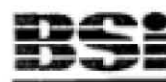


Draft for Public Comment



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Draft: BS EN ISO 15614-9

Title: Specification and approval of welding procedures for metallic materials — Welding procedure test
Part 9 : Underwater hyperbaric wet welding

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No. 28, 04/05/00

Commenting on drafts

Introduction

This draft standard is based on European discussions in which the UK took an active part. Your comments on this draft are welcome and will assist in the preparation of the consequent British Standard. If no comments are received to the contrary, then the UK will approve this draft and implement it as a British Standard. Comment is particularly welcome on national legislative or similar deviations that may be necessary.

Even if this draft standard is not approved by the UK, if it receives the necessary support in Europe, the UK will be obliged to publish the official English Language text unchanged as a British Standard and to withdraw any conflicting standard.

UK vote

Please indicate whether you consider the UK should submit a negative (with reasons) or positive vote on this draft.

Format

The guidance given below is intended to ensure that all comments receive efficient and appropriate attention by the responsible BSI committee. **Annotated drafts are not acceptable and will be rejected.**

Each comment shall make one point only, be clearly separated from the others and be structured as follows in clause order:

- clause/sub-clause;
- paragraph/table/figure number;
- type of comment (general, technical or editorial);
- comment (with rationale);
- proposed change.

Submission

All comments should be submitted to the committee secretary at the Head Office address, preferably electronically via e-mail or on diskette (MS-DOS compatible, 1.44 megabytes). Comments should be compatible with Version 6.0 or Version 97 of Microsoft® Word for Windows™, if possible; otherwise comments in ASCII text format are acceptable. Any comments not submitted electronically should still adhere to the format requirements given above. No acknowledgement will normally be sent.

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Draft no: prEN ISO 15614-9	Project no.: 1994/02868	DPC no.: 00/708223DC
Short title: Welding procedure test — Part 9 : Underwater hyperbaric wet welding	Commentator:	Date:

Clause/ subclause	Paragraph/ Figure/ Table	Type of comment (General/ technical/editorial)	Comment (with rationale)	Proposed change
Examples:				
3.1	1st definition	Editorial	Definition is ambiguous and needs clarifying.	Amend to read '... so that the mains connector to which no connection ...'
6.4	2nd paragraph	Technical	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK, giving rise to misleadingly high results.	Delete reference to UV photometer.

DRAFT
prEN ISO 15614-9

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

April 2000

ICS

English version

Specification and approval of welding procedure for metallic materials - Welding procedure test - Part 9: Underwater hyperbaric wet welding (ISO/DIS 15614-9:2000)

Descriptif et qualification d'un mode opératoire de soudage pour les métaux métalliques - Epreuve de qualification d'un mode opératoire de soudage - Partie 9: Soudage hyperbare en pleine eau (ISO/DIS 15614-9:2000)

Anforderung und Anerkennung von Schweißverfahren für metallische Werkstoffe - Schweißverfahrensprüfung - Teil 9: Naßschweißen unter Überdruck (ISO/DIS 15614-9:2000)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 121.

If this draft becomes a European Standard, 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.

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

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Del. No. prEN ISO 15614-9:2000 E

09/15614-9:2000

Foreword

The text of prEN ISO 15614-9:2000 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 document is currently submitted to the parallel Enquiry.

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

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Introduction

All new welding procedure approvals shall be in accordance with this standard from the date of its issue.

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

Also, where additional tests have to 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 procedure approvals to former national standards or specifications should be at the time of the enquiry or contract stage and agreed between the contracting parties.

1 Scope

This standard specifies how a welding procedure specification is approved by welding procedure tests for welding in a hyperbaric wet environment.

This standard is part of a series of standards. Annex B gives details of this series of standards.

This standard defines the conditions for the execution of welding procedure approval tests and the limits of validity of an approved welding procedure for all practical welding operations within the range of variables listed in clause 8.

Tests shall be carried out in accordance with this standard unless more severe tests are specified by the relevant application standard or contract when these shall apply.

This standard applies to the arc welding of steels. The principles of this standard may be applied to other fusion welding processes subject to agreement between the contracting parties.

Arc welding is covered by the following processes in accordance with prEN ISO 4063 :

- 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 of contracting parties.

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.

EN 571-1, *Non-destructive testing – Penetrant testing – Part 1 : General principles.*

EN 875, *Destructive tests on welds in metallic materials – Impact tests – Test specimen location, notch orientation and examination.*

EN 895, *Destructive tests on welds in metallic materials – Transverse tensile test.*

EN 910, *Destructive tests on welds in metallic materials – Bend tests.*

EN 970, *Non-destructive examination of fusion welds – Visual examination.*

EN 1043-1, *Destructive tests on welds in metallic materials – Hardness testing – Part 1 : Hardness test on arc welded joints.*

EN 1290, *Non-destructive examination of welds – Magnetic particle examination of welds.*

EN 1321, *Destructive tests on welds in metallic materials – Microscopic and macroscopic 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.*

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prEN ISO 4063, *Welding and allied processes – Nomenclature of processes and reference numbers.* (ISO 4063:1998)

EN ISO 6947:1997, *Welds – Working positions – Definitions of angles of slope and rotation.* (ISO 6947:1993)

EN 12062, *Non-destructive examination of welds – General rules for metallic material.*

prEN ISO 15607, *Specification and approval of welding procedures for metallic materials – General rules.* (ISO/DIS 15607:1999)

CR ISO/TR 15608, *Welding – Guidelines for a metallic material grouping system.*

prEN ISO 15609-1, *Specification and approval of welding procedures for metallic materials – Welding procedure specification – Part 1 : Arc welding.* (ISO/DIS 15609-1:1999)

prEN ISO 15618-1, *Approval testing of welders for under-water welding – Part 1 : Diver-welder for hyperbaric wet welding.* (ISO/FDIS 15618:1999)

EN 25817, *Arc-welded joints in steel – Guidance on quality levels for imperfections* (ISO 5817:1992).

