare en  
caisson (ISO 15618-2:2001)

Prüfung von Schweißern für Unterwasserschweißen - Teil  
2: Unterwasserschweißer und Bediener von  
Schweißanlagen für Trockenschweißen unter Überdruck  
(ISO 15618-2:2001)

This European Standard was approved by CEN on 14 August 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

## Contents

	Page
<b>Foreword</b> .....	3
<b>Introduction</b> .....	4
<b>1 Scope</b> .....	4
<b>2 Normative references</b> .....	4
<b>3 Terms and definitions</b> .....	6
<b>4 Symbols and abbreviations</b> .....	6
4.1 General .....	6
4.2 Test piece .....	6
4.3 Consumable .....	6
4.4 Miscellaneous .....	6
<b>5 Essential variables for approval testing</b> .....	7
5.1 General .....	7
5.2 Welding processes .....	7
5.3 Joint types (butt and fillet welds) .....	7
5.4 Material groups .....	7
5.5 Consumables .....	7
5.6 Dimensions .....	8
5.7 Welding positions .....	8
5.8 Hyperbaric environment .....	8
<b>6 Range of approval</b> .....	8
6.1 General .....	8
6.2 Welding process .....	9
6.3 Joint types .....	9
6.4 Material groups .....	10
6.5 Consumables .....	10
6.6 Dimensions .....	10
6.7 Welding positions .....	10
6.8 Hyperbaric environment .....	11
<b>7 Examination and testing</b> .....	12
7.1 General .....	12
7.2 Supervision .....	12
7.3 Shapes and dimensions of test pieces .....	12
7.4 Welding conditions .....	14
7.5 Test methods .....	15
7.6 Test pieces and test specimens .....	15
<b>8 Acceptance requirements for test pieces</b> .....	20
<b>9 Re-tests</b> .....	20
<b>10 Period of validity</b> .....	21
10.1 Initial approval .....	21
10.2 Prolongation .....	21
<b>11 Certificate</b> .....	21
<b>12 Designation</b> .....	22
<b>Annex A</b> (informative) Diver-welder or welding operator approval test certificate for hyperbaric dry welding .....	23
<b>Annex B</b> (informative) Job knowledge .....	25

## Foreword

The text of EN ISO 15618-2:2001 has been prepared by Technical Committee CEN/TC 121 "Welding", the secretariat of which is held by DS, in collaboration with Technical Committee ISO/TC 44 "Welding and allied processes".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2002, and conflicting national standards shall be withdrawn at the latest by June 2002.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN ISO 15618-2:2003](https://standards.iteh.ai/catalog/standards/sist/904a1814-04a3-470b-865e-ee078bd7aadf/sist-en-iso-15618-2-2003)

<https://standards.iteh.ai/catalog/standards/sist/904a1814-04a3-470b-865e-ee078bd7aadf/sist-en-iso-15618-2-2003>

**EN ISO 15618-2:2001 (E)****Introduction**

This standard covers the principles to be observed in the approval testing of diver-welder or welding operator performance for the fusion welding of steels in a hyperbaric, dry environment.

The ability of the diver-welder or welding operator 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.

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

The test weld may be used to approve a welding procedure and a diver-welder or welding operator, provided that all the relevant requirements, e.g. test piece dimensions, are satisfied.

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

**1 Scope**

This standard applies to welding processes where the skill of the diver-welder or welding operator has a significant influence on weld quality.

This standard specifies essential requirements, ranges of approval, test conditions, acceptance requirements and certification for the approval testing of diver-welder or welding operator performance for the welding of steels underwater in a hyperbaric dry environment. The recommended format for the certificate of approval testing is given in Annex A.

During the approval test the diver-welder or welding operator should be required to show adequate practical experience and job knowledge (test non mandatory) of the welding processes, materials and safety requirements for which he is to be approved, information on these aspects is given in Annex B.

This standard is applicable when the diver-welder's or welding operator's approval testing is required by the purchaser, by inspection authorities or by other organisations.

The welding processes referred to in this standard include fusion welding processes which are designated as manual or partly mechanized welding for diver-welders and fully mechanized or automatic welding for operators (see 5.2).

All new approvals are in accordance with this standard from the date of this issue.

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

Also, where additional tests should be carried out to make the approval technically equivalent it is only necessary to do the additional tests on a test piece which should be made in accordance with this standard. Consideration of previous approvals to former national standards or specifications should be at the time of the enquiry/contract stage and agreed between the contracting parties.

