BRITISH STANDARD

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288-9:1999

Specification and approval of welding procedures for metallic materials —

Part 9: Welding procedure test for pipeline welding on land and offshore site butt welding of transmission pipelines

The European Standard EN 288-9:1999 has the status of a British Standard

ICS 25.160.10

National foreword

This British Standard is the English language version of EN 288-9:1999.

The UK participation in its preparation was entrusted by Technical Committee WEE/21, Pipework welding, to Subcommittee WEE/21/7, Field welding, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled "International Standards Correspondence Index", or by using the "Find" facility of the BSI Standards Electronic Catalogue.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

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Specification and approval of welding procedures for metallic materials — Part 9: Welding procedure test for pipeline welding on land and offshore site butt welding of transmission pipelines

Descriptif et qualification d'un mode opératoire de soudage pour les matériaux métalliques — Partie 9: Epreuve de qualification d'un mode opératoire de soudage pour le soudage bout a bout de canalisations de transport sur site, sur terre et en mer

Anforderung und Anerkennung von Schweißverfahren für metallische Werkstoffe — Teil 9: Schweißverfahrensprüfung für baustellengeschweißte Stumpfnähte von Versorgungsrohrleitungen an Land und Offshore

This European Standard was approved by CEN on 3 March 1999.

CEN

European Committee for Standardization
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Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 288-9:1999 E

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 121, Welding, the Secretariat of which is held by DS.

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 September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

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.

Contents

Introduction

All new welding procedure approvals are 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 specification, 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 employed.

Also, where additional tests are carried out to make the welding procedure approval technically equivalent, the additional tests are made 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 made 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 on land and offshore site butt welding of transmission pipelines under normal atmospheric conditions.

Tests are carried out in accordance with this standard unless additional tests (e.g. CTOD tests and all weld metal tensile tests) are specified by the relevant application standard or contract when these apply.

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**.

It applies to the arc welding of steels of groups 1, 2 and 3 according to CR 12187. The principles of this standard can be applied to other fusion welding processes subject to agreement between the contracting parties.

The requirements for welding procedure specification and qualification for hyperbaric and “wet” welding are not covered by this supplementary standard.

Arc welding is covered by the following processes in accordance with EN 24063:

- 111 — metal-arc welding with covered electrode;
- 114 — flux-cored wire metal-arc welding without gas shield;
- 121 — submerged arc welding with wire electrode;
- 131 — metal-arc inert gas welding, MIG-welding;
- 135 — metal-arc active gas welding, MAG-welding;
- 136 — flux-cored wire metal-arc welding with active gas shield;
- 141 — tungsten inert gas arc welding, TIG-welding.

Other fusion welding processes by agreement e.g. metal cored wire arc welding.

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 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 439, *Welding consumables — Shielding gases for arc welding and cutting.*

EN 760, *Welding consumables — Fluxes for submerged arc welding — Classification.*

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 material — Tranverse tensile test.*

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

EN 1043-1, *Destructive test on weld 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 test 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 6947, *Welds — Working positions — Definitions of angles of slope and rotation.*
(ISO 6947:1993)

EN 10045-1, *Metallic materials — Charpy impact test — Part 1: Test method.*

EN 24063, *Welding, brazing, soldering and braze welding of metals — Nomenclature of processes and reference numbers for symbolic representation on drawings.*
(ISO 4063:1990)

EN ISO 6520-1:1998, *Welding and applied processes — Classification of geometric imperfections in metallic materials — Part 1: Fusion welding.*
(ISO 6520-1:1998)

CR 12187, *Welding — Guidelines for a grouping system of materials for welding purposes.*

3 Definitions

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

3.1

repair

any operation which involves welding to rectify the weld, outside the normal welding cycle

3.2

full penetration repair

welded repair through the whole thickness of the qualification joint

3.3

internal repair

welded repair carried out from the inside surface or the root side of a weld, after excavation and repreparation, using either a single or a multi-pass weld deposition sequence

3.4

make

specific trade or brand name of the consumable, but not its designation

4 Preliminary welding procedure specification (pWPS)

The preliminary welding procedure specification shall be prepared in accordance with EN 288-2. It shall specify the range for all relevant parameters including the following additional items:

— steel grade and supply conditions (N, TM, QT steels);
— number and location of welders;
— time lapse between start of root pass and start of hot pass;
— partially completed joint: number of runs before the joint is permitted to cool to ambient temperature;
— type of line up clamp;
— time of clamp removal;
— number of runs completed before lowering off or barge move up;
— preheating method;
— method to control cooling.

5 Welding procedure test

The making and testing of test pieces representing the type of welding used in production shall be carried out in accordance with clauses **6** and **7** of this standard.

When a welding procedure is to be qualified and approved for pipe-reeling, the proposed welding procedures shall include relevant previously documented strain ageing data and/or any additional tests specified.

NOTE These tests can include representative strain cycles and accelerated ageing typically for 1 h at 100° C.

Where data regarding pipe material performance/weldability exist, these data shall be considered when selecting suitable welding parameters and conditions for incorporating into the pWPS. Where such data do not exist it can be necessary to carry out preliminary welding trials to establish these data.

The welder who undertakes the welding procedure test satisfactorily in accordance with this standard can be approved, by agreement between the contracting parties, for welding on site within the ranges covered by the approved welding procedure specification.

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 or pieces, as specified in **6.2**.

6.2 Shape and dimensions of test pieces

Test welds shall be made between whole pipe lengths (if agreed between the contracting parties the length could be reduced to a minimum of one diameter) under simulated site conditions (this may include the application of installation strains). Welding shall follow the pWPS, with removal of line-up clamps, lowering off, partial completion and recommencement where applicable.

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 production welding which they shall represent. Welding positions and limitations for the angle of slope and rotation of test piece shall be in accordance with EN ISO 6947 (see also **8.4.2**).

If tack 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 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 carried out in accordance with the requirements of Table 1.

When Charpy impact tests are specified for welds exceeding 20 mm thick, they are required at two different thickness locations (see **7.4.3**).

Repairs outside essential variables need full approval in accordance with annex A.

7.2 Location and cutting of test specimens

The location of test specimens shall be in accordance with Figures 1 and 2.

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

Table 1 — Examination and testing of the test pieces

Test piece	Type of test	Extent of testing	Note
Butt-weld	Visual examination (EN 970)	100%	—
	Radiographic examination (EN 1435) or		
	Ultrasonic examination (EN 1714)	100 %	—
	Surface crack detection	100 %	1
	Transverse tensile test (EN 895)	2 test specimens	—
	Impact test (EN 875)	2 or 4 sets	2
	Hardness test (EN 1043-1)	required	3
	Macro-examination (EN 1321)	1 test specimen	—

NOTE 1 Magnetic particle examination according to EN 1290.

NOTE 2 1 set in the weld metal and 1 set in the HAZ at each location. See also **7.4.3**.

NOTE 3 Not required for parent metals in ferritic steels with $R_m \leq 430$ N/mm^2 ($R_e \leq 275$ N/mm^2).

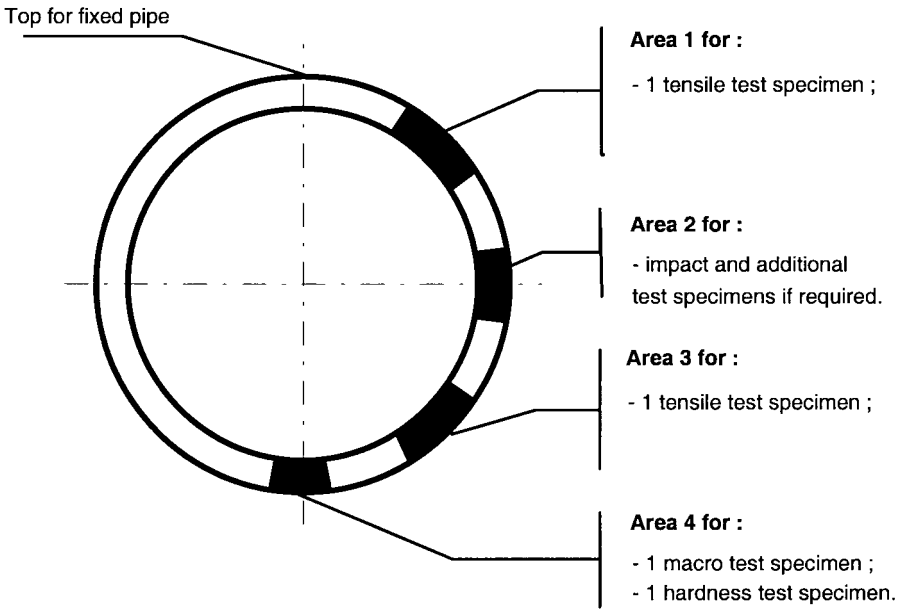


Figure 1 — Location of test specimens for a butt-weld in pipe — Upwards welding

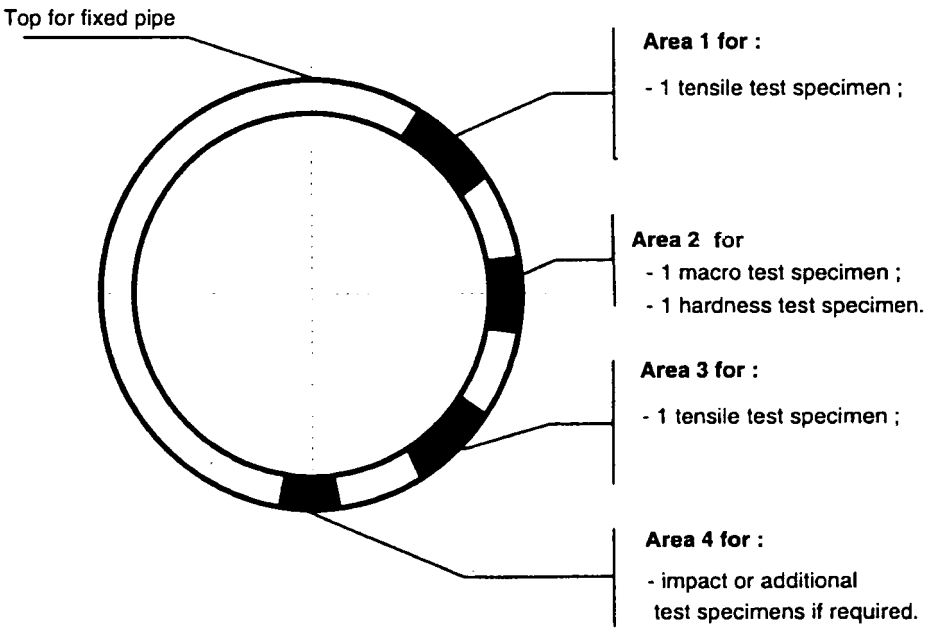


Figure 2 — Location of test specimens for a butt-weld in pipe — Downwards welding

7.3 Non-destructive examination

7.3.1 *Method*

After any required post-weld heat treatment and 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 susceptibility to hydrogen induced cracking and consequently the NDE should be delayed. The NDE delay shall be 24 h, unless agreed by the contracting parties or by the relevant application standard.

7.3.2 *Acceptance levels*

A welding procedure is approved if the imperfections in the test piece are within the specified limits given in Table 2.

7.4 Destructive tests

For welds carried out by cellulosic coated electrodes, a degassing heat treatment of 250 °C of up to 16 h can be carried out, if necessary according to special requirements.

7.4.1 *Transverse tensile testing*

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

For pipes > 50 mm outside diameter, the weld reinforcement shall be removed on both faces to give the test specimen a thickness equal to wall thickness of the pipe.

Transverse tensile test is acceptable if the test specimen breaks in the parent material or when it breaks in the weld metal with a tensile strength equal to or greater than the specified minimum tensile strength of pipe material.

7.4.2 *Macro-examination*

Test specimens and testing for macro examination shall be in accordance with EN 1321.

The acceptance levels stated in **7.3.2** shall apply.

7.4.3 *Impact testing*

In the absence of an application standard, impact testing is required for pipes with specified impact properties and wall thicknesses $t \geq 12$ mm.

Test specimens shall be taken and prepared in accordance with EN 10045-1 in such a way that the axis of the notch is perpendicular to the pipe surface.

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

For weld metal, test specimen type VWT0 and for HAZ specimen type VHT0 shall be used (see Figure 3). From each specified position, each set shall be comprised of three test specimens.

Test specimens with Charpy V-notch shall be used and sampled from 1 mm to 2 mm below the inner surface of the pipe and transverse to the weld.

When the pipe wall thickness exceeds 20 mm, two more sets are required, in the same circumferential locations, but taken within 1 mm to 2 mm of the outside surface of the pipe.

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

Table 2 — Limits for imperfections

Imperfection designation	EN ISO 6520-1: 1998 reference	Limits for imperfections
Cracks	100	Not permitted
Gas pore Uniformly distributed porosity Linear porosity Elongated cavity Surface pore	2011 2012 2014 2016 2017	Individual gas pores or uniformly distributed porosity shall be unacceptable when any of the following conditions exists: a) the size of an individual pore exceeds 3 mm; b) the size of an individual pore exceeds 25 % of the thinner of the nominal wall thickness joined; c) the total area, when projected radially through the weld shall not exceed 2 % of the projected weld area in the radiograph, consisting of the length of the weld affected by the porosity, with a minimum length of 150 mm multiplied by the maximum width of the weld.
Localized (clustered) porosity	2013	— Clustered porosity that occurs in any pass except the finish pass shall comply with the criteria of gas pores. — Clustered porosity that occurs in the finish pass shall be unacceptable when any of the following conditions exists: a) the diameter of the clustered porosity exceeds 13 mm; b) the aggregate length of clustered porosity in any continuous 300 mm length of weld exceeds 13 mm; c) an individual pore within a clustered porosity exceeds 2 mm in size.
Elongated cavity	2015	Unacceptable in the root pass when any of the following conditions exists: a) the length of an individual indication exceeds 50 mm; b) the aggregate length of the elongated cavities in any continuous 300 mm length of weld exceeds 50 mm; c) the aggregate length of the elongated cavities exceeds 15 % of the weld length.
Crater pipe	2024	Unacceptable when the maximum length exceeds 2 mm or 30 % of the wall thickness, whichever is the smaller.

Table 2 — Limits for imperfections *(continued)*

Imperfection designation	EN ISO 6520-1: 1998 reference	Limits for imperfections
Slag inclusion: — linear — isolated	301 3011 3012	Unacceptable when any of the following conditions exists: a) the length of a linear slag inclusion exceeds 50 mm; NOTE Parallel linear indications separated by approximately the width of the root run (wagon tracks) should be considered as single indications unless the width of either of them exceeds 0,8 mm. In that case, they should be considered as separate indications. b) the aggregate length of linear slag inclusions in any continuous 300 mm length of weld exceeds 50 mm; c) the width of a linear slag inclusion exceeds 1,6 mm; d) the aggregate length of isolated slag inclusions in any continuous 300 mm length of weld exceeds 50 mm; e) the width of an isolated slag inclusion exceeds 3 mm or 50 % of the wall thickness, whichever is less; f) more than four isolated slag inclusions with the maximum width of 3 mm are present in any continuous 300 mm length of weld; g) the aggregate length of linear and isolated slag inclusions exceeds 15 % of the weld length.
Metallic inclusions: — tungsten — copper	304 3041 3042	Unacceptable when any of the following conditions exists: a) the size of a copper or tungsten inclusion exceeds 3 mm or 50 % of the wall thickness, whichever is the smaller; b) the aggregate length of copper or tungsten inclusions exceeds 12 mm in any continuous 300 mm length of weld or more than four such inclusions are present in any continuous 300 mm length of weld.
Lack of fusion: — lack of side wall fusion — lack of inter-run fusion	401 4011 4012	Unacceptable when any of the following conditions exists: a) the length of an individual indication exceeds 50 mm b) the aggregate length of indications in any continuous 300 mm length of weld exceeds 50 mm; c) the aggregate length of indications exceeds 15 % of the weld length.

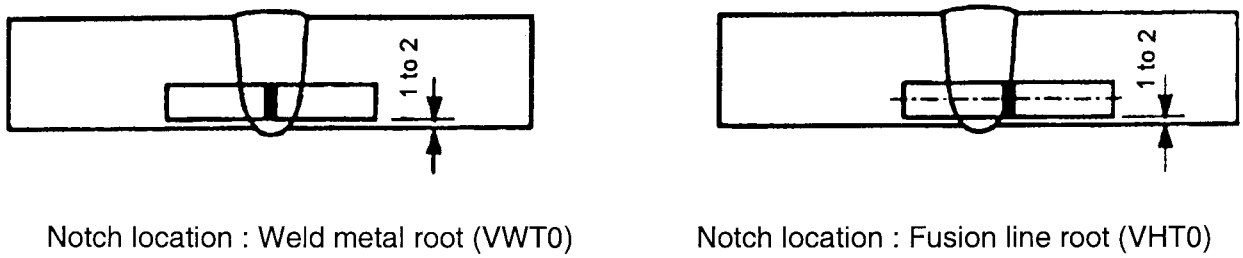
Table 2 — Limits for imperfections *(continued)*

Imperfection designation	EN ISO 6520-1: 1998 reference	Limits for imperfections
— lack of fusion at the root of the weld	4013	Unacceptable, for single sided welds, when any of the following conditions exists: a) the length of an individual indication exceeds 25 mm; b) the aggregate length of indications in any continuous 300 mm length of weld exceeds 25 mm; c) the aggregate length of indications exceeds 8 % of the weld length in any weld less than 300 mm long.
Lack of penetration (incomplete penetration)	402	Unacceptable when any of the following conditions exists: a) the length of an individual indication of incomplete penetration exceeds 25 mm; b) the aggregate length of indications of incomplete penetration in any continuous 300 mm length of weld exceeds 25 mm; c) the aggregate length of indications of incomplete penetration exceeds 8 % of the weld length in any weld less than 300 mm long; d) incomplete penetration in double sided welds exceeds 50 mm in total length in any continuous 300 mm of weld length or 15 % of the weld length.
Undercut Undercut Shrinkage groove	5011 5012 5013	Unacceptable when any of the following conditions exists: a) the aggregate length of undercut, both external and internal, in any continuous 300 mm length of weld exceeds 50 mm; b) the aggregate length of undercut, both external and internal, exceeds 15 % of the weld length. Undercuts shall not be deeper than 1,5 mm or 10 % of the pipe wall thickness, whichever is the smaller.
Excess weld metal Excessive penetration	502 504	Both external and internal reinforcement should not exceed a height of more than 3 mm.

Table 2 — Limits for imperfections *(continued)*

Imperfection designation	EN ISO 6520-1: 1998 reference	Limits for imperfections
Linear misalignment	507	— Maximum external misalignment permitted: — for $t \leq 10$ mm : 0,3 t; — for 10 mm < $t \leq 20$ mm : 3 mm; — for $t > 20$ mm : 0,125 t. — Maximum internal misalignment permitted: — 1 mm on entire circumference; — 2 mm over length D; — 2,5 mm over length 1/3 D.
Sagging in flat (PA) or overhead (PE)	5092	Unacceptable.
Burn through	510	Unacceptable when any of the following conditions exists: a) the maximum dimension exceeds 6 mm and the density of the burn through of the radiographic image exceeds that of the thinnest adjacent parent metal; b) the maximum dimension exceeds the thinner of the nominal wall thicknesses joined, and the density of the burn through of the radiographic image exceeds that of the thinnest adjacent parent metal; c) more than one burn through of any size is present and the density more than one of the radiographic images exceeds that of the thinnest adjacent parent metal.
Incompletely filled grove	511	Unacceptable.
Root concavity	515	Root concavity up to 25 % of the total length of weld, is acceptable, provided the density of the radiographic image of the root concavity does not exceed that of the thinnest adjacent parent metal. For areas that exceed the density of the thinnest adjacent parent metal, the criteria for burn through (510) are applicable.
Accumulation of imperfections	—	Any accumulation of imperfections shall be unacceptable when any of the following conditions exists: a) the aggregate length of indications in any continuous 300 mm length of weld exceeds 50 mm; b) the aggregate length of indications exceeds 15 % of the weld length.

Dimensions in millimetres



Notch location : Weld metal root (VWT0) Notch location : Fusion line root (VHT0)

Figure 3a — For all wall thicknesses

Notch location : Weld metal (VWT0) Notch location : Fusion line (VHT0)

Figure 3b — Additional for wall thicknesses > 20 mm

Figure 3 — Position of Charpy-V notch test specimens

7.4.4 ***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. This will include rows of indentation one of which shall be 2 mm maximum below each surface.

For each row of indentation there shall be a minimum of three individual indentations in each part of the weld, the HAZ (both sides) and the parent metal (both sides).

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 3.

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 geometric 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 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.

Table 3 — Permitted maximum hardness values HV10

Hardness location	Weld metal		Heat-affected zone	
	Root	Cap	Root	Cap
Sour service, any process:				
$t < 9{,}5$ mm;	250	275	250	275
$t \geq 9{,}5$ mm.	250	275	250	300
Non-sour service:				
— manual welding with cellulosic electrodes;	275	275	275	325
— other welding processes.	275	275	350	350

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 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*

Steel grades are grouped in accordance with CR 12187 (groups 1, 2 and 3).

A welding procedure test carried out with one of the steel grades of a group covers for steel grades with lower or equal specified minimum yield strength of that group but does not cover steel grades with higher specified minimum yield strength.

A change of supply conditions requires a reapproval of the welding procedure test in all cases.

In addition a reapproval of the welding procedure test is required, if the ladle analysis differs from that tested by more than the amount defined in Table 4:

— for group 1.1 steels when CTOD test is required;

— for groups 1.2 and 1.3 steels when either impact test or CTOD test is required;

— for groups 2 and 3 steels.

Table 4 — Qualified ranges of chemical analysis

	Element	Value tested	Values qualified
Part 1	Carbon	Any	Value tested ±0,04 %
	Manganese	Any	Value tested ±0,25 %
	Silicon	Any	Value tested ±0,20 %
	Sulfur	Not over 0,008 % Over 9,008 %	Up to 0,015 % over the value tested Not less than 0,009 %, up to 0,015 % over the value tested
	Phosphorus	Any	Up to 0,015 % over value tested
	Carbon equivalent[1)]	Any	Value tested −0,06 % or +0,03 %[2)3)]
Part 2[4)]	Aluminium(tot)	Not over 0,015 % Over 0,015 %	Not less than value tested Value tested ±0,030 % but shall be between 0,016 % and 0,060 %
	Niobium	Any	Value tested −0,02 % or +0,01 %
	Vanadium	Any	Value tested ±0,03 %
	Nickel	Any	Value tested ±0,10 %
	Copper	Any	Value tested −0,20 % or +0,10 %
	Chromium	Any	Value tested −0,10 % or +0,05 %
	Molybdenum	Any	Value tested −0,10 % or +0,05 %
	Titanium	Any	Value tested ±0,005 %
Part 3[5)]	Nitrogen	Any	Value tested +0,004 %
	Calcium	Not over 0,004 % Over 0,004 %	Not over 0,004 % Not over value tested

[1)] Carbon equivalent = % C + % Mn/6 + (% Cr + % Mo + % V)/5 + (% Ni + % Cu)/15.

[2)] The client may specify a lower maximum for sour service.

[3)] For steels of carbon equivalent ≥ 0,4 % increase preheat can be needed

[4)] The "values qualified" limits in this part apply only where impact testing is required, or where the material tested has a carbon equivalent exceeding 0,43 %

[5)] Measurement of elements of this part is not required unless CTOD testing is required and the material tested has a carbon equivalent exceeding 0,40 %.

8.3.2 ***Parent metal thickness and pipe diameter***

8.3.2.1 *Thickness*

The approval of a welding procedure test on thickness t shall include approval for thicknesses in the following ranges given in Table 5, provided this does not conflict with the impact test requirements of **7.4.3**.

8.3.2.2 *Pipe diameter*

The approval of a welding procedure test on outside diameter D shall include approval for diameters in the range 0,5 D to 2 D.

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. In a multi-process procedure the approval is only valid for the order used in the welding procedure test.

8.4.2 ***Welding positions***

The range of approval for welding position is ±25° of the position tested, except for position PA according to EN ISO 6947 which is qualified by position PF or PG.

8.4.3 ***Type of joint***

Any change in joint configuration outside tolerances specified in the WPS requires a reapproval of the welding procedure test.

8.4.4 ***Filler metal designation***

Where the filler metal designation is based on tensile or yield strengths the approval of one filler metal shall approve the others within the same specified group except where impact properties are required to be demonstrated.

Where the filler metal designation is based on chemical composition the approval of one filler metal shall approve others within the same specified chemical group.

A change of type of coating or flux e.g. basic/rutile/cellulosic shall entail reapproval of the welding procedure.

8.4.5 ***Filler metal make***

When impact testing is required, the approval given is only applicable to the specific make used in the welding procedure test. It is permissible to change the specific make of filler metal to another with the same compulsory part of the classification when an additional test piece is welded.

This test piece shall be welded using the identical welding parameters as the original weld procedure test and only weld metal impact test specimens shall be tested.

NOTE This provision does not apply to solid wire and rods with the same classification and nominal chemical compositions.

8.4.6 ***Type of current***

The approval given is the type of current (a.c., d.c., pulsed current) and the polarity used in the welding procedure test.

8.4.7 ***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 15 % greater than that used in the welding procedure test.

The lower limit of heat input approved is 15 % lower than that used in the welding procedure test.

8.4.8 ***Preheat temperature***

The lower limit of approval is the preheat temperature used in the welding procedure test.

8.4.9 ***Interpass temperature***

The upper limit of approval is the interpass temperature used in the welding procedure test and shall not exceed 250 °C.

8.4.10 ***Post-heating***

When post-heating is carried out as a part of the WPS, the time and the temperature of the post-heating shall be not less than those reached in the welding procedure test.

8.4.11 ***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 unless otherwise specified. Where required, heating rates, cooling rates and holding time shall be related to the production assembly.

8.4.12 ***Removal of line up clamp***

The line up clamp shall not be removed when the length of weld (in % of circumference) or number of runs is less than that reached in the welding procedure test.

Table 5 — Range of approval for thickness

Dimensions in millimetres

Thickness of the test piece t	**Range of approval**		
	Steel $R_e \leq 275$ N/mm^2	**Steel** $275 < R_e \leq 360$ N/mm^2	**Steel** $R_e = 360$ N/mm^2
$3 < t \leq 12$	3 to 2 t	0,8 t to 1,5 t	0,8 t to 1,25 t
$12 < t \leq 100$	0,5 t to 2 t (max. 150)	0,8 t to 1,5 t	0,8 t to 1,25 t

8.4.13 *Time interval*

The requirements of this clause shall only apply when cellulosic electrodes are used.

The approval given is restricted to time lapses not exceeding that recorded in the welding procedure test.

8.4.14 *Number of welders*

The approval given is restricted to the minimum number of root run and hot pass welders used in the welding procedure test.

The number of welders used for filling passes can be different but shall at least be equal to that recorded in the welding procedure test.

8.4.15 *Partially completed joint*

The approval given is restricted to welds which have at least as many runs deposited before cooling below preheat temperature as recorded in the welding procedure test.