3 Terms and definitions

For the purposes of this European standard, the terms and definitions given in prEN ISO 15607 and in prEN ISO 15618-1 apply.

4 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with prEN ISO 15609-1. It shall specify the tolerance for all the relevant parameters including the following additional items :

- water depth at which production welding is to be carried out ;
- type of water (fresh or salt water) ;
- acceptance levels for imperfections for NDE as specified in EN 25817.

5 Welding procedure test

The making and testing of test pieces representing the type of welding used in production shall be in accordance with clauses 6 and 7 of this standard and shall be performed under simulated or actual site conditions at the appropriate water depth.

The diver-welder who undertakes the welding procedure test satisfactorily in accordance with this standard is approved for the appropriate range of approval given in prEN ISO 15618-1.

6 Test piece

6.1 General

The welded assembly to which the welding procedure will relate in production, shall be represented by making a standardized test piece(s), as specified in 6.2.

6.2 Shape and dimensions of test pieces

The test pieces shall be of a sufficient size to ensure a reasonable heat distribution.

In figures 1 to 4 " t " is the thickness of the thicker component part.

Edge preparation and fit-up shall be as detailed in the preliminary Welding Procedure Specification (pWPS).

Additional test pieces, or longer test pieces than the minimum size, may be prepared in order to allow for extra and/or for re-testing specimens (see 7.5).

If required by the application standard, the direction of plate rolling shall be marked on the test piece when impact tests are required to be taken in the Heat Affected Zone (HAZ).

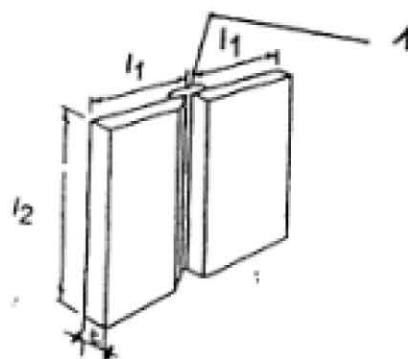
The thickness and/or pipe outside diameter of the test pieces shall be selected in accordance with 8.3.2.1. to 8.3.2.4.

Unless otherwise specified, the shape and minimum dimensions of the test piece shall be as follows.

6.2.1 Butt weld in plate

The test piece shall be in accordance with Figure 1. The length of the test piece shall be such as to provide for the appropriate test specimens as given in Table 1.

(Dimensions in millimetres)



Key

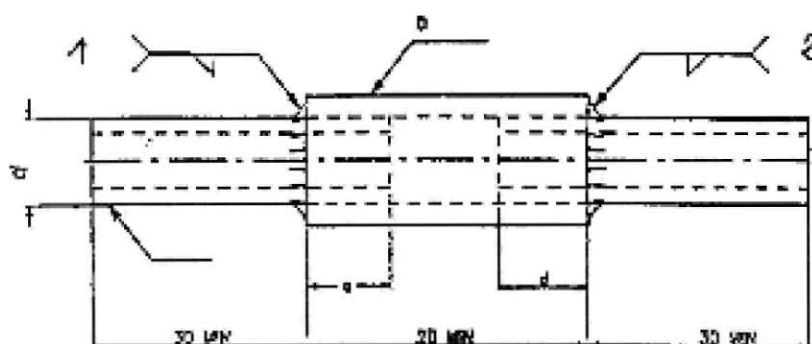
- 1 Backing bar
- $l_1 \geq 150$ mm
- $l_2 \geq 350$ mm

Figure 1 — Test piece for a butt weld in plate

6.2.2 Lap weld on pipe

The test piece shall be in accordance with Figure 2. When small pipe diameters are used, several test pieces may be necessary.

NOTE The word "pipe", alone or in combination, is used to mean "pipe", "tube" or "hollow section".

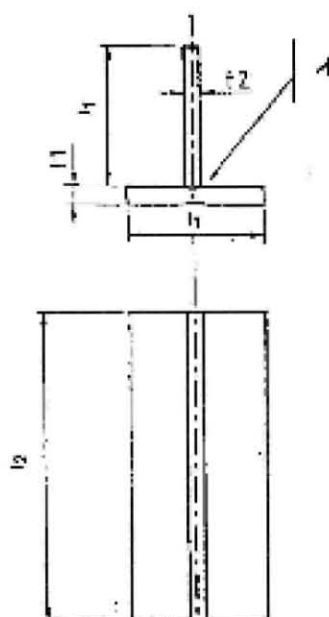


Key
1 Shop weld
2 Underwater weld

Figure 2 — Test piece for a lap weld on pipe

6.2.3 Fillet weld on plate

The test piece shall be in accordance with Figure 3 or 4.



