

Approval testing of welders for fusion welding

Part 1. Steels

The European Standard EN 287 : Part 1 : 1992, with the incorporation of its amendments A1 : 1997 and A2 : 1998, has the status of a British Standard

ICS 25.160.01

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee WEE/36, Approval testing of welding procedures and welders, upon which the following bodies were represented:

- Aluminium Federation
- Associated Offices Technical Committee
- Association of Consulting Scientists
- British Constructional Steelwork Association Ltd.
- British Gas plc
- British Nuclear Fuels plc
- British Railways Board
- British Steel Industry
- Electricity Industry in United Kingdom
- Engineering Equipment and Material Users' Association
- General, Municipal, Boilermakers' and Allied Trades Union
- Health and Safety Executive
- Lloyd's Register of Shipping
- Ministry of Defence
- Power Generation Contractors' Association (BEAMA Ltd.)
- Process Plant Association
- Railway Industry Association of Great Britain
- Stainless Steel Fabricators' Association of Great Britain
- United Kingdom Atomic Energy Authority
- The Welding Institute
- Welding Manufacturers' Association (BEAMA Ltd.)

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 August 1997

© BSI 1998

The following BSI references relate to the work on this standard:
Committee reference WEE/36
Draft for comment 89/70005 DC

ISBN 0 580 20325 5

Amendments issued since publication

Amd. No.	Date	Text affected
9665	August 1997	Indicated in the margin by a sideline
9804	January 1998	Indicated in the margin by a sideline
10009 Corr. No. 1	April 1998	Indicated in the margin by a sideline

National foreword

This British Standard has been prepared under the direction of the Welding Standards Policy Committee and is the English language version of EN 287 *Approval testing of welders — Fusion welding — Part 1 : Steels*, incorporating amendments A1 and A2, published by the European Committee for Standardization (CEN). It supersedes BS 4871 : Part 1 : 1982 which is withdrawn.

EN 287-1 was produced as a result of international discussions in which the UK took an active part.

Contract requirements

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

UDC: 621.791-057.2 : 377.127.6 : 669.14

Descriptors: Welding, fusion welding, steels, welders (personnel), approval, specifications, inspection, tests, acceptability, quality certificate

English version

Approval testing of welders — Fusion welding — Part 1: Steels

(includes amendment A1 : 1997)

Qualification des soudeurs — Soudage par
fusion — Partie 1: Aciers
(inclut l'amendement A1 : 1997)

Prüfung von Schweißern — Schmelzschweißen —
Teil 1: Stahl
(enthält Änderung A1 : 1997)

This European Standard was approved by CEN on 1992-02-21; amendment A1 was approved by CEN on 1997-01-11. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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

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

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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

Foreword

This standard has been prepared by Working Group 2 Approval requirements for welding and allied processes personnel of CEN/TC 121, Welding.

For this Standard, ISO/DIS 9606-1 *Approval testing of welders — Fusion welding — Part 1: Steels*, was considered and used as a basis. However, alterations were necessary due to the consideration of experience and updated knowledge.

In accordance with the Common CEN/CENELEC Rules, being part of the Internal Regulations of CEN, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Foreword of amendment A1

This amendment, EN 287-1 : 1992/A1 : 1997 to EN 287-1 : 1992, has been prepared by Technical Committee CEN/TC 121, Welding, the secretariat of which is held by DS.

This amendment to the European Standard EN 287-1 : 1992 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 1997, and conflicting national standards should be withdrawn at the latest by October 1997.

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

Contents

	Page
Foreword	2
Foreword of amendment A1	2
Introduction	3
1 Scope	3
2 Normative references	3
3 Definitions	4
4 Symbols and abbreviations	4
5 Essential variables for approval testing	5
6 Range of approval for the welder	9
7 Examination and testing	11
8 Acceptance requirements for test pieces	20
9 Re-tests	20
10 Period of validity	20
11 Certification	21
12 Designation	21
Annexes	
A (normative) Comparison of steel groups	22
B (informative) Welder approval test certificate	23
C (informative) Manufacturer's welding procedure specification (WPS)	24
D (informative) Job knowledge	25

Introduction

This standard covers the principles to be observed in the approval testing of welder performance for the fusion welding of steels.