8.5 Specific to processes

8.5.1 *Processes 111 and 114*

The approval given is for the diameter of electrode used in the welding procedure test plus or minus one electrode diameter size for each run, with the exception of the two first layer and the capping layer on single sided without backing butt-welds for which no size change is permissible.

8.5.2 *Process 121*

The approval given is restricted to the wire system and wire diameters used in the welding procedure test (e.g. single-wire or multiple-wire system).

The approval given for the flux is restricted to the make and classification according to EN 760 used for the procedure welding test.

8.5.3 *Processes 131, 135 and 136*

The approval given to the face and/or back shielding gas is restricted to the type of gas (nominal composition) according to EN 439 used in the welding procedure test.

The approval given is restricted to the wire system used in the welding procedure test (e.g. single-wire or multiple-wire system).

8.5.4 *Process 141*

The approval given to the face and/or back shielding gas is restricted to the type of gas (nominal composition) according to EN 439 used in the welding procedure test.

A test made without back shielding gas covers welding back shielding gas.

8.5.5 *Face shielding gas flow rate*

For processes 131, 135, 136, and 141 the face shielding gas flow rate shall not change by more than 10 %.

8.6 Period of validity

The period of use of a WPAR is unlimited.

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 EN 288-2 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 the examiner or 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 C.

Annex A (normative)

Repairs

Before beginning production, the contractor shall qualify the weld repair procedure applicable to groups 2 and 3 steels according to CR 12187.

For a joint made in accordance with **6.3**, and which has been or is subsequently shown to be as satisfactory, in accordance with Table 1, the procedures shall include two types of repair:

— a full penetration repair;

— an internal repair if the pipe diameter allows it.

The groove for the repairs shall be made in the axis of the weld, and located according to Figures A.1 and A.2.

NOTE Rotation of the pipe is permissible to avoid overlap with the main weld procedure testing.

The testings shall be carried out in accordance with **7.3** and **7.4**.

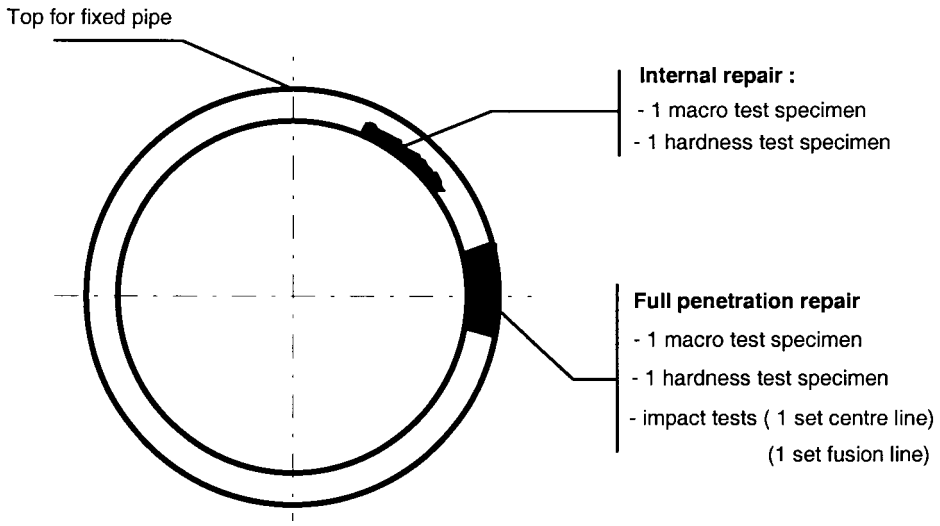


Figure A.1 — Location of type of repairs — Upwards welding

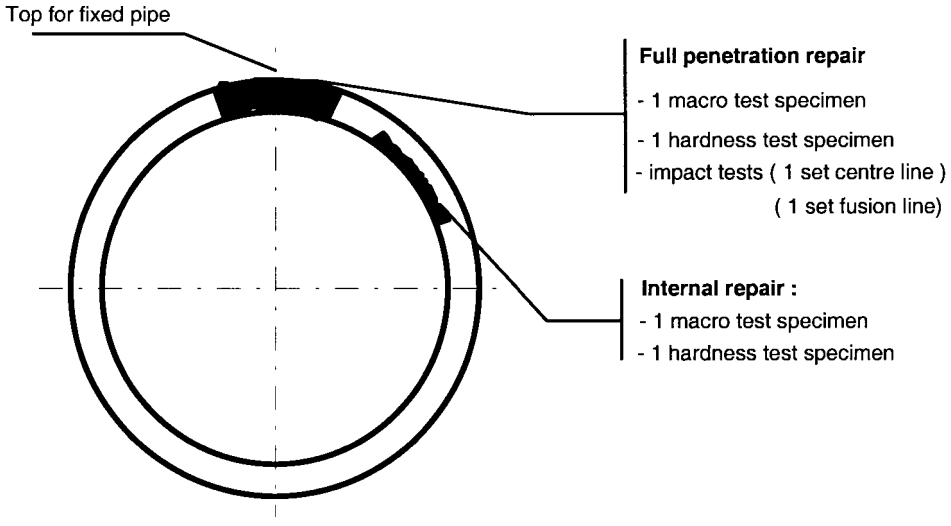


Figure A.2 — Location of type of repairs — Composite welding (root pass upwards, filling downwards)

Annex B (informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC member.