Key
1 Weld one side or both sides
as detailed in the preliminary
Welding Procedure Specification (pWPS)
 $t_1 \geq 150 \text{ mm}$
 $t_2 \geq 350 \text{ mm}$
 t_1 and t_2 = thicknesses of the plates

Figure 3 — Test piece for a fillet weld on plate

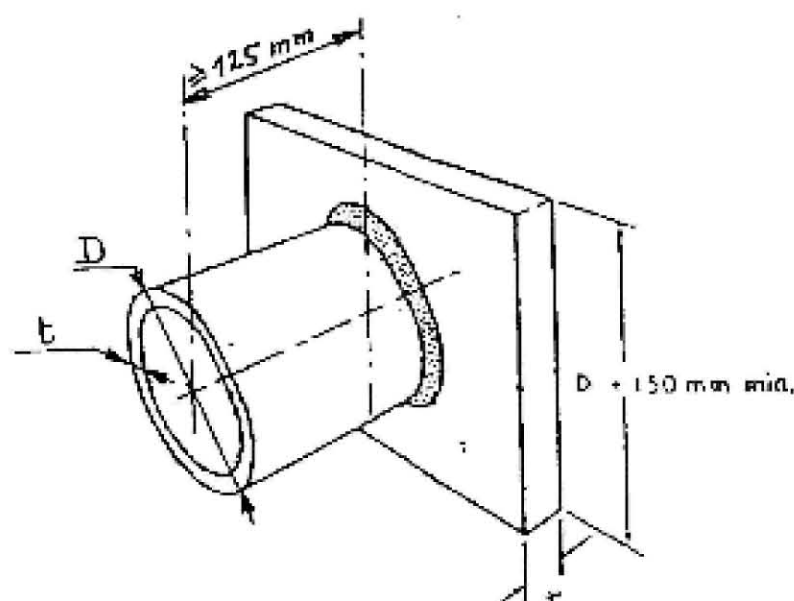


Figure 4 — Test piece for a fillet weld for pipe on plate

6.3 Welding of test pieces

Preparation and welding of test pieces shall be carried out in accordance with the pWPS, and under the general conditions of working in production which they shall represent. Welding positions and limitations for the angle of slope and rotation of the test piece shall be in accordance with EN ISO 6947.

If lack welds are to be fused into the final joint they shall be included in the test piece.

Welding and testing of the test pieces shall be witnessed by an examiner or an examining body.

7 Examination and testing

7.1 Extent of testing

The testing includes both non-destructive examination (NDE) and destructive testing which shall be in accordance with the requirements of table 1.

Table 1 — Examination and testing of the test pieces

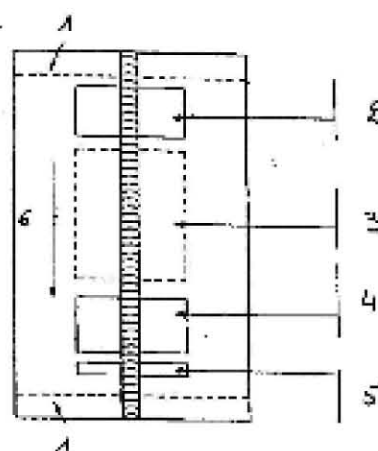
Test piece	Type of test	Extent of testing	Footnote
Butt-weld Figure 1	Visual	100 %	-
	Radiographic or ultrasonic	100 %	a
	Surface crack detection	100 %	b
	Transverse tensile test	2 test specimens	-
	Transverse bend test	2 root and 2 face test specimens	c
	Impact test	2 sets	d
	Hardness test	1 test specimen	e
	Macro-examination	1 test specimen	-
Lap weld Figure 2	Visual	100 %	-
	Surface crack detection	100 %	b
	Hardness test	1 test specimen	e
	Macro-examination	2 test specimens	-
	Fracture test	2 test specimens	f
Fillet weld on plate ^a Figure 3	Visual	100 %	-
	Surface crack detection	100 %	b
	Macro-examination	2 test specimens	-
Fillet weld pipe on plate ^a Figure 4	Hardness test	1 test specimen	e
	Fracture test	2 test specimens	-

- ^a Ultrasonic testing is only applicable for ferritic steels and for $t \geq 8$ mm.
- ^b Penetrant testing or magnetic particle testing. For non-magnetic materials, penetrant testing.
- ^c 2 root and 2 face bend test specimens may be preferably substituted by 4 side bend test specimens for $t \geq 12$ mm.
- ^d 1 set in the weld metal and 1 set in the HAZ. Required only for $t \geq 12$ mm and only for parent metals having specified impact properties or when required by the application standard. If a testing temperature has not been specified, testing shall be performed at room temperature. See also 7.4.4.
- ^e Not required for parent metals :
- ferritic steels with $R_m \leq 430$ N/mm² ($R_m \leq 275$ N/mm²) ;
 - group 9 steels according to CR ISO/TR 15608.
- ^f The fracture tests may be replaced by 1 transverse fillet weld shear test as specified in 7.5.4 in prEN ISO 15618-1, by agreement between contracting parties.
- ^g Testing as detailed does not provide information on the mechanical properties of the joint. Where these properties are relevant to the application an additional approval shall also be held e.g. a butt weld approval.

7.2 Location and cutting of test specimens

The location of test specimens shall be in accordance with Figures 5, 6, 7 and 8.

Test specimens shall be taken after NDE has shown satisfactory results. It is permitted to take the test specimens from locations avoiding areas showing acceptable imperfections.



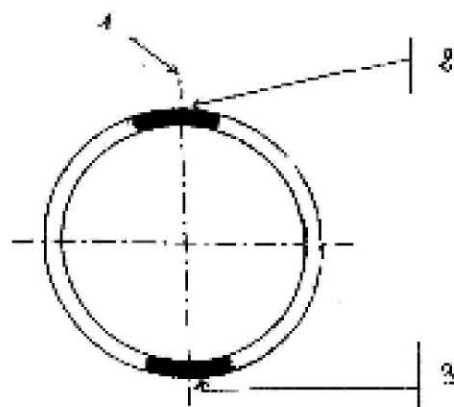
Key

- 1 Discard 25 mm
- 2 Area 1 for :
 - 1 tensile test specimen ;
 - bend test specimens.
- 3 Area 2 for :
 - impact and additional test specimens if required.
- 4 Area 3 for :
 - 1 tensile test specimen ;
 - bend test specimens ;
- 5 Area 4 for :
 - 1 macro test specimen
 - 1 hardness test specimen

6 Welding direction

NOTE Not to scale.

Figure 5 — Location of test specimens for a butt weld in plate

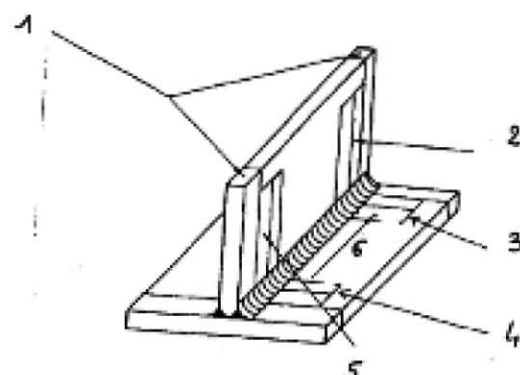


Key

- 1 Top for fixed pipe
- 2 Area 1 for :
 - 1 macro test specimen ;
 - 1 fracture test specimen.
- 3 Area 2 for :
 - 1 macro test specimen;
 - 1 hardness test specimen;
 - 1 fracture test specimen.

NOTE Not to scale.

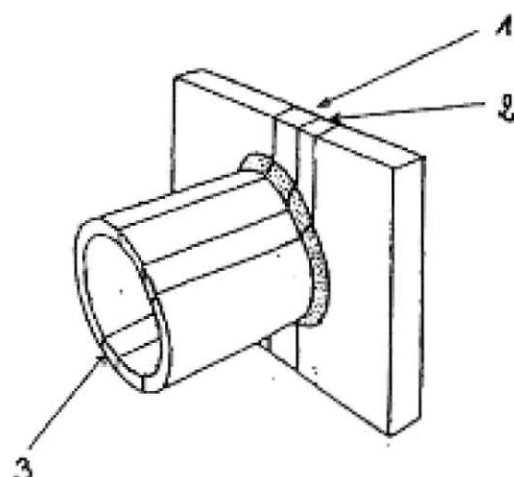
Figure 6 — Location of test specimens for a lap weld on pipe



Key

- 1 Discard 25 mm
- 2 Macro
- 3 1 fracture test specimen
- 4 1 fracture test specimen
- 5 Macro and hardness test specimen
- 6 Welding direction

Figure 7 — Location of test specimens for a fillet weld on plate



Key

- 1 2 test specimens cut at 180°
for macro and hardness
- 2 1 fracture test specimen
- 3 1 fracture test specimen

Figure 8 — Location of test specimens for a fillet weld for pipe on plate

7.3 Non-destructive examination

7.3.1 Method

Prior to the cutting of test specimens, all test pieces shall be examined visually and non-destructively in accordance with 7.1.

For non-post weld heat treated test pieces, account should be taken of the materials that are susceptible to hydrogen induced cracking and consequently the NDE should be delayed.

Depending upon joint geometry, materials and the requirements for work, the NDE shall be carried out in accordance with EN 970 (visual examination), EN 1435 (radiographic examination), EN 1714 (ultrasonic examination), EN 571-1 (penetrant testing) and EN 1290 (magnetic particle testing).

7.3.2 Acceptance levels

The acceptance levels shall be agreed between contracting parties as appropriate to the intended application, on the basis of EN 25817 and included in the WPS. A welding procedure is approved if the imperfections in the test piece are within these specified limits.

The correlation between the quality levels of EN 25817 and the acceptance levels of the different NDE techniques are given in EN 12062.

7.4 Destructive tests (DT)

7.4.1 Transverse tensile testing

Specimens and testing for transverse tensile testing for butt joints shall be in accordance with EN 895.

The tensile strength of the test specimen shall normally not be less than the corresponding specified minimum value for the parent metal. For dissimilar metal joints the tensile strength of the test specimen shall not be less than the lower one.

When the value to be obtained is less than the minimum value specified for the parent metal, it shall be specified prior to testing and included in the pWPS.

7.4.2 Bend testing

Specimens and testing for bend testing for butt joints shall be in accordance with EN 910. Care should be taken in the preparation of the test specimens to ensure that the surface condition is not the cause of failure.

For dissimilar metal joints or heterogeneous butt joint in plates, one root and one face longitudinal bend test specimen may be used instead of transverse bend tests.

The diameter of the former or the inner roller shall be $12x$ and the bending angle shall be a minimum of 180° unless the low ductility of the parent metal or filler metal impose other limitations.

During testing, the test specimens shall not reveal any one single flaw > 3 mm in any direction. Flaws appearing at the corners of a test specimen during testing, shall be ignored in the evaluation.

7.4.3 Macro-examination

The test specimen shall be prepared and etched in accordance with EN 1321 on one side to clearly reveal the fusion line, the HAZ and the build up of the runs.

The macro-examination shall include unaffected parent metal.

The acceptance levels stated in 7.3.2 shall apply.

7.4.4 Impact testing

Test specimens and testing for impact tests for butt joints shall be in accordance with this standard for position of specimens, and temperature of testing, and with EN 875 for dimensions and testing.

For weld metal, test specimen type VWT (V : Charpy V-notch - W : notch in weld metal - T : notch through the thickness) and for HAZ specimen type VHT (V : Charpy V-notch - H : notch in heat affected zone - T : notch through the thickness) shall be used. From each specified position, each set shall comprise three test specimens.

Specimens with Charpy V-notch shall be used and sampled a maximum of 2 mm below the surface of the parent metal and transverse to the weld.

The V-notch shall be cut perpendicular to the surface of the weld.

In the HAZ the notch shall be at 1 mm to 2 mm from the fusion line and in the weld metal the notch shall be at the weld centreline.

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For thicknesses > 50 mm, two additional sets of specimens shall be taken, one from the weld metal and one from the HAZ just below the mid thickness or in the root area of the weld.

Test temperature and absorbed energy shall be in accordance with the specified design requirements for the complete product in question, provided the requirements laid down by the application standard are met.

For dissimilar metal joints impact tests shall be carried out on specimens from each parent HAZ in each parent metal.

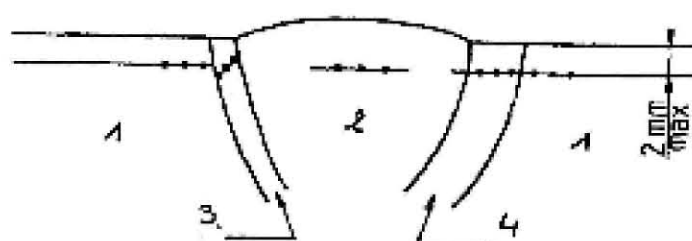
7.4.5 Hardness testing

The hardness testing shall be in accordance with EN 1043-1. The Vickers method HV10 shall be used. The indentation shall be made in the weld, the HAZs and the parent metal with the object of measuring and recording the range of values in the weld joint. For materials less than 5 mm thick one row of indentations shall be carried out 2 mm maximum below the surface. For materials over 5 mm thick one row of indentations shall be carried out 2 mm maximum below each surface. For double sided welds and for fillet and T-butt welds one additional row of indentations shall be taken through the root area. Typical examples are shown in Figures 1a, b, e and f of EN 1043-1.

For each row of indentation there shall be a minimum of 3 individual indentations in each part of the weld, the HAZ (both sides) and the parent metal (both sides). A typical example is shown in Figure 9.

For the HAZ the first indentation shall be placed as close to the fusion line as possible.

The results from the hardness test shall meet the requirements given in Table 2.



- Key**
- 1 Parent metal
 - 2 Weld
 - 3 HAZ narrow
 - 4 HAZ wide

Figure 9 — Typical examples of hardness testing

Table 2 — Permitted maximum hardness values HV10

Steel group	Non-heat treated	Heat treated
1 ^a	350	320
^a If hardness tests are required.		

7.4.6 Fracture testing

The fracture testing shall be in accordance with EN 1320.

In the case of lap weld on pipe, the test specimen shall be in accordance with Figure 10.



Key

- 1 Saw cut 2 mm deep
(if required)
- 2 Direction of
fracture force

Figure 10 — Fracture test specimen for lap weld on pipe

The exposed surface of each broken test specimen shall be free from cracks, lack of fusion and lack of penetration. Other imperfections in the weld metal shall be within the following limits :

- a) Gas pores : The greatest dimension of any pore shall not exceed 20 % of the pipe thickness or 3 mm, whichever is the smaller. The combined area of all pores shall not exceed 5 % of the cross-sectional area.
- b) Inclusions : The acceptance level (according to EN 25817) shall be the same as for NDE, as specified in the pWPS (see clause 4).

7.5 Re-testing

If the test piece fails to comply with any of the requirements for visual examination or NDE specified in 7.3.2, one further test piece shall be welded and subjected to the same examination. If this additional test piece does not comply with the relevant requirements, the pWPS shall be regarded as not capable of complying with the requirements of this standard without modification.

If any test specimen fails to comply with the relevant requirements of 7.4 only due to weld imperfections, two further test specimens shall be obtained for each one that failed. These can be taken from the same test piece if there is sufficient material available or from a new test piece, and shall be subjected to the same test.

If either of these additional test specimens do not comply with the relevant requirements, the pWPS shall be regarded as not capable of complying with the requirements of this standard without modification.

8 Range of approval

8.1 General

All the conditions of validity stated below shall be met independently of each other.

Changes outside of the ranges specified shall require a new welding procedure test.

8.2 Related to the manufacturer

An approval of a WPS obtained by a manufacturer is valid for welding in workshops or sites under the same technical and quality control of that manufacturer.

