BRITISH STANDARD

BS EN
12072:2000

Welding consumables — Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels — Classification

The European Standard EN 12072:1999 has the status of a British Standard

ICS 25.160.20

National foreword

This British Standard is the English language version of EN 12072:1999. It supersedes BS 2901-2:1990 and (together with BS EN 760:1996) BS 5465:1987 which are withdrawn.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

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Welding consumables - Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels - Classification

Produits consommables pour le soudage - Fils-électrodes, fils d'apport et baguettes d'apport pour le soudage à l'arc des aciers inoxydables et des aciers résistant aux températures élevées - Classification

Schweißzusätze - Drahtelektroden, