INTERNATIONAL STANDARD

ISO 15618-1

First edition
2001-12-15

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

Reference number
ISO 15618-1:2001(E)

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Printed in Switzerland

Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

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 part of ISO 15618 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 the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 11, *Approval requirements for welding and allied processes personnel*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

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

— *Part 1: Diver-welders for hyperbaric wet welding*

— *Part 2: Diver-welders and welding operators for hyperbaric dry welding*

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

Contents

Foreword

The text of EN ISO 15618-1:2001 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of an identical text or by endorsement, at the latest by June 2002, and conflicting national standards shall be withdrawn at the latest by June 2002.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.

Introduction

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

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

The diver-welder's skill and job knowledge continue to be approved only if the diver-welder is 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 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 performance for the welding of steels underwater in hyperbaric wet environment. The recommended format for the certificate of approval testing is given in Annex A.

During the approval test the diver-welder 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 testing is required by the purchaser, by inspection authorities or by other organisations.

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 approvals should be in accordance with this standard from the date of this issue.

However, this standard does not invalidate previous diver-welder 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 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 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 particles 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 1435
Non-destructive examination of welds – Radiographic examination of welded joints

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 6520:1998)

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

3 Terms and definitions

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

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

3.2
hyperbaric wet welding
the process of welding in a hyperbaric wet environment at an elevated pressure with no mechanical barrier around the arc and with the diver-welder working directly in the water

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	nominal throat thickness
BW	butt weld
D	outside diameter of the smaller pipe
FW	fillet weld
P	plate
t	plate or pipe wall thickness
T	pipe
z	leg length of fillet weld

4.3 Consumable

R	rutile covering
RR	rutile thick covering
RB	rutile basic covering
fc	flux cored
mc	metal cored

4.4 Miscellaneous

bs	welding from both sides
gg	back gouging or back grinding of welds
mb	welding with backing material
ss	single-side welding
wd	water depth
sa	salt water
fr	fresh water

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 in these areas. Each criterion is considered to be a significant factor in the approval testing.

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

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 wet environment.

111 manual metal arc welding (metal arc welding with covered electrode);
114 self-shielded tubular-cored arc welding;

136 tubular cored metal arc welding with active gas shield;
137 tubular cored metal arc welding with inert gas shield.

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[1]) (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 and 8.

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

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

It is assumed that in most approval tests the filler metal will be similar to the parent metal. When a diver-welder's test has been carried out using a filler metal, shielding gas or flux suitable for a certain material group, this test will only confer approval on the diver-welder to use those consumables (filler metal, shielding gas or flux) for other materials from the same material group.

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 wet welding only three of these classifications are applicable. These are

– R rutile covering;
– RR rutile thick covering;
– RB rutile basic covering.

NOTE The covered electrodes for wet application are specially designed electrodes with an additional water protective coating adjusted according to the composition of the alloying elements of the core wire and the flux.

For flux cored arc welding in wet environment special designed wire electrodes are applied. These are of the seamless or the folded type. The internal flux is covered and protected against excessive moisture penetration by the surrounding metal.

5.6 Dimensions

The diver-welder 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 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.

[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 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
$100 < D \leq 300$	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 taken from EN ISO 6947.

The positions PF and H-L045 are exclusively used for process 114, 136 and 137 (see table 4).

5.8 Hyperbaric environment

The diver-welder approval test shall be carried out under actual or simulated hyperbaric conditions, taking into account:

– diving depth;
– visibility;
– water temperature;
– salinity.

6 Range of approval

6.1 General

As a general rule, the test piece approves the diver-welder 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 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.

6.3 Joint types

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

a) approval for welds in plates in all relevant positions covers welds on pipes having an outside diameter ≥ 600 mm;

b) in cases where the production work is predominantly fillet welding, it is recommended that the diver-welder should be approved also by an appropriate fillet welding test, i.e. on plate, pipe or branch connection;

c) approval of welding from both sides without gouging covers welds from one side with backing and welds from both sides with gouging;

d) in cases where the production work is either predominantly branch welding or involves a complex branch connection, it is recommended that the diver-welder should receive special training. In some cases a diver-welder approval test on a branch connection including any restricted access may be necessary.

Table 3 - Range of approval for tests (Details of weld type)

Details of weld type			Range of approval					
			Butt welds		Lap welds		Fillet welds	
			welded from one side (ss)	welded from both sides (bs)				
			with backing (mb)	with gouging (gg)	plate	pipe	plate	pipe
Butt welds	welded from one side (ss)	with backing (mb)	x	x	x	x[a]	x	x[a]
	welded from both sides (bs)	with gouging (gg)	x	x	x	x[a]	x	x[a]
Lap welds	plate		–	–	x	x[a]	x	x[a]
	pipe		–	–	x	x	x	x
Fillet welds	plate		–	–	–	–	x	x[a]
	pipe		–	–	–	–	x	x

[a] See 6.3 a)

Key
x indicates those welds for which the welder is approved
– indicates for what the diver welder is not approved

6.4 Material groups

According to the material group of the test piece, specified in 5.4, the diver-welder is only approved for this special material group. For any steel not covered the diver-welder shall carry out an approval test, which only approves for that steel.

6.5 Consumables

It is not permitted to:

– change the standard or commercial designation of the electrodes and waterprotective coating;
– add or omit the waterprotective coating;
– change the nominal electrode diameter;
– change the nominal composition of the shielding gas.

6.6 Dimensions

The range of approval according to plate thickness or wall thickness of pipe and/or pipe diameter is shown in tables 1 and 2.

6.7 Welding positions

The range of approval for each welding position is given in table 4. The welding positions and codes refer to

EN ISO 6947.

Table 4 - Range of approval according to welding position

Range of approval																						
Welding position of test piece			Plate										Pipe									
			Butt welds					Fillet welds					Lap welds						Fillet welds			
			PA	PC	PG	PF[c]	PE	PA	PB	PG	PF[c]	PD	PB	PD	PG[a]	PF[c]	H-L045[c]	J-L045	PB[a,b]	PG[a]	PF[c]	PD[a,d]
PLATES	Butt welds	PA	x	–	–	–	–	x	x	–	–	–	–	–	–	–	–	–	x	–	–	–
		PC	x	x	–	–	–	x	x	–	–	–	–	–	–	–	–	–	x	–	–	–
		PG	–	–	x	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	–	–
		PF[c]	x	–	–	x	–	x	x	–	x	–	–	–	–	–	–	–	x	–	x	–
		PE	x	x	–	–	x	x	x	–	–	x	–	–	–	–	–	–	x	–	–	x
	Fillet welds	PA	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–
		PB	–	–	–	–	–	x	x	–	–	–	–	–	–	–	–	–	x	–	–	–
		PG	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	–	–
		PF[c]	–	–	–	–	–	x	x	–	x	–	–	–	–	–	–	–	x	–	–	–
		PD[d]	–	–	–	–	–	x	x	–	–	x	–	–	–	–	–	–	x	–	–	x
PIPES	Lap welds	PB	–	–	–	–	–	x	x	–	–	–	x	–	–	–	–	–	x	–	–	–
		PD	–	–	–	–	–	x	x	–	–	x	x	x	–	–	–	–	x	–	–	x
		PG[a]	–	–	–	–	–	–	–	x	–	–	–	–	x	–	–	–	–	x	–	–
		PF[3]	–	–	–	–	–	x	x	–	x	–	x	–	–	x	–	–	x	–	x	–
		H-L045[c]	–	–	–	–	–	x	x	–	x	x	x	x	–	x	x	–	x	–	x	x
		J-L045	–	–	–	–	–	x	x	x	–	x	x	x	x	–	–	x	x	x	–	x
	Fillet welds	PB[a,b]	–	–	–	–	–	x	x	–	–	–	–	–	–	–	–	–	x	–	–	–
		PG[a]	–	–	–	–	–	–	–	x	–	–	–	–	–	–	–	–	–	x	–	–
		PF [c]	–	–	–	–	–	x	x	–	x	–	–	–	–	–	–	–	x	–	x	–
		PD [a,d]	–	–	–	–	–	x	x	–	–	x	–	–	–	–	–	–	x	–	–	x

[a] for pipes welded in: pipe fixed; axis horizontal; weld: vertical
[b] for pipes welded in: pipe fixed; axis vertical; weld: horizontal
[c] see to 5.7
[d] This is an approved position and which is covered by the other related test.

Key
x indicates those welding positions for which the diver-welder is approved
– indicates those welding positions for which the diver-welder is not approved

6.8 Hyperbaric environment

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

The range of approval for water depth is given in table 5.

Table 5 - Range of approval according to water depth

Type of welding	Depth of welding for test piece	Range of approval wd
Wet welding of parent metal suitable for mild steel filler metal	wd < 20 m 20 m ≤ wd < 50 m 50 m ≤ wd < 100 m	0 m up to 20 m 10 m up to wd + 20 m 0,85 wd up to 1,10 wd
Wet welding of parent metal suitable for austenitic stainless filler metal	wd	0,90 wd up to wd + 3 m
Wet welding of parent metal suitable for other filler metals	wd	0,90 wd up to wd + 10 m
NOTE 1 For the maximum depth approved, depth shall be measured from the lower extremity of the test weldment with a tolerance of plus or minus 250 mm. NOTE 2 For the minimum depth approved, depth shall be measured from the upper extremity of test weldment with a tolerance of plus or minus 250 mm.		

7 Examination and testing

7.1 General

Only approved commercial diver can participate in the examinations and tests.

7.2 Supervision

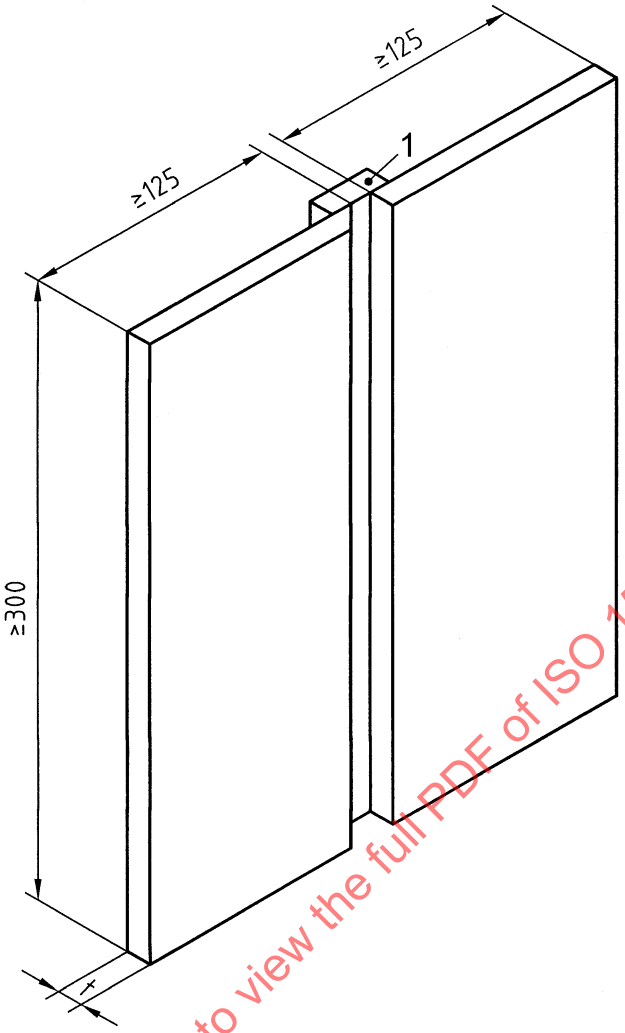
The welding and testing of test pieces shall be witnessed by an examiner or examining body.

The test pieces shall be marked with the identification of the examiner and the diver-welder before welding starts.

The examiner or examining body may stop the test if the welding conditions are not correct or if it appears that the diver-welder does not have the technical competence to achieve the required standard, e.g. where there are excessive and/or systematic repairs.

7.3 Shapes and dimensions of test pieces

The shape and dimensions of test pieces (see 5.6) are shown in figures 1 to 6.

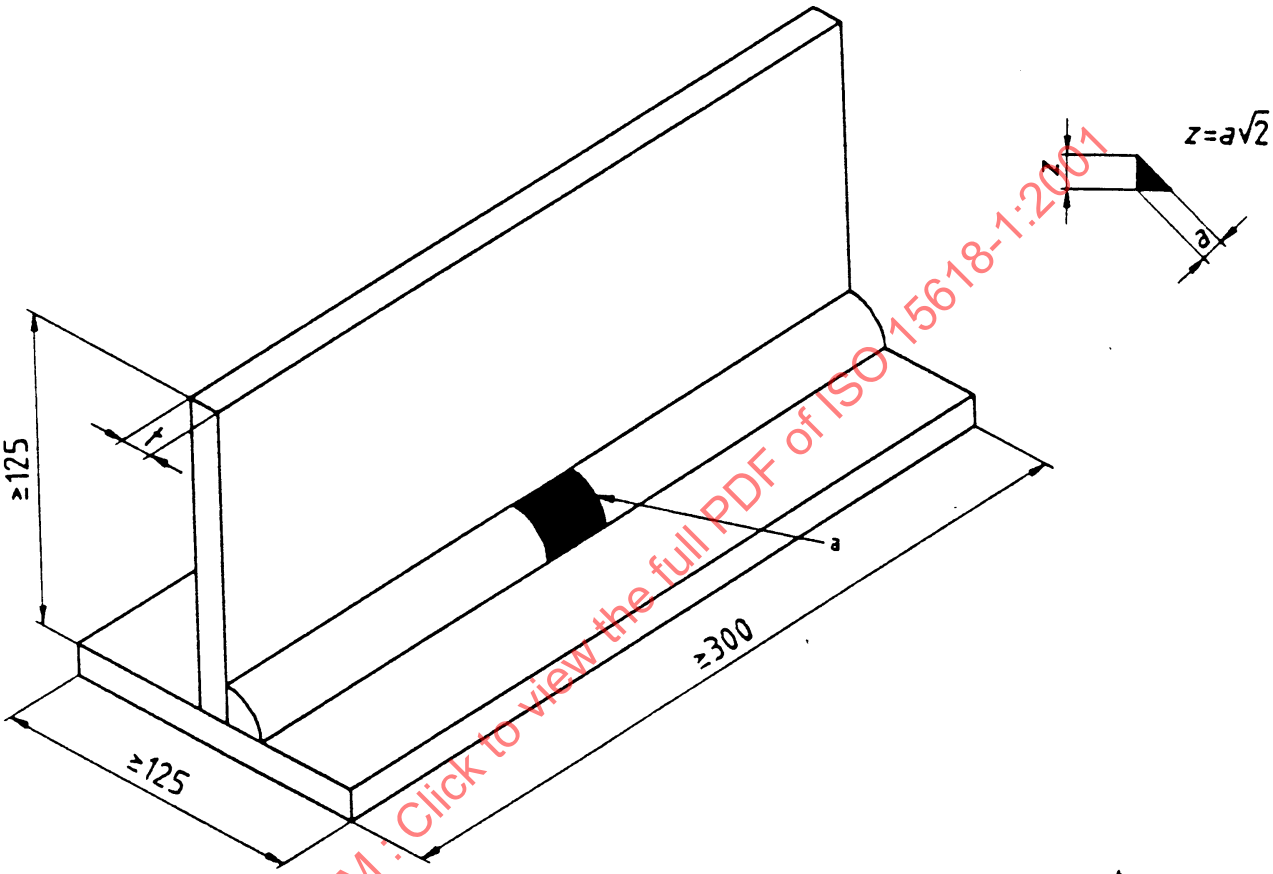


Key
1 Backing bar or preparation in accordance with table 3

Figure 1 - Dimensions of test piece for a butt weld in plate

Dimensions in millimetres

for $t \geq 6$ mm, $a \leq 0{,}5\ t$



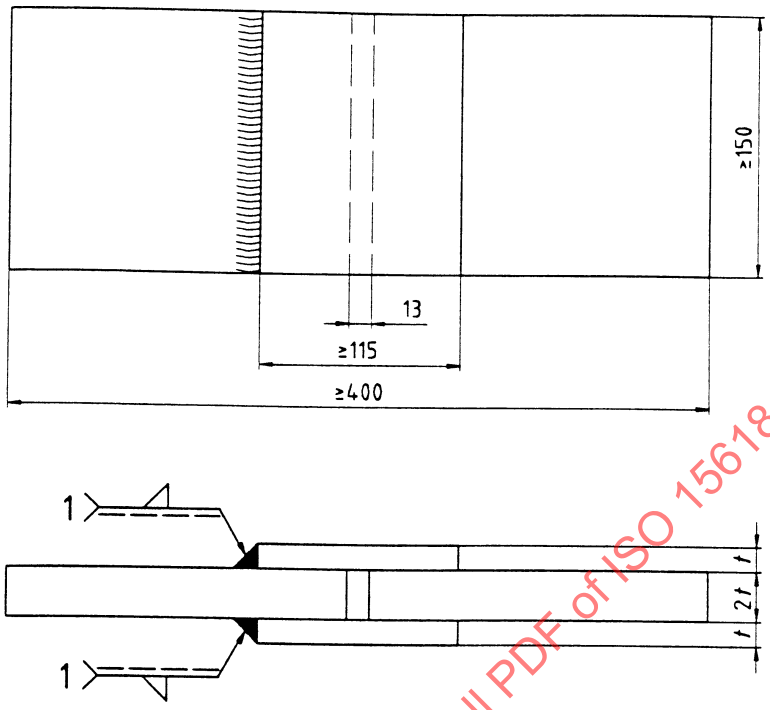
for $t < 6$ mm, $0{,}5\ t \leq a \leq t$

($z \approx 0{,}7\ t$)

[a] Stop and restart at the centre

Figure 2 - Dimensions of test piece for fillet weld(s) on plate (T-joint)

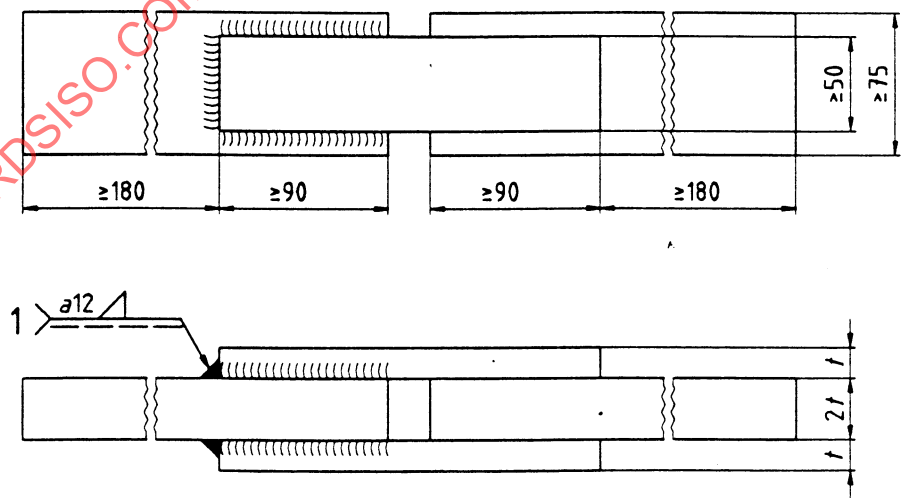
Dimensions in millimetres



Key
1 Shop weld

Figure 3 - Dimensions of test piece for fillet weld transverse from plate (lap joint)

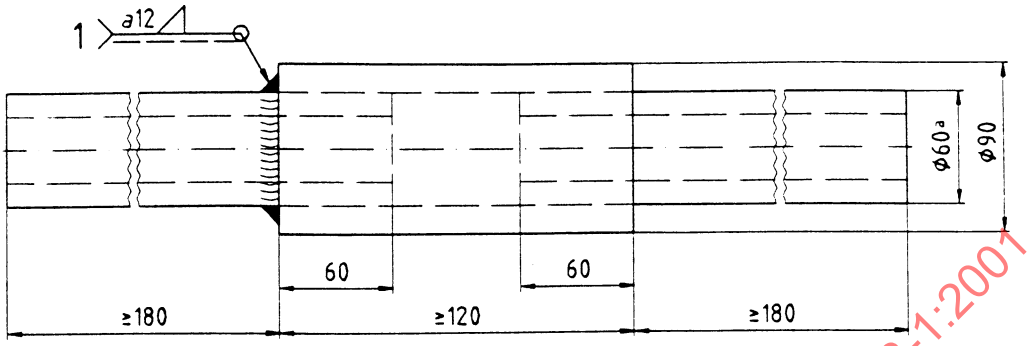
Dimensions in millimetres



Key
1 Shop weld

Figure 4 - Dimensions of test piece for fillet weld longitudinal from plate (lap joint)

Dimensions in millimetres

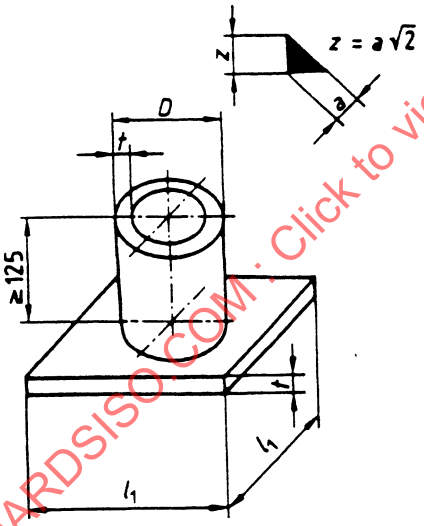


Key
1 Shop weld

[a] The outside diameter of the smaller pipe may be machined for joint fit up.

Figure 5 - Dimensions of test piece for fillet weld transverse from pipe (lap joint)

Dimensions in millimetres



t corresponds to the thinner part
for $t \geq 6$ mm, $a \leq 0{,}5\ t$
for $t < 6$ mm, $0{,}5\ t \leq a \leq t$
($z \approx 0{,}7\ t$)

$l_1 = D + 150$ mm min.

Figure 6 - Dimensions of test piece for fillet weld in pipe

7.4 Welding conditions

The approval test for the diver-welder shall correspond to the conditions used in production and follow a WPS or pWPS prepared in accordance with EN 288-2.

The following conditions shall apply:

a) the welding equipment shall be equivalent to that used in production;

b) the test piece shall have at least one stop and one re-start in the root run and in the top capping run and be identified in the inspection length to be examined (see figure 2);

c) any controlled heat input required in the WPS or pWPS is mandatory for the diver-welder's test piece;

d) identification of the test piece;

e) the diver-welder shall be allowed to remove minor imperfections, except on the surface layer, by grinding, gouging or any other method used in production. The approval of the examiner or examining body shall be obtained;

f) the test shall be carried out under actual or simulated hyperbaric conditions in the range of water depth specified in 6.8;

g) only covered electrodes with a diameter of approximately 3,25 mm or flux cored electrodes designed for wet application shall be used.

7.5 Test methods

Each completed weld shall be examined visually according to EN 970 in the as welded condition. When required (see table 6), visual examination can be supplemented by magnetic particle (EN 1290), penetrant (EN 571-1) or other test methods, and macroscopic examination (EN 1321) on butt welds. If accepted by visual inspection, additional testing shall be performed as specified in table 6. The macroscopic specimen shall be prepared and etched on one side to clearly reveal the weld.

Prior to mechanical testing, backing strips, where used, shall be removed. The test piece can be sectioned by thermal cutting or by mechanical means discarding the first and last 25 mm of the test piece at the end of the plates (see figures 7 and 8).

Table 6 - Test methods

Test method	Butt weld plate	Lap weld in pipe or plate	Fillet weld
Visual examination	mandatory	mandatory	mandatory
Radiographic examination	mandatory[a,d]	mandatory[a,d]	not mandatory
Bend test	mandatory	not mandatory	not mandatory
Fracture test	mandatory[a,c]	mandatory[a,c]	mandatory
Macroscopic examination	mandatory	mandatory	not mandatory[b]

[a] Radiographic examination or fracture test shall be used, but not both.
[b] The fracture test may be replaced by macroscopic examination of at least four sections.
[c] The minimum thickness of a test piece for fracture test shall be 5 mm.
[d] The radiographic examination may be replaced by an ultrasonic examination for thicknesses ≥ 8 mm on ferritic steels only in accordance with EN 1714.

7.6 Test pieces and test specimens

7.6.1 General

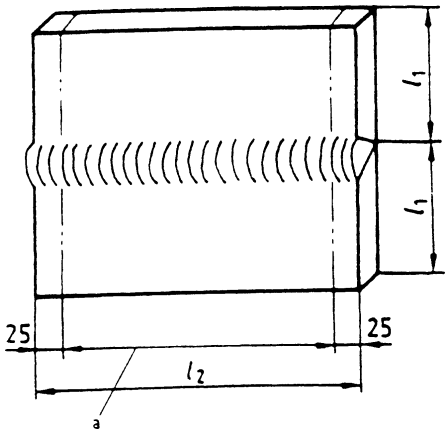
In 7.6.2 to 7.6.5 details of the type, dimensions and preparation of test pieces and test specimens are given. In addition, the requirements for mechanical tests are indicated.

7.6.2 Butt weld in plate

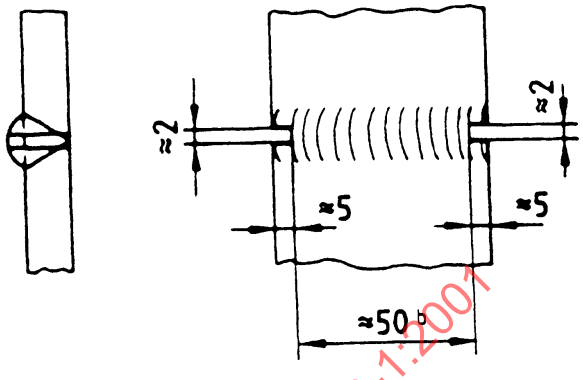
When radiographic examination is used, the whole inspection length of the weld in the test pieces shall be radiographed in the as-welded condition in accordance with EN 1435 using class B technique.

When fracture testing is used, it shall be carried out in accordance with EN 1320. One root fracture test specimen and one face fracture test specimen shall be tested. The inspection length of the test specimen shall be ≈ 50 mm. The specimen preparation, types of notch profiles and methods of fracture shall be in accordance with EN 1320.

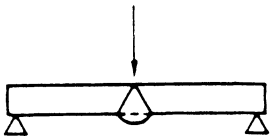
When transverse bend testing is used for plate thickness ≥ 3 mm, two root bend test specimens and two face bend test specimens shall be tested in accordance with EN 910. The diameter of the former or the inner roller shall be 12*t* and the bending angle of at least 120°.



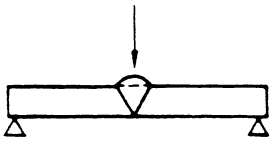
7a) Sectioning into an even-numbered quanitity of test specimens



7b) Preparation



7c) Fracture testing, face side



7d) Fracture testing, root side

Key

[a] Inspection length of the test piece

[b] Inspection length of the test specimen

NOTE Figure b) shows the notch profile q according to EN 1320.

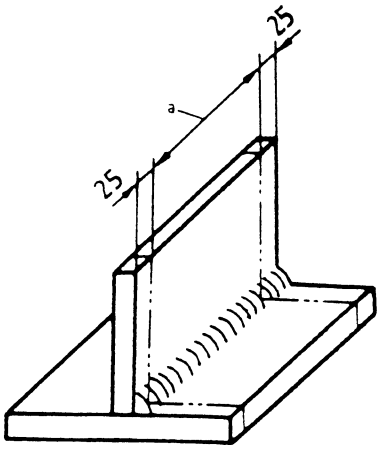
Figure 7 - Preparation and fracture testing of test specimens for a butt weld in plate

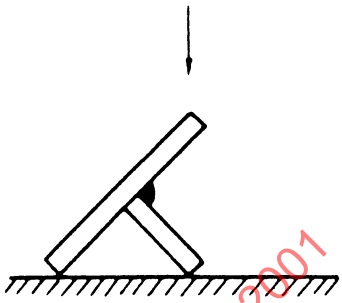
7.6.3 Fillet weld on plate

For fracture tests according to EN 1320 the test piece can be cut, if necessary, into several test specimens (see Figure 7a)). Each test specimen shall be positioned for breaking as shown in Figure 7d), and examined after fracture.

When macroscopic examination is used, at least four test specimens shall be taken equally spaced in the inspection length. Macroscopic tests shall be carried out in accordance with EN 1321.

Dimensions in millimetres





8a) Inspection length of fillet welds

8b) Fracture testing (The fillet weld may be notched, if necessary)

Key

[a] inspection length of the test piece

Figure 8 - Preparation and fracture testing of test specimens for a fillet weld on plate

7.6.4 Lap weld in pipe or plate

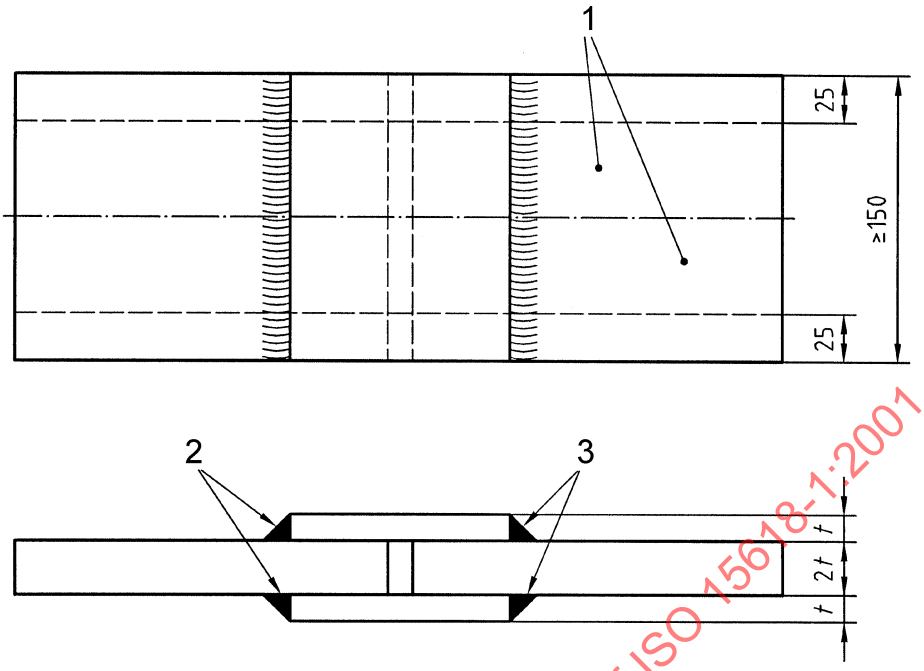
When radiographic examination is used, the inspection length of the weld in the test piece shall be radiographed in the as-welded condition in accordance with EN 1435 except where double wall technique is necessary, using class B technique.

Prior to testing, the average throat thickness and total fillet weld test length shall be measured. Root penetration is disregarded for throat thickness. The weld area in shear is calculated by multiplying the average throat thickness by the total test length.

The specimen shall be tested in tension to failure, which shall be by shear through the test fillet welds. The maximum load is recorded.

When fracture testing according to EN 1320 is used, the full test piece inspection length shall be tested and prepared according to figures 9 to 11.

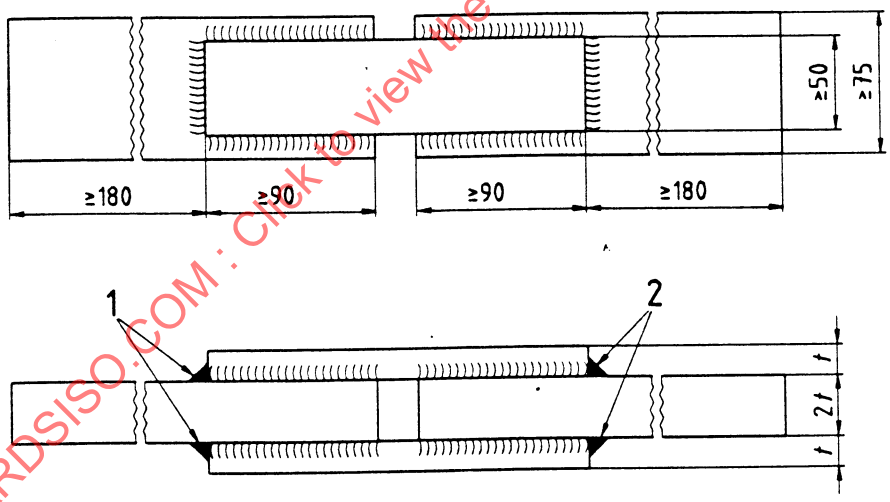
Dimensions in millimetres



Key
1 Specimen
2 Shop weld
3 Underwaterweld

Figure 9 - Fillet weld shear strength specimen, transverse from plate

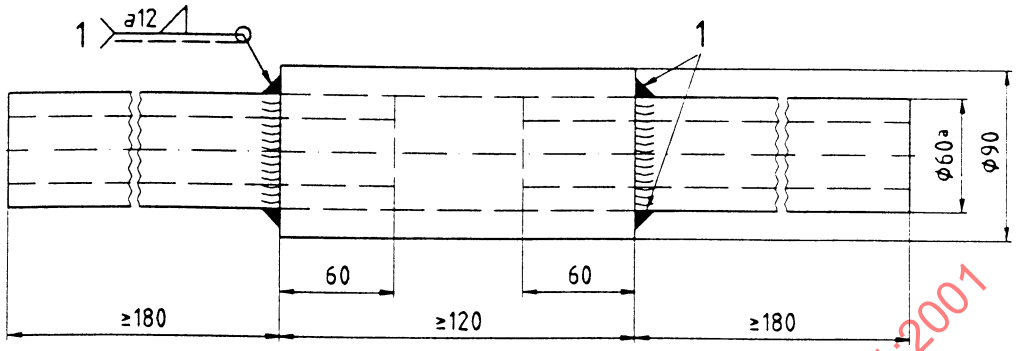
Dimensions in millimetres



Key
1 Shop weld
2 Underwater weld

Figure 10 - Fillet weld shear strength specimen, longitudinal from plate

Dimensions in millimetres



Key
1 Under water weld

Figure 11 - Transverse fillet weld shear test specimen from pipe

7.6.5 Fillet weld on pipe

For fracture tests in accordance with EN 1320, the test piece shall be cut into four or more test specimens and fractured (see figure 12).

When macroscopic examination according to EN 1321 is used, at least four test specimens shall be taken equally spaced around the pipe.

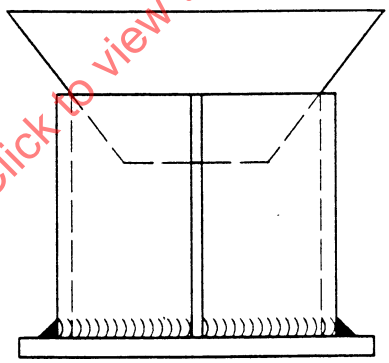


Figure 12 - Preparation and fracture testing of test specimens for a fillet weld on pipe

8 Acceptance requirements for test pieces

Test pieces shall be assessed according to the acceptance requirements specified for relevant types of imperfections. A full explanation of these imperfections is given in EN ISO 6520-1. The acceptance requirements for imperfections found by test methods according to this standard shall, unless otherwise specified, be assessed in accordance with prEN ISO 5817. A diver-welder is approved if the imperfections in the test piece are within the specified limits of level B in prEN ISO 5817, except for imperfection types as follows – excess weld metal, excessive convexity, excessive throat thickness, for which level C shall apply.

If the imperfections in the diver-welder's test piece exceed the permitted maximum specified, then the diver-welder shall not be approved.

Reference should also be made to the corresponding acceptance level for non-destructive examination. Specified procedures shall be used for all destructive and non-destructive examinations.

9 Re-tests

If any test piece fails to comply with the requirements of this standard, the diver-welder shall produce a new test piece.

If it is established that failure is attributed to the diver-welder's lack of skill, the diver-welder shall be regarded as incapable of complying with the requirements of this standard without further training before re-testing.

If it is established that failure is due to metallurgical or other extraneous causes and cannot be directly attributed to the diver-welder's lack of skill, an additional test or additional specimens are required in order to assess the quality and integrity of the new test material and/or new test conditions.

10 Period of validity

10.1 Initial approval

The validity of the diver-welder's approval begins from the date when all the required tests are satisfactorily completed. This date may be different to the date of issue marked on the certificate.

A diver-welder's approval shall remain valid for a period of two years providing that the relevant certificate is signed at six month intervals by the employer/co-ordinator and that all the following conditions are fulfilled:

a) The diver-welder shall be engaged with reasonable continuity on welding work within the current range of approval. An interruption for a period no longer than three months is permitted.

b) There shall be no specific reason to question the diver-welder's skill and knowledge.

If any of these conditions are not fulfilled, the approval shall be cancelled.

10.2 Prolongation

The validity of the approval on the certificate may be prolonged for a further period of two years, within the original range of approval, provided each of the following conditions as well as the conditions according to 10.1 are fulfilled:

a) the production welds made by the diver-welder are of the required quality;

b) records of all tests according to table 6, half yearly documented, shall be maintained on file with the diver welder approval certificate.

The examiner or examining body shall verify compliance with the above conditions and sign the prolongation of the diver-welder's approval test certificate.

11 Certificate

It shall be verified that the diver-welder has passed the performance approval test. All relevant test conditions shall be recorded on the certificate. If the diver-welder fails any of the prescribed tests, no certificate shall be issued.

The certificate shall be issued under the sole responsibility of the examiner or examining body and shall contain all the information detailed in Annex A. The format of Annex A is recommended to be used as the diver-welder's approval test certificate.

If any other form of diver-welder's approval test certificate is used, it shall contain the information required in Annex A. The manufacturer's pWPS or WPS as shown in EN 288-2 shall give information about materials, welding positions, processes and range of approval etc. in accordance with this standard.

The diver-welder's approval test certificate shall be issued at least in one of the official CEN languages (English, French, German).

The practical test and the examination of job knowledge (see Annex B) shall be designated by "Accepted" or "Not tested".

Each change of the essential variables for the approval testing beyond the permitted ranges requires a new test and a new approval certificate.