8.3 Related to the material

8.3.1 Parent metal

8.3.1.1 Grouping system

In order to minimize the unnecessary multiplication of welding procedure tests, steels shall be grouped as shown in CR ISO/TR 15608.

A procedure test carried out with one of the steels of a group covers the lower alloyed steels of the same group for the intentional added elements, but not for fortuitous impurities, or the steels with equal or lower specified yield point of this group, as long as the welding consumables used for the test can also be used for the other steels of this group. Permanent backing material shall be considered as a parent metal.

A separate approval of a welding procedure test shall be obtained for each steel or steel combinations not covered by the grouping system.

8.3.1.2 Dissimilar metal joints

Any dissimilar metal joint shall require a specific test.

8.3.2 Parent metal thickness and pipe diameter

8.3.2.1 General

Nominal thickness t shall have the following meanings :

- For a butt joint : the parent metal thickness, which for joints between dissimilar thicknesses is that of the thinner material.
- For a fillet weld : the parent metal thickness approved for joints between different thicknesses is that of the thicker material. For each thickness range approved as in table 4 there is also an associated range of approved fillet weld throat thicknesses as given in 8.3.2.3.

8.3.2.2 Range of approval for butt welds

The approval of a welding procedure test on thickness t shall include approval for thicknesses in the following ranges given in table 3.

Table 3 — Range of approval for thickness

Dimensions in millimetres	
Thickness of the test piece t	Range of approval ^a
$t \leq 6$	t
$t > 6$	$0,5 \times t$ to $1,5 \times t$ (min 6 mm)
^a For tests below the impact limit approval is < 12 mm without impact testing.	

8.3.2.3 Range of approval for fillet welds

In addition to the requirements of Table 4, the range of approval of the throat thickness ^a shall be "0,75x t " to "1,5x t ". However a test with a throat thickness ≥ 10 mm, shall give approval for all throat thicknesses ≥ 10 mm.

Where a fillet weld is approved by means of a butt weld test, the throat thickness range approved shall be based on the thickness of the deposited weld metal.

8.3.2.4 Range of approval for the diameter of pipes

The approval of a welding procedure test on diameter D shall include approval for diameters in the following ranges given in Table 4.

Table 4 — Range of approval for pipe

Dimensions in millimetres

Diameter of the test piece D^a	Range of approval
$D \leq 100$	$0,75 D$ to $2 D$
$100 < D \leq 300$	$0,5 D$ to $2 D$ (min 75)
$D \geq 300^b$	$\geq 0,5 D$
^a For structural hollow sections D is the dimension of the smallest side.	
^b Approval for butt welds in pipes includes butt welds in plates.	

8.4 Common to all welding procedures

8.4.1 Welding process

The approval is valid only for the welding process used in the welding procedure test. It is not permitted to change a multi run deposit into a single run (or single run on each side) or vice versa for a given process.

8.4.2 Welding positions

The range of approval for welding positions is given in Table 5.

When either impact and/or hardness requirements are specified, impact tests shall be taken from the weld made in the highest heat input position and hardness tests shall be taken from the weld made in the lowest heat input position in order to approve for all positions.

To satisfy both hardness and impact requirements two test pieces in different welding positions shall be required unless a single position approval is required. Where approval is required for all positions both test pieces shall be subjected to full visual examination and non-destructive testing.

NOTE Other destructive tests may be taken from either test piece. One of the test pieces may be of reduced length.

Table 5 — Range of approval according to welding position

Welding position of approval test piece			Range of approval																	
			Plates										Pipes							
			Butt weld					Fillet weld					Lap weld					Fillet weld		
PA	PG	PG	PF ^a	PE	PA	PB	PG	PP ^b	PD	PG ^c	PF ^a	PG ^c	H-L 045 ^a	J-L 045	PB ^d	PG ^e	PP ^b	PD ^{b,c}		
P l a t e s	Butt weld	PA	x	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	
		PG	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
		PG	-	-	x	-	-	-	x	-	-	x	-	-	-	-	-	x	-	
		PF ^a	-	-	-	x	-	-	-	x	x	-	x	-	-	-	-	-	x	-
		PE	x	x	-	-	x	-	-	-	-	x	-	-	-	-	x	-	-	x
	Fillet weld	PA	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-
		PB	-	-	-	-	-	x	x	-	-	-	-	x	-	-	x	-	-	-
		PG	-	-	x	-	-	-	-	x	-	-	x	-	-	-	-	x	-	-
		PF ^a	-	-	-	x	-	-	-	-	x	-	-	x	-	-	-	-	x	-
		PD ^b	-	-	-	-	-	x	x	-	-	x	-	-	-	-	x	-	-	x
P i p e s	Lap weld	PG ^c	-	-	x	-	-	-	x	-	-	x	-	-	-	-	-	x	-	-
		PF ^a	-	-	-	x	-	-	-	-	x	x	-	-	-	-	-	-	x	-
		PG ^c	-	-	-	-	-	x	x	-	-	-	-	x	-	-	x	-	-	-
		H-L045 ^a	-	-	-	x	-	-	-	-	x	-	-	x	-	-	-	-	x	-
		J-L045	-	-	x	-	-	x	-	x	-	-	x	-	-	-	x	-	x	-
	Fillet weld	PG ^d	-	-	-	-	-	x	x	-	-	-	-	x	-	-	x	-	-	-
		PG ^c	-	-	-	x	-	-	-	x	-	-	x	-	-	-	-	x	-	-
		PF ^a	x	x	-	-	-	-	-	-	x	-	-	x	-	-	-	-	x	-
		PD ^{b,c}	x	x	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	x

^a Positions PF and H-L045 are exclusively used for processes 114, 136 and 137.

^b This is an approved position and it is covered by the other related test.

^c For pipes welded as follows : pipe : fixed ; axis : horizontal ; weld : vertical.

^d For pipes welded as follows : pipe : fixed ; axis : vertical ; weld : horizontal.

Key :

x Indicates those welding positions for which the WPS is approved.

- Indicates those welding positions for which the WPS is not approved.

^a Positions PF and H-L045 are exclusively used for processes 114, 136 and 137.

^b This is an approved position and it is covered by the other related test.

^c For pipes welded as follows : pipe : fixed ; axis : horizontal ; weld : vertical.

^d For pipes welded as follows : pipe : fixed ; axis : vertical ; weld : horizontal.

Key :

x Indicates those welding positions for which the WPS is approved.

- Indicates those welding positions for which the WPS is not approved.

8.4.3 Joint type

The range of approval for the types of welded joints used in the procedure test is given in Table 6.

In this table the range of approval is indicated in the same horizontal line.

Table 6 — Range of approval for types of joints

Type of joint in approval test piece		Range of approval			
		Butt weld on plate	Lap or fillet weld		
			Welded from one side	Plate (Fillet)	Pipe (Lap)
Butt weld on plate	Welded from one side	x	x	x *	x *
Lap or fillet weld	Plate (Fillet)	-	x	x	x
	Pipe (Lap)	-	x	x	x
	Pipe on plate (Fillet)	-	x	x	x

* only permitted for pipes with a diameter ≥ 600 mm.

Key: :

x indicates those welds for which the WPS is approved.

- indicates those welds for which the WPS is not approved.

8.4.4 Filler metal, designation

A change of :

- standardized or commercial designation of flux cored wires or electrodes and waterprotective coating ;
- standard dimensions (diameter, length) ;
- underwater transport or storage method ;
- and/or addition or omission of the waterprotective coating,

shall entail reapproval of the welding procedure.

8.4.5 Type of current

The approval given is on the type of current (alternating current (AC), direct current (DC)) and polarity used in the welding procedure test.

8.4.6 Heat input

The requirements of this clause only apply when the control of heat input is specified.

When impact requirements apply, the upper limit of heat input approved is 25 % greater than that used in welding the test piece.

When hardness requirements apply, the lower limit of heat input approved is 25 % lower than that used in welding the test piece.

8.4.7 Preheat temperature

The lower limit of approval is the preheat temperature applied at the start of the welding procedure test.

8.4.8 Interpass temperature

The upper limit of approval is the interpass temperature reached in the welding procedure test.

8.4.9 Post-weld heat-treatment

Addition or deletion of post weld heat treatment is not permitted.

The temperature range approved is the holding temperature used in the welding procedure test ± 20 °C. Where required, heating rates, cooling rates and holding time shall be related to the production assembly.

8.5 Specific to processes

8.5.1 Processes 111, 114, 136 and 137

The approval given is for the diameter of electrode/consumable used in the welding procedure test.

8.5.2 Processes 136 and 137

The approval given to the face shielding gas is restricted to the type of gas (nominal composition) used in the welding procedure test.

The face shielding gas flow rate shall not change by more than 15 %.

8.6 Water depth and type

The range of approval related to water depth is given in Table 7.

Table 7 — Range of approval for water depth

Dimensions in meters

Type of welding	Depth of welding for test piece	Range of approval W_D
Wet welding with mild steel filler metal (group 1)	$W_D < 10$ $20 < W_D < 50$ $50 < W_D < 100$	0 up to 10 $0,85 W_D$ up to $1,15 W_D$ $0,85 W_D$ up to $1,10 W_D$
Wet welding with austenitic stainless steel (group 9)	W_D	$0,90 W_D$ up to $W_D + 3$
Wet welding with other filler materials	W_D	$0,90 W_D$ up to $W_D + 10$
NOTE 1 : W_D is qualification depth. NOTE 2 : For the maximum depth qualified, depth shall be measured from the lower extremity of the test weldment with a tolerance of plus or minus 250 mm. NOTE 3 : For the minimum depth qualified, depth shall be measured from the upper extremity of the test weldment with a tolerance of plus or minus 250 mm.		

A change from salt water to fresh water is not permitted. The converse shall not require reapproval.

9 Welding procedure approval record (WPAR)

The welding procedure approval record (WPAR) is a statement of the results of assessing each test piece including re-tests. The relevant items listed for the WPS in prEN ISO 15609-1 shall be included, together with details of any features that would be rejectable by the requirements of clause 7. If no rejectable features or unacceptable test results are found, a WPAR detailing the welding procedure test piece results is approved and shall be signed and dated by an examiner or an examining body.

A WPAR format shall be used to record details for the welding procedure and the test results, in order to facilitate uniform presentation and assessment of the data.

An example of the WPAR-format is shown in annex A.

