

Specification and approval of welding procedures for metallic materials

Part 2. Welding procedure specification for arc welding

The European Standard EN 288 : Part 2 : 1992 has the status of a
British Standard

Descriptif et qualification d'un mode
opérateur de soudage sur les matériaux
métalliques
Partie 2. Descriptif d'un mode opératoire de
soudage pour la soudage à l'arc

Anforderung und Anerkennung von
Schweißverfahren für metallische Werkstoffe
Teil 2. Schweißanweisung für das
Lichtbogenschweißen

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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 288 'Specification and approval of welding procedures for metallic materials — Part 2 : Welding procedure specification for arc welding', published by the European Committee for Standardization (CEN).

EN 288-2 was produced as a result of international discussion in which the UK took an active part.

National appendix NA gives the constitution of the committee responsible for UK participation in the preparation of this standard.

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

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Ref. No. EN 288-2 : 1992 E

Foreword

This standard has been prepared by Working Group 1 Specification and approval of welding procedures for metallic materials of CEN/TC 121 Welding.

For this standard, ISO/TC 44/SC10 N 176 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, 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.

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1 Scope

This standard specifies requirements for the content of welding procedure specifications for arc welding processes. The principles of this standard may be also applied to other fusion welding processes subject to agreement between the contracting parties.

Variables listed in this standard are those influencing the metallurgy, mechanical properties and the geometry of the assembly.

2 Normative references

This 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 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 26848, Tungsten electrodes for inert gas shielded arc welding, and for plasma cutting and welding – Codification
ISO 4063:1990, Welding brazing, soldering and braze welding of metals – Nomenclature of processes and reference numbers for symbolic representation on drawings
ISO 6947:1990, Welds – Working positions – Definitions of angles of slope and rotation.

3 Definitions

For the purpose of this standard, the definitions listed in part 1 of this standard apply.

4 Technical contents of welding procedure specification (WPS)

4.1 General

The Welding Procedure Specification (WPS) shall give details of how a welding operation is to be performed and shall contain all relevant information about the welding work.

Welding procedure specifications may cover a certain range of thickness of the joined parts and may also cover a range of parent metals and even filler metals. Some manufacturers may prefer additionally to prepare work instructions for each specific job as part of detailed production planning.

Information listed in 4.2 to 4.5 is adequate for most welding procedures. For some applications it may be necessary to supplement or reduce the list. The relevant information shall be specified in the WPS.

Ranges and tolerances, according to the manufacturer's experience, shall be specified where appropriate.

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

4.2 Related to the manufacturer

4.2.1 Identification of the manufacturer

4.2.2 Identification of the WPS

4.2.3 Reference to the Welding Procedure Approval Record (WPAR) or other documents as required

4.3 Related to the parent metal

4.3.1 Parent metal type:

- Identification of material, preferably by reference to an appropriate standard.
- A WPS may cover a group of materials.

4.3.2 Material dimensions:

- The thickness ranges of the joint.
- Outside diameter ranges for pipes.

4.4 Common to all welding procedures

4.4.1 Welding process:

- Welding process(es) used shall be designated in accordance with standard ISO 4063.

4.4.2 Joint design:

- Sketch of the joint design showing configuration and dimensions.

Details may be given by reference to an appropriate standard on joint design.

- Weld run sequence shall be given on the sketch if essential for the properties of the weld.

4.4.3 Welding position:

- Applicable welding positions shall be specified in accordance with standard ISO 6947.

4.4.4 Groove or edge preparation:

- Groove cleaning, degreasing, jiggling and tack welding.
- The methods to be used.

4.4.5 Welding technique:

- No weaving
- Weaving:
 - a) For manual welding max width of the run.
 - b) For mechanized welding max weaving or amplitude, frequency and dwell time of oscillation.
- Torch, electrode and/or wire angle.

4.4.6 Back gouging:

- The method to be used.

