BRITISH STANDARD

BS EN
1668 : 1997

# Welding consumables — Rods, wires and deposits for tungsten inert gas welding of non alloy and fine grain steels — Classification

The European Standard EN 1668 : 1997 has the status of a British Standard

ICS 25.160.20

# National foreword

This British Standard is the English language version of EN 1668 : 1997. It partially supersedes BS 2901 : Part 1 : 1983, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/39, Welding consumables, 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.

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**Summary of pages**

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 6, an inside back cover and a back cover.

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 December 1997



ISBN 0 580 28921 4

**Amendments issued since publication**

| Amd. No. | Date | Text affected |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

# EN 1668

August 1997

ICS 25.160.20

Descriptors: Welding, arc welding, filler wire, filler metal, steels, unalloyed steels, characteristics, chemical composition, mechanical properties, classifications

English version

# Welding consumables — Rods, wires and deposits for tungsten inert gas welding of non alloy and fine grain steels — Classification

Produits consommables pour le soudage — Baguettes, fils d'apport et dépôts pour le soudage sous atmosphère inerte avec électrode réfractaire des aciers non alliés et des aciers à grains fins — Classification

Schweißzusätze — Stäbe, Drähte und Schweißgut zum Wolfram-Schutzgasschweißen von unlegierten Stählen und Feinkornstählen — Einteilung

This European Standard was approved by CEN on 1997-07-24. 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.

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**CEN**

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

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



Ref. No. EN 1668 : 1997 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 February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

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

This standard proposes a classification in order to designate rods and wires in terms of the yield strength, tensile strength and elongation of the all-weld metal. The ratio of yield to tensile strength of weld metal is generally higher than that of parent metal. Users should note that matching weld metal yield strength to parent metal yield strength will not necessarily ensure that the weld metal tensile strength matches that of the parent material. Where the application requires matching tensile strength, therefore, selection of the consumable should be made by reference to column 3 of table 1.

It should be noted that the mechanical properties of all-weld metal test specimens used to classify the rods and wires will vary from those obtained in production joints because of differences in welding procedure such as diameter, width of weave, welding position and material composition.

## 1 Scope

This standard specifies requirements for classification of rods, wires and all-weld metal in the as-welded condition for tungsten inert gas welding of non alloy and fine grain steels with a minimum yield strength of up to 500 N/mm$^2$ in the as-welded condition.

## 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 439 | *Welding consumables — Shielding gases for arc welding and cutting* |
| EN 759 | *Welding consumables — Technical delivery conditions for welding filler metals — Type of product, dimensions, tolerances and marking* |
| EN 1597-1 | *Welding consumables — Test methods — Part 1: Test assembly for all-weld metal specimens in steel, nickel and nickel alloys* |
| EN ISO 13916 | *Welding — Guidance for the measurement of preheating temperature, interpass temperature and preheat maintenance temperature* (ISO 13916 : 1996) |
| ISO 31-0 : 1992 | *Quantities and units — Part 0: General principles* |

## 3 Classification

The classification includes all-weld metal properties obtained with a rod or wire and the shielding gas EN 439-I1. The classification is based on the rod/wire diameter 2,4 mm.

It shall be noted that only one shielding gas is used for classification purposes. The designation does therefore not give any symbol for shielding gas.

The classification is divided into four parts:

1) the first part gives a symbol indicating the product/process to be identified;

2) the second part gives a symbol indicating the strength and the elongation of all-weld metal;

3) the third part gives a symbol indicating the impact properties of all-weld metal;

4) the fourth part gives a symbol indicating the chemical composition of rods or wires.

## 4 Symbols and requirements

### 4.1 Symbol for the product/process

The symbol for a rod/wire for the tungsten inert gas welding process and/or the resulting weld deposit shall be the letter W.

### 4.2 Symbol for strength and elongation of all-weld metal

The symbol in table 1 indicates yield strength, tensile strength and elongation of the all-weld metal in the as-welded condition in accordance with clause **5**.

**Table 1. Symbol for strength and elongation of all-weld metal**

| Symbol | Minimum[1] yield strength $R_{eL}$ N/mm$^2$ | Tensile strength $R_m$ N/mm$^2$ | Minimum elongation[2] $A$ % |
|---|---|---|---|
| 35 | 355 | 440 to 570 | 22 |
| 38 | 380 | 470 to 600 | 20 |
| 42 | 420 | 500 to 640 | 20 |
| 46 | 460 | 530 to 680 | 20 |
| 50 | 500 | 560 to 720 | 18 |

[1] For yield strength the lower yield ($R_{eL}$) shall be used when yielding occurs, otherwise the 0,2 % proof strength ($R_{po,2}$) shall be used.

[2] Gauge length is equal to five times the test specimen diameter.

### 4.3 Symbol for impact properties of all-weld metal

The symbol in table 2 indicates the temperature at which an average impact energy of 47 J is achieved under conditions given in clause **5**. Three specimens shall be tested. Only one individual value may be lower than 47 J but not lower than 32 J. When an all-weld metal has been classified for a certain temperature, it automatically covers any higher temperature in table 2.

**Table 2. Symbol for impact properties**

| Symbol | Temperature for minimum average impact energy of 47 J<br>°C |
|---|---|
| Z | No requirements |
| A | + 20 |
| 0 | 0 |
| 2 | − 20 |
| 3 | − 30 |
| 4 | − 40 |
| 5 | − 50 |
| 6 | − 60 |

### 4.4 Symbol for the chemical composition of rods/wires

The symbol in table 3 indicates the chemical composition of the rod/wire and includes an indication of characteristic alloying elements.

## 5 Mechanical tests

### 5.1 General

Tensile and impact tests and any required retests shall be carried out in the as-welded condition using an all-weld metal test assembly type 3 prepared in accordance with EN 1597-1 using 2,4 mm rods/wires and welding conditions as described in **5.2** and **5.3**.

### 5.2 Preheating and interpass temperatures

Preheating is not required, welding can start from room temperature.

The interpass temperature shall be measured using temperature indicator crayons, surface thermometers or thermocouples, see EN ISO 13916.

The interpass temperature shall not exceed 250 °C. If, after any pass, this interpass temperature is exceeded, the test assembly shall be cooled in air to a temperature below that limit.

### 5.3 Welding conditions

The welding conditions and details of test assembly in table 4 shall be used.

The direction of welding to complete a layer consisting of two passes shall not vary, but the direction of welding of layers shall be alternated.

**Table 3. Symbol for chemical composition of rods/wires**

| Symbol | Chemical composition % (m/m) [1) 2) 3)] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | C | Si | Mn | P | S | Mo | Ni | Al | Ti + Zr |
| W0 | Any agreed analysis not specified in this standard | | | | | | | | |
| W2Si | 0,06 to 0,14 | 0,50 to 0,80 | 0,90 to 1,30 | 0,025 | 0,025 | — | — | — | — |
| W3Si1 | 0,06 to 0,14 | 0,70 to 1,00 | 1,30 to 1,60 | 0,025 | 0,025 | — | — | — | — |
| W4Si1 | 0,06 to 0,14 | 0,80 to 1,20 | 1,60 to 1,90 | 0,025 | 0,025 | — | — | — | — |
| W2Ti | 0,04 to 0,14 | 0,40 to 0,80 | 0,90 to 1,40 | 0,025 | 0,025 | — | — | 0,05 to 0,20 | 0,05 to 0,25 |
| W3Ni1 | 0,06 to 0,14 | 0,50 to 0,90 | 1,00 to 1,60 | 0,020 | 0,020 | — | 0,80 to 1,50 | — | — |
| W2Ni2 | 0,06 to 0,14 | 0,40 to 0,80 | 0,80 to 1,40 | 0,020 | 0,020 | — | 2,10 to 2,70 | — | — |
| W2Mo | 0,08 to 0,12 | 0,30 to 0,70 | 0,90 to 1,30 | 0,020 | 0,020 | 0,40 to 0,60 | — | — | — |

1) Finished product chemical composition. If not specified: Mo < 0,15 %, Ni < 0,15 %, Cr < 0,15 %, V < 0,03 %, Al < 0,02 %, Ti + Zr < 0,15 %, Cu < 0,35 % (residual in steel plus any coating).

2) Single values shown in the table are maximum values.

3) The results shall be rounded to the same number of significant figures as in the specified value using the rule A in accordance with annex B of ISO 31-0 : 1992.

| **Table 4. Welding conditions** | |
|---|---|
| **Conditions** | **Parameters** |
| Rod/wire diameter mm | 2,4 |
| Length of weld deposit mm | min. 200 |
| Type of current[1)] | d.c. |
| Welding current A | 240 ± 20 |
| Welding speed mm/min | 140 ± 20 |
| Interpass temperature range °C (no preheat) | ≤ 250 |
| [1)] d.c. means direct current. Electrode negative. | |

## 6 Chemical analysis

Chemical analysis is performed on specimens of the rod/wire. Any analytical technique can be used, but in case of dispute reference shall be made to established published methods.

NOTE. See annex A.

## 7 Technical delivery conditions

Technical delivery conditions shall meet the requirements in EN 759.

## 8 Designation

The designation of the rod or wire shall follow the principles given in the example below:

*Example:*

A weld deposit produced by tungsten inert gas welding (W) having a minimum yield strength of 460 N/mm$^2$ (46) and a minimum average impact energy of 47 J at − 30 °C (3) produced under argon shield, EN 439-I1, using the rod W3Si1 is designated:

Rod EN 1668 − W 46 3 W3Si1

A rod complying with the chemical requirement of W3Si1 in table 3 is designated:

Rod EN 1668 − W3Si1

where:

| | | |
|---|---|---|
| EN 1668 | = | standard number; |
| W | = | rod/wire and or deposit/tungsten inert gas welding (see **4.1**); |
| 46 | = | strength and elongation (see table 1); |
| 3 | = | impact properties (see table 2); |
| W3Si1 | = | chemical composition of rod/wire (see table 3). |

## Annex A (informative)
## Bibliography

**A.1** Handbuch für das Eisenhüttenlaboratorium, VdEh, Düsseldorf

**A.2** BS 6200-3 *Sampling of iron, steel and other ferrous metals — Part 3 : Methods of analysis*

**A.3** CR 10261 ECISS Information Circular 11 — Iron and Steel — *Review of available methods of chemical analysis*

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