The quality of work involved in welding depends on the skill of the welder to a high degree.

The ability of the 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 applies to processes where the skill of the welder has a significant influence on weld quality.

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

The test weld may be used to approve a welding procedure and a welder provided that all the relevant requirements, e.g. test piece dimensions, are satisfied (see EN 288-3).

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

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

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

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

1 Scope

This standard specifies essential requirements, ranges of approval, test conditions, acceptance requirements and certification for the approval testing of welder performance for the welding of steels. The recommended format for the certificate of approval testing is given in annex B.

During the approval test the 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 D.

This standard is applicable when the welder's approval testing is required by the purchaser, by inspection authorities or by other organizations.

This standard applies to the approval testing of welders for the fusion welding of steels.

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

This standard covers approval testing of welders for work on semi-finished and finished products made from wrought, forged or cast material types listed in 5.4.

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.

EN 288-2	<i>Specification and approval of welding procedures for metallic materials — Part 2: Welding procedure specification for arc welding</i>
EN 288-3	<i>Specification and approval of welding procedures for metallic materials — Part 3: Welding procedure tests for the arc welding of steels</i>
prEN 499	<i>Classification of covered electrodes for manual metal arc welding of carbon steels, carbon-manganese steels and micro alloyed steels</i>
EN 571-1	<i>Non-destructive testing — Penetrant inspection — Part 1: General principles for the examination</i>
EN 910	<i>Destructive tests on welds in metallic materials — Bend tests</i>

prEN 1290	<i>Non-destructive examination of welds — Magnetic particles testing of welds — Method</i>
EN 1320	<i>Destructive tests on welds in metallic materials — Fracture tests</i>
EN 1321	<i>Destructive examination of welds in metallic materials — Macroscopic and microscopic examination of welds</i>
prEN 1435	<i>Non-destructive examination of welds — Radiographic examination of welded joints</i>
EN 25817	<i>Arc-welded joints in steel — Fusion welding — Guidance on quality levels for imperfections</i>
EN 26520	<i>Classification of imperfections in metallic fusion welds, with explanations</i>
ISO 857 : 1990	<i>Welding, brazing and soldering processes — Vocabulary</i>
ISO 3452 : 1984	<i>Non-destructive testing — Penetrant inspection — General principles</i>
ISO 3580 : 1975	<i>Covered electrodes for manual arc welding of creep-resisting steels — Code of symbols for identification</i>
ISO 3581 : 1976	<i>Covered electrodes for manual arc welding of stainless and other similar high alloy steels — Code of symbols for identification</i>
ISO 4063 : 1990	<i>Welding, brazing, soldering and braze welding of metals — Nomenclature of processes and reference numbers for symbolic representation on drawings</i>
ISO 6947 : 1990	<i>Welds — Working positions — Definitions of angles of slope and rotation</i>

3 Definitions

3.1 welder

A welder who holds and manipulates the electrode holder, welding gun, torch or blowpipe by hand.

3.2 welding operator

A welder who operates welding equipment with partly mechanized relative movement between the electrode holder, welding gun, torch or blowpipe and the workpiece.

3.3 examiner or examining body

A person or organization who verifies compliance with the applicable standard. The examiner/examining body shall be acceptable to any contracting party.

3.4 welding procedure specification (WPS)

A document providing in detail the required variables for a specific application to assure repeatability.

3.5 range of approval

The extent of approval for an essential variable.

3.6 test piece

The welded assembly which is used in the approval test.

3.7 test specimen

The part or portion cut from the test piece in order to perform a specified destructive test.

3.8 test

A series of operations which will include the making of a welded test piece and subsequent non-destructive and/or destructive testing and reporting of results.

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 B).

4.2 Test piece

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

4.3 Consumable (including auxiliaries, e.g. shielding gas, flux)

nm	no filler metal
wm	with filler metal
A	acid covering
B	basic covering
C	cellulosic covering
R	rutile covering
RA	rutile-acid covering
RB	rutile-basic covering
RC	rutile-cellulosic covering
RR	rutile thick covering
S	other types

4.4 Miscellaneous

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

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

The welder's 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 and reference numbers of welding processes for symbolic representation are listed in ISO 4063.