4.4.7 Backing:

- The method and type of backing, material and dimensions.
- For gas backing apply 4.5.3 to 4.5.5.

4.4.8 Filler metal, designation:

- Classification, manufacturer and trade name.

4.4.9 Filler metal, dimensions:

- Diameter of electrode/wire or width and thickness of strip electrode.

4.4.10 Filler metal and flux, handling:

- If a filler metal or flux is to be dried or treated before use, this shall be specified. Reference to an appropriate standard is permitted.

4.4.11 Electrical parameters:

- Type of current (AC or DC) and polarity.
- Pulse welding: Pulse time, pulse current, pulse frequency, background current and background voltage to be specified.
- Current range.
- Arc voltage range.

4.4.12 Mechanized welding:

- Travel speed range.
- Wire feed speed range.

NOTE: applied to 4.4.11 and 4.4.12 – If the equipment does not permit control of one of those variables, the machine settings shall be specified instead. The range of application for the WPS shall then be limited to equipment of that particular type.

4.4.13 Preheat temperature:

- If preheating is not required, the lowest permitted ambient temperature in workshop or on site.

4.4.14 Interpass temperature:

- Maximum interpass temperature.

4.4.15 Post-weld heat-treatment:

- For any post-weld heat-treatment, or ageing, the procedure or reference to be made to a separate post-weld heat-treatment or ageing specification.

4.5 Specific to a group of welding processes**4.5.1 Process group 11 (Metal-arc welding without gas protection):**

- For process 111 the run-out per unit length of electrode consumed.

4.5.2 Process group 12 (Submerged arc welding):

- For multiple electrode systems the number and configuration of wire electrodes and electrical connections.
- Stand off distance: The distance from contact tip nozzle to the surface of the workpiece for mechanized welding.
- Flux, designation: Classification, manufacturer and trade name.
- Additional filler metal.

4.5.3 Process group 13 (Gas-shielded metal arc welding)

- Shielding gas and flow rate, nozzle diameter.
- Number of wire electrodes.
- Wire feed speed.
- Additional filler metal.
- Stand off distance: The distance from contact tip nozzle to the surface of the workpiece for mechanized welding.

4.5.4 Process group 14 (Gas-shielded welding with non-consumable electrode)

- For tungsten electrode, the diameter, and codification in accordance with EN 26848.
- Shielding gas and flow rate, nozzle diameter.

4.5.5 Process group 15 (Plasma arc welding)

- Plasma gas parameters, e.g. type, nozzle diameter, flow rate.
- Shielding gas parameter, e.g. type, nozzle diameter, flow rate.
- Type of torch.
- Plasma current.
- Stand off distance.

Annex A
(informative)**Manufacturer's welding procedure specification (WPS)**Location:
Manufacturer's Welding Procedure
Reference No.:
WPAR No.:

Examiner or test body:

Method of Preparation and Cleaning:
Parent Material Specification:Manufacturer:
Welder's Name:
Welding Process:
Joint Type:
Weld Preparation Details (Sketch)*: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 Speed	Travel Speed*	Heat input*

Filler Metal Classification and trade name:

Any Special Baking or Drying:

Gas/Flux: shielding:
backing:Gas Flow Rate - Shielding:
Backing:

Tungsten Electrode Type/Size:

Details of Back Gouging/Backing:

Preheat Temperature:

Interpass Temperature:

Other information*:

e.g. weaving (maximum width of run):

Oscillation: amplitude, frequency, dwell time:

Pulse welding details:

Stand off distance:

Plasma welding details:

Torch angle:

Post-Weld Heat Treatment and/or Ageing:

Time, Temperature, Method:

Heating and Cooling Rates*:

Manufacturer

Name, date and signature

Examiner or test body

Name, date and signature

* If required

National appendix NA (informative)

The United Kingdom participation in the preparation of this European Standard was entrusted by the Welding Standards Policy Committee (WEE/-) to Technical Committee WEE/36, upon which the following bodies were represented:

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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 Materials 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.)

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