Annex A

(informative)

Welding procedure approval record form (WPAR)

Welding procedure approval - Test certificate

Manufacturer's Welding procedure
Reference N° :

Examiner or examining body
Reference N° :

Manufacturer:

Address :

Code Testing Standard :

Quality level for imperfections (according to EN 25817) :

Extent of approval :

Welding process :

Joint type:

Parent metal(s) :

Parent metal thickness (mm) :

Outside diameter (mm) :

Filler metal :

- standardized or commercial designation
- diameter/length
- waterprotective coating
- underwater transport or storage method

Face shielding gas • nominal composition
 • flowrate

Type of welding current :

Welding positions :

Preheat :

Post-weld heat treatment and/or ageing :

Water - depth (m) : - type : salt / fresh

Other information :

Certified that test welds prepared, welded and tested satisfactorily in accordance with the requirements of the code/testing standard indicated above.

Location

Date of issue

Examiner or examining body

Name, date and signature

Test results

Manufacturer's Welding procedure
Reference N° :

Examiner or examining body
Reference N° :

Visual examination :
Penetrant/Magnetic particle testing*

Radiographic examination :
Ultrasonic examination :

Tensile tests

Temperature :

Type/N°	Re N/mm ²	Rm N/mm ²	A % on	Z %	Fracture location	Remarks
Requirement						

Bend tests

Former diameter :

Type/N°	Bend angle	Elongation*	Result

Macro examination :
Micro examination* :

Fracture test

Type/N°	Result

Impact test*

Type :

Size :

Requirement :

Notch location /Direction	Temp. °C	Values 1 2 3	Average	Remarks

Hardness tests*

Location of measurements (sketch*)

Type/load
Parent metal :
H.A.Z. :
Weld metal :

Other tests* :

Remarks :

Tests carried out in accordance with the requirements of :
Laboratory report reference N°
Test results were acceptable/not acceptable (delete as appropriate)
Tests carried out in the presence of :

.....
Examiner or examining body
Name date and signature

* if required.

Annex B (informative)

New numbering system - Details of the standards dealing with specification and approval of welding procedures

See table B.1.

Table B.1 — Details of the standards dealing with specification and approval of welding procedures

Process	Arc welding	Gas welding	Electron beam welding	Laser beam welding	Resistance welding	Stud welding	Friction welding
General rules	EN ISO 15607						
Guidelines for a grouping system	CR ISO/TR 15608				Not applied	CR ISO/TR 15608	
WPS	EN ISO 15609-1	EN ISO 15609-2	EN ISO 15609-3	EN ISO 15609-4	EN ISO 15609-5	EN ISO 14555	EN ISO 15620
Approved consumables	EN ISO 15610			Not applied			
Previous welding experience	EN ISO 15611					EN ISO 15611 EN ISO 14555	EN ISO 15611 EN ISO 15620
Standard procedure	EN ISO 15612				Not applied		
Pre-production test	EN ISO 15613					EN ISO 15613 EN ISO 14555	EN ISO 15613 EN ISO 15620
Welding procedure test	EN ISO 15614 Part 1: Steel/Nickel Part 2: Aluminium Part 3: Cast Iron Part 4: Finishing welding of aluminium castings Part 5: Titanium/zirconium Part 6: Copper Part 7: Surfacing Part 8: Tube to tube sheet Part 9: Wet hyperbaric Part 10: Dry hyperbaric	EN ISO 15614 Part 1: Steel/Nickel Part 3: Cast Iron Part 6: Copper Part 7: Surfacing	EN ISO 15614 Part 7: Surfacing Part 11: Electron beam/Laser beam	EN ISO 15614 Part 12: Spot, seam and projection Part 13: Flash and butt		EN ISO 14555	EN ISO 15620

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU directives.

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of EU Directive 97/23/EEC.

WARNING : Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The following clauses of this standard are likely to support requirements of Directive 97/23/EEC.

Compliance with the clauses of this standard provides one with means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Table ZA.1 – Relation between this European standard and the Directive 97/23/EEC

Clauses/Paragraphs of this European standard	Essential requirement of the Directive 97/23/EEC	Comments/Notes
All clauses	Annex 1, 3.1.2	Permanent joining

Bibliography

List of ISO standards conforming to European standards quoted in clause 2

European standard given in clause 2	ISO standard corresponding	Title of the ISO standard
EN 571-1	-	
EN 875	ISO/DIS 9016	Destructive test on welds in metallic materials – Impact test – Test specimen location, notch orientation and examination
EN 895	ISO/DIS 4136	Destructive test on welds in metallic materials – Transverse tensile test
EN 910	ISO/DIS 5173	Destructive tests on welds in metallic materials – Bend test
EN 970	ISO/AWI 17637	Non-destructive examination of fusion welds – Visual examination
EN 1043-1	ISO/DIS 9015-1	Destructive tests on welds in metallic materials – Hardness testing – Part 1: Hardness test on arc welded joints
EN 1290	ISO/AWI 17638	Non-destructive examination of welds – Magnetic particle examination of welds
EN 1321	ISO/AWI 17639	Destructive tests on welds in metallic materials – Macroscopic and microscopic examination of welds
EN 1435	ISO/AWI 17636	Non-destructive examination of welds – Radiographic examination of welded joints
EN 1714	ISO/AWI 17640	Non-destructive examination of welds – Ultrasonic examination of welded joints
EN 12062	ISO/AWI 17635	Non-destructive examination of welds – General rules for metallic material
EN 25817:1992	ISO 5817:1992	Arc-welded joints in steel – Guidance on quality levels for imperfections