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

**2 Normative references**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 288-1

Specification and approval of welding procedures for metallic materials – Part 1: General rules for fusion welding

EN 288-2

Specification and approval of welding procedures for metallic materials – Part 2: Welding procedure specification for arc welding

- EN 499  
Welding consumables – Covered electrodes for manual metal arc welding of non alloy and fine grain steels – Classification
- EN 571-1  
Non-destructive testing – Penetrant testing – Part 1: General principles
- EN 910  
Destructive tests on welds in metallic materials – Bend tests
- EN 970  
Non-destructive examination of fusion welds – Visual examination
- EN 1290,  
Non-destructive examination of welds – Magnetic particle examination of welds
- EN 1320  
Destructive tests on welds in metallic materials – Fracture test
- EN 1321  
Destructive tests on welds in metallic materials – Macroscopic and microscopic examination of welds
- EN 1418  
Welding personnel – Approval testing of welding operators for fusion welding and resistance weld setters for fully mechanized and automatic welding of metallic materials
- EN 1435  
Non-destructive examination of welds – Radiographic examination of welded joints
- EN 1600  
Welding consumables – Covered electrodes for manual metal arc welding of stainless and heat resisting steels – Classification
- EN 1714  
Non destructive examination of welds – Ultrasonic examination of welded joints
- EN ISO 4063  
Welding and allied processes – Nomenclature of processes and reference numbers (ISO 4063:1998)
- prEN ISO 5817  
Welding – Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) – Quality levels for imperfections (ISO/DIS 5817:2000)
- EN ISO 6520-1  
Welding and allied processes – Classification of geometric imperfections in metallic materials – Part 1: Fusion welding (ISO 6520-1:1998)
- EN ISO 6947  
Welds – Working positions – Definitions of angles of slope and rotation (ISO 6947:1993)
- CR ISO 15608  
Welding – Guidelines for a metallic material grouping system (ISO/TR 15608:2000)
- ISO 857-1  
Welding and allied processes – Vocabulary – Part 1: Metal welding processes
- ISO 3581  
Covered electrodes for manual arc welding of stainless and other similar high alloy steels – Code of symbols for identification

## EN ISO 15618-2:2001 (E)

**3 Terms and definitions**

For the purposes of this standard, the terms and definitions listed below and in EN 288-1 apply.

**3.1****diver-welder**

a person who performs the welding under hyperbaric conditions

**3.2****hyperbaric welding operator**

a person who performs fully mechanized or automatic welding in dry hyperbaric conditions (see also EN 1418)

**3.3****hyperbaric dry welding**

the process of welding in a dry underwater environment wherein the gaseous atmosphere acting on the welding arc and weld is at an elevated pressure the level of which is determined by the depth of water

**3.4****habitat**

the sealed enclosure surrounding the work area from which the water has been displaced by a gaseous medium to provide a dry environment for performance of the welding operation

**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**

<i>a</i>	nominal throat thickness
BW	butt weld
<i>D</i>	outside diameter of pipe
FW	fillet weld
P	plate
<i>t</i>	plate or pipe wall thickness
T	pipe
<i>z</i>	leg length of fillet weld

iteh STANDARD PREVIEW  
(standards.iteh.ai)

SIST EN ISO 15618-2:2003

<https://standards.iteh.ai/catalog/standards/sist/904a1814-04a3-470b-865e-ee078bd7aadf/sist-en-iso-15618-2-2003>

**4.3 Consumable**

nm	no filler metal
wm	with filler metal (solid wire)
B	basic covering
S	other coating types
fc	flux cored
mc	metal cored

**4.4 Miscellaneous**

bs	welding from both sides
gb	welding with gas backing
gg	back gouging or back grinding of welds
mb	welding with backing material
nb	welding without backing
ng	no back gouging or no back grinding
ss	single-side welding
wd	water depth



## 5 Essential variables for approval testing

### 5.1 General

The criteria specified in this clause shall be examined in order to identify the ability of the diver-welder or welding operator in these areas. Each criterion is considered to be a significant factor in the approval testing.

The diver-welder or welding operator shall be tested separately. The approval test shall be carried out on test pieces and is independent of the type of construction.

Approval of a diver welder according to this standard does not approve a welding operator and vice versa.

### 5.2 Welding processes

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

This standard covers the following welding processes applicable in hyperbaric dry environment.

111	manual metal arc welding (metal arc welding with covered electrode);
114	self-shielded tubular-cored arc welding;
131	metal inert gas welding, MIG welding;
135	metal active gas welding, MAG welding;
136	tubular cored metal arc welding with active gas shield;
137	tubular cored metal arc welding with inert gas shield;
141	tungsten inert gas welding, TIG welding;
15	plasma arc welding.

Other fusion welding processes 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<sup>1)</sup> (T) for approval tests in accordance with 7.3.