This European Standard falls under Directive 97/23.

NOTE (from CEN/CENELEC Internal Regulations Part 2:1994, **3.1.9**): Where standards fall under EU Directives, it is the view of the Commission of the European Communities (OJ No C 59, 9.3.1982) that the effect of the decision of the Court of Justice in case 815/79 Cremonini/Vrankovich (European Court Reports 1980, p. 3583) is that compliance with A-deviations is no longer mandatory and that the free movement of products complying with such a standard should not be restricted within the EU except under the safeguard procedure provided for the relevant Directive.

A-deviations in an EFTA country are **valid instead** of the relevant provisions of the European Standard in that country until they have been removed.

Clause A-deviation

SWEDEN

According to Ordinance AFS 1994:39 concerning “Pressure Vessels” issued by the National Swedish Board of Occupational Safety and Health, chapter 4, sections 6, 11 and 12, the clauses which cause the request of A-deviations are the following:

7.3.2 In Table 2, for linear misalignment (507), change the limits given by the following ones:

— maximum external misalignment permitted:

— for $t \leq 5$ mm : 0,5 t, max. 1 mm;
— for 5 mm < $t \leq 10$ mm : 0,2 t;
— for $t > 10$ mm : 0,1 t, max. 4 mm.

— maximum internal misalignment permitted:

— for $t \leq 5$ mm : 0,5 t, max. 1 mm;
— for $t > 5$ mm : 0,05(t-5) + 1, max. 2 mm.

Annex C (informative)
Welding procedure approval record form

Welding procedure approval — Test certificate (WPAR)

Manufacturer's welding procedure
Reference no.:
Manufacturer:
Address:
Code/testing standard:
Date of welding:

Examiner or examining body:
Reference no.:

Extent of approval

Welding process:
Joint type:
Parent metal(s)
Metal thickness (mm):
Outside diameter (mm):
Filler metal type:
Shielding gas/flux:
Type of welding current:
Welding positions:
Preheat:
Post-weld heat treatment and/or ageing:
Other information:
— Time lapse between start of root pass and start of hot pass:

Supply conditions:

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 no.:
Visual examination:
Magnetic particle examination*:

Examiner or examining body:
Reference no.:
Radiographic examination*:
Ultrasonic examination*:
Temperature:

Tensile tests

Type/no.	R_e N/mm^2	R_m N/mm^2	A % on	Z %	Fracture location	Remarks
Requirement						

Macro examination:

Impact test* Type: Size: Requirement:

Notch location/direction	Temperature °C	Values 1 2 3	Average	Remarks

Hardness tests* Location of measurements (Sketch*)

Type/load
Parent metal:
HAZ:
Weld metal:

Other tests:
Remarks:
Tests carried out in accordance with the requirements of:
Laboratory report reference no.:
Test results were acceptable/not acceptable (Delete as appropriate)
Test carried out in the presence of:

Name date and signature

Examiner or examining body

* If required.

Detail of weld test

Location:
Manufacturer's welding procedure
Reference no.:
WPAR no.:
Manufacturer:
Welder's name:
Welding process:
Joint type:
Weld preparation details (Sketch)*:

Examiner or examining body
Method of preparation and cleaning;
Parent material specification:

Material thickness (mm):
Outside diameter (mm):
Welding position:

Joint design	Welding sequences

Welding details

Run	Process	Size of filler metal	Current A	Voltage V	Type of current/ polarity	Wire feed	Run out length/ travel speed*	Heat input*

Filler metal designation and trade name:
Any special backing or drying:
Gas/flux: shielding:
backing:
Gas flow rate — shielding:
backing:
Tungsten electrode type/size:
Details of back gouging/backing:
Preheat temperature:
Interpass temperature:
Post-weld heat treatment and/or ageing:
Time, temperature, method:
Heating and cooling rates*:

Other information*:
e.g.: weaving (maximum width of run):
Oscillation: amplitude, frequency, dwell time:
Pulse welding details:
Stand off distance:
Torch angle:

Manufacturer

Name, date and signature

Examiner or examining body

Name, date and signature

* If required.

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