This standard covers the following welding processes:

- 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;
- 137 — flux-cored wire metal-arc welding with inert gas shield;
- 141 — tungsten inert gas arc welding (TIG welding);
- 15 — plasma arc welding;
- 311 — oxy-acetylene welding;
- other fusion welding processes by agreement.

5.3 Joint types (butt and fillet welds)

Test pieces shall be produced for butt weld (BW) and fillet weld (FW) in plates (P) or pipes¹⁾ (T) for approval tests in accordance with 7.2.

5.4 Material groups**5.4.1 General**

In order to minimize unnecessary multiplication of technically identical tests, steels with similar metallurgical and welding characteristics are grouped for the purpose of a welder's approval (see 5.4.2).

In general, a 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).

The welding of any one material in a group confers approval on the welder for the welding of all other materials within the same group.

When welding parent metals from two different groups which do not give approval to each other according to tables 4 and 5 (see 6.4) an approval for the combination as a separate group is required.

When the filler metal is dissimilar to the parent metal group, an approval for that combination of parent metal group and filler metal is needed, except when permitted by tables 4 and 5.

5.4.2 Steel groups of parent metal**5.4.2.1 General**

For the comparison of steel groups for the approval of welders and welding procedure testing according to EN 288-3, see annex A.

5.4.2.2 Group W 01

Low-carbon unalloyed (carbon-manganese) steels and/or low alloyed steels.

This group also includes fine-grained structural steel with a yield strength, $R_{eH} \leq 360 \text{ N/mm}^2$.

5.4.2.3 Group W 02

Chromium-molybdenum (CrMo) and/or chromium-molybdenum-vanadium (CrMoV) creep-resisting steels.

5.4.2.4 Group W 03

Fine-grained structural steels normalized, quenched and tempered as well as thermomechanically treated steels with a yield strength, $R_{eH} > 360 \text{ N/mm}^2$ as well as similarly weldable nickel steels, with a nickel content of 2 % to 5 %.

5.4.2.5 Group W 04

Ferritic or martensitic stainless steels, with a chromium content of 12 % to 20 %.

5.4.2.6 Group W 11

Stainless ferritic-austenitic and austenitic stainless chromium-nickel (CrNi) steels.

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 welder's test has been carried out using a filler metal, shielding gas or flux suitable for that material group, this test will confer approval on the welder to use any other similar consumables (filler metal, shielding gas or flux) for the same material group.

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

5.5.2 Metal-arc welding with covered electrodes

Covered electrode groups are classified with respect to the most important characteristics according to prEN 499 as follows:

- A acid covering;
- B basic covering;
- C cellulosic covering;
- R rutile covering;
- RA rutile-acid covering;
- RB rutile-basic covering;
- RC rutile-cellulosic covering;
- RR rutile thick covering;
- S others.

NOTE. For further details on covered electrodes reference should be made to prEN 499, ISO 3580 or ISO 3581 according to the steel in question.

5.6 Dimensions

The welder approval test should be based on the thickness of the material (i.e. plate thickness or wall thickness of pipe) and pipe diameters which the welder will use in production. A test is listed for each of the three ranges of plate thickness and pipe wall thickness or pipe diameter as specified in tables 1 and 2.

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

Table 1. Test piece (plate or pipe) and range of approval	
Test piece thickness t mm	Range of approval
t ≤ 3	t to 2t ¹⁾
3 < t ≤ 12	3 mm to 2t ²⁾
t > 12	≥ 5 mm
¹⁾ For oxy-acetylene welding (311): t to 1,5 t.	
²⁾ For oxy-acetylene welding (311): 3 mm to 1,5 t.	

Table 2. Test piece diameter and range of approval	
Test piece diameter D ¹⁾ mm	Range of approval
D ≤ 25	D to 2D
25 < D ≤ 150	0,5D to 2D (25 mm min.)
D > 150	≥ 0,5D
¹⁾ For structural hollow sections 'D' is the dimension of the smallest side.	

5.7 Welding positions

For the purpose of this standard the welding positions identified in figures 1 and 2 shall apply (according to ISO 6947). Angles of slope and rotation for straight welds in the welding positions shall be in accordance with ISO 6947.

The positions and angles used in the approval test shall be based on the same tolerances as used in production.