British Standard

BRITISH STANDARD

BS EN
12534:1999

Welding consumables — Wire electrodes, wires, rods and deposits for gas shielded metal arc welding of high strength steels — Classification

The European Standard EN 12534:1999 has the status of a British Standard

ICS 25.160.20

National foreword

This British Standard is the English language version of EN 12534:1999.

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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Welding consumables - Wire electrodes, wires, rods and deposits for gas shielded metal arc welding of high strength steels - Classification

Produits consommables pour le soudage - Fils-électrodes, fils, baguettes et dépôts en soudage à l'arc sous protection gazeuse des aciers à haute résistance - Classification

Schweißzusätze - Drahtelektroden,Drähte, Stäbe und Schweißgut zum Schutzgasschweißen von hochfesten Stählen - Einteilung

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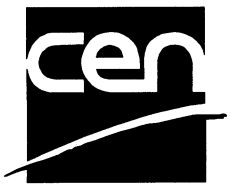

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Foreword

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

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of an identical text or by endorsement, at the latest by February 2000, and conflicting national standards shall be withdrawn at the latest by February 2000.

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.

Introduction

This standard proposes a classification in order to designate wire electrodes, wires and rods in terms of their chemistry and, where required, 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, selection of the consumable should be based on column 3 of Table 1. When selecting the consumables, it should be noted that with increasing thickness of the parent metal, the requirements of tensile strength and proof strength can decrease.

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

1 Scope

This standard specifies requirements for classification of wire electrodes, wires, rods and weld deposits in the as-welded or stress relieved condition for gas shielded metal arc welding and gas tungsten arc welding of steels with a minimum yield strength higher than 500 N/mm². The classification of the wire electrodes, wires and rods is based on their chemical composition.

The classification of a weld deposit is based on tests of the all-weld metal in the as-welded or stress relieved condition. One wire electrode, wire and rod can be tested and classified with different gases.

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 ISO 13916	Welding - Guidance on the measurement of preheating temperature, interpass temperature and preheat maintenance temperature (ISO 13916:1996)
EN 1597-1	Welding consumables - Test methods for classification - Part 1: Test piece for all-weld metal test specimens in steel, nickel and nickel alloys
ISO 31-0:1992	Quantities and units - Part 0: General principles

3 Classification

A wire electrode, wire and rod shall be classified according to its chemical composition in Table 3. A weld deposit shall be classified with additional symbols according to the mechanical properties of its all-weld metal.

The classification of a weld deposit is divided into six 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 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 type of shielding gas used.

5) The fifth part gives a symbol indicating the chemical composition of the wire electrode used.

6) The sixth part gives a symbol indicating the stress relief treatment in case this is applied.

4 Symbols and requirements

4.1 Symbol for the product/process

The symbol for the wire electrode, wire or rod used in the arc welding process shall be the letter G (gas shielded metal arc welding) and/or W (gas tungsten arc welding).

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 determined in accordance with clause **5**.

NOTE: Stress relief treatment can alter the strength of the weld metal from that obtained in the as-welded condition.

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

Symbol	Minimum[1)] yield strength N/mm^2	Tensile strength N/mm^2	Minimum elongation[2)] %
55	550	640 to 820	18
62	620	700 to 890	18
69	690	770 to 940	17
79	790	880 to 1080	16
89	890	940 to 1180	15

[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 shall not be 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 of all-weld metal

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

NOTE: Stress relief treatment can alter the impact properties of the all-weld metal from that obtained in the as-welded condition.

4.4 Symbol for shielding gas

The symbols M and C indicate shielding gas as described in accordance with EN 439. No symbol shall be used for TIG welding when argon shield EN 439-I1 is used.

The symbol M, for mixed gases, shall be used when the classification has been performed with the shielding gas EN 439 – M2, but without helium.

The symbol C shall be used when the classification has been performed with the shielding gas EN 439 – C1, carbon dioxide.

4.5 Symbol for the chemical composition of wire electrodes, wires and rods

The symbol in Table 3 indicates the chemical composition of the wire electrode, wire and rod and includes an indication of characteristic alloying elements.

Table 3: Symbol for chemical composition of wire electrodes, wires and rods

Symbol	Chemical composition in % [1) 2) 3)]									
	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	Total other elements
Z	Any other agreed composition									
Mn3NiCrMo	0,14	0,60 to 0,80	1,30 to 1,80	0,015	0,018	0,40 to 0,65	0,50 to 0,65	0,15 to 0,30	0,30	0,25
Mn3Ni1CrMo	0,12	0,40 to 0,70	1,30 to 1,80	0,015	0,018	0,20 to 0,40	1,20 to 1,60	0,20 to 0,30	0,35	0,25 V = 0,05 to 0,13
Mn3Ni1Mo	0,12	0,40 to 0,80	1,30 to 1,90	0,015	0,018	0,15	0,80 to 1,30	0,25 to 0,65	0,30	0,25
Mn3Ni1,5Mo	0,08	0,20 to 0,60	1,30 to 1,80	0,015	0,018	0,15	1,40 to 2,10	0,25 to 0,55	0,30	0,25
Mn3Ni1Cu	0,12	0,20 to 0,60	1,20 to 1,80	0,015	0,018	0,15	0,80 to 1,25	0,20	0,30 to 0,65	0,25
Mn3Ni1MoCu	0,12	0,20 to 0,60	1,20 to 1,80	0,015	0,018	0,15	0,80 to 1,25	0,20 to 0,55	0,30 to 0,65	0,25
Mn3Ni2,5CrMo	0,12	0,40 to 0,70	1,30 to 1,80	0,015	0,018	0,20 to 0,60	2,30 to 2,80	0,30 to 0,65	0,30	0,25
Mn4Ni1Mo	0,12	0,50 to 0,80	1,60 to 2,10	0,015	0,018	0,15	0,80 to 1,25	0,20 to 0,55	0,30	0,25
Mn4Ni2Mo	0,12	0,25 to 0,60	1,60 to 2,10	0,015	0,018	0,15	2,00 to 2,60	0,30 to 0,65	0,30	0,25
Mn4Ni1,5CrMo	0,12	0,50 to 0,80	1,60 to 2,10	0,015	0,018	0,15 to 0,40	1,30 to 1,90	0,30 to 0,65	0,30	0,25
Mn4Ni2CrMo	0,12	0,60 to 0,90	1,60 to 2,10	0,015	0,018	0,20 to 0,45	1,80 to 2,30	0,45 to 0,70	0,30	0,25
Mn4Ni2,5CrMo	0,13	0,50 to 0,80	1,60 to 2,10	0,015	0,018	0,20 to 0,60	2,30 to 2,80	0,30 to 0,65	0,30	0,25

[1)] If not specified: Ti ≤ 0,10%, Zr ≤ 0,10%, Al ≤ 0,12%, and V ≤ 0,03%. Residual copper content in the steel including any coating shall comply with stated value.
[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 rules in accordance with annex **B**, Rule A of ISO 31-0:1992.

4.6 Symbol for stress relief treatment

The letter T indicates that strength, elongation and impact properties in the classification of deposited metal are obtained after a stress relief treatment at 560 ºC to 600 ºC for 1 h. The test piece shall be left in the furnace for cooling down to 300 ºC.

5 Mechanical tests

Tensile and impact tests and any required retests shall be carried out in the as-welded condition or stress relieved condition using an all-weld metal test assembly prepared in accordance with EN 1597-1, as described below in **5.1** and **5.2**.

5.1 Preheating and interpass temperatures

Welding of the all-weld metal test piece shall be executed in a temperature range from 120 ºC to 180 ºC with the exception of the first layer in the test assembly, which may be welded without preheat.

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

5.2 Welding conditions and pass sequence

The pass sequence shall be as indicated in table 4 and welding conditions as given in Table 5.

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 4: Pass sequence

Process	Type of test assembly EN 1597-1	Diameter mm	Passes per layer	Number of layers
G	3	1,2	2 [1)]	6 to 10
W	1	2,4	2 [2)]	8 to 11

[1)] The top layer can be completed with three passes.
[2)] The top layer can be completed with three or four passes.

Table 5: Welding conditions

Process	Diameter mm	Welding current A	Welding voltage V	Contact tube distance mm	Travel speed mm/min
G	1,2	280 ± 10	[1)]	20 ± 3	450 ± 50
W	2,4	200 ± 20	[2)]	-	150 ± 15

[1)] The welding voltage will depend on the choice of shielding gas.
[2)] It is not possible to set the voltage on a TIG equipment.

6 Chemical analysis

Chemical analysis is performed on specimens of the product. 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 wire electrodes, wires and rods shall follow the principle given in the examples below:

EXAMPLE 1:

A wire electrode producing a weld deposit by gas shielded metal arc welding (G) having a minimum yield strength of 620 N/mm² (62) and a minimum average impact energy of 47 J at - 60°C (6) under mixed gas (M) using the wire Mn4Ni1Mo in the as-welded condition is designated:

Wire electrode EN 12534 - G 62 6 M Mn4Ni1Mo

where:

EN 12534	is the standard number;
G	is the wire electrode and/or deposit/gas shielded metal arc welding (see **4.1**);
62	are the strength and elongation (see Table 1);
6	are the impact properties (see Table 2);
M	is the shielding gas (see **4.4**);
Mn4Ni1Mo	is the chemical composition of the wire electrode (see Table 3).

EXAMPLE 2:

A rod producing a weld deposit by TIG welding (W) having a minimum yield strength of 550 N/mm² (55) and a minimum average impact energy of 47 J at - 60°C (6) under argon shield EN 439-I1 using the rod Mn4Ni1Mo in the stress relieved condition (T) is designated:

Rod EN 12534 - W 55 6 Mn4Ni1Mo T

EXAMPLE 3:

A rod complying with the chemical requirement of Mn4Ni1Mo in Table 3 is designated:

Rod EN 12534 - W Mn4Ni1Mo

Annex A (informative)

Bibliography

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