### 5.4 Material groups

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

This standard applies to the following material groups according to CR ISO 15608: 1, 2, 3, 7, 8 and 10.

In general, diver-welder's or welding operator's approval test shall involve depositing weld metal having a chemical composition and mechanical strength compatible with any of the steels in the parent metal group(s).

When welding parent metals from two different groups which do not give approval to each other, an approval for the combination as a separate group is required.

When the filler metal is dissimilar to the parent metal group, an approval for that combination of parent metal group and filler metal is needed.

### 5.5 Consumables

#### 5.5.1 General

Only consumables for the intended hyperbaric application shall be used, e. g. by the welding procedure test.

---

<sup>1)</sup> The word "pipe", alone or in combination, is used to mean "pipe", "tube" or "hollow section".

**EN ISO 15618-2:2001 (E)****5.5.2 Metal-arc welding with covered electrodes**

Covered electrode groups are classified with respect to the most important characteristics according to EN 499 as given in 4.3. In the case of hyperbaric dry welding only two of these classifications are applicable. These are

- B basic covering;
- S other covering.

NOTE: For further details on covered electrodes reference should be made to EN 499, EN 1600 or ISO 3581 according to the steel in question.

**5.6 Dimensions**

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

It is not intended that thicknesses or diameters should be measured precisely but rather the general philosophy behind the values given in Tables 1 and 2 should be applied.

**Table 1 - Test piece (plate or pipe) and range of approval**

Test piece thickness $t$ mm	Range of approval
$t \leq 6$	$\geq t$ (max. 6 mm)
$t > 6$	$0,5 t$ to $2 t$ (min. 6 mm)

**Table 2 - Test piece diameter and range of approval**

Test piece diameter $D^a$ mm	Range of approval
$D \leq 100$	$0,7 D$ to $2 D$
$100 < D \leq 300^b$	$0,5 D$ to $2 D$ (min. 75 mm)
$D > 300$	$\geq 0,5 D$

<sup>a</sup> For structural hollow sections, "D" is the dimension of the smallest side.  
<sup>b</sup> See also 6.3 a).

**5.7 Welding positions**

The welding positions shall be taken from EN ISO 6947.

Angles of slope and rotation for straight welds in the welding positions shall be in accordance with EN ISO 6947.

**5.8 Hyperbaric environment**

The diver-welder or welding operator approval test shall be carried out under actual or simulated hyperbaric conditions at the appropriate water depth.

**6 Range of approval****6.1 General**

As a general rule, the test piece approves the diver-welder or welding operator not only for the conditions used in the test, but also for all joints which are considered easier to weld. The range of approval for each type of test is given in the relevant subclauses and tables. In these tables the range of approval is indicated in the same horizontal line.

## 6.2 Welding process

Each test approves one welding process. A change of welding process requires a new approval test. However, it is possible for a diver-welder or welding operator to be approved for more than one welding process by a single test or by several approval tests to be used to cover a multi-process joint. For example in a case where approval is required for a single-side butt joint with the root to be welded by TIG (141) without backing and to be filled by metal-arc welding with covered electrode (111), the diver-welder or welding operator may be approved by either of the following routes:

- a) successful completion of an approval test simulating the multi-process joint, i.e. the root run welded by TIG (141) without backing, subsequent runs or layers welded by metal-arc welding with covered electrode (111) within the limits of the range of approval for each welding process;
- b) successful completion of separate relevant approval tests one for TIG (141) without backing for the root run and a separate test for the fill by metal-arc welding with covered electrode (111) with backing or welded from both sides with or without gouging.

## 6.3 Joint types

Depending on the test piece, the range of welds for which the diver-welder or welding operator is approved is shown in Table 3; the following additional criteria are applicable:

- a) approval for butt welds in pipes with diameter > 300 mm includes butt welds in plates;
- b) approval for butt welds in plates in all relevant positions covers butt welds on pipes having an outside diameter  $\geq$  600 mm;
- c) welding from one side without backing approves welds from one side with backing and welds from both sides with and without gouging;
- d) welding in plates or pipes with backing approves welds made from both sides, but not for welds without backing;
- e) butt welds approve fillet welds for similar welding conditions;
- f) in cases where the production work is predominantly fillet welding, it is recommended that the diver-welder or welding operator should be approved also by an appropriate fillet welding test, i.e. on plate, pipe or branch connection (see EN 288-3).
- g) welding from both sides without gouging approves welds from one side with backing and welds from both sides with gouging;
- h) approval for butt welds in pipes without backing includes approval for branch connections within the same range of approval as in Tables 3 and 4. For a branch weld the range of approval is based on the diameter of the branch;
- i) in cases where the production work is either branch welding or involves a complex branch connection a special training and testing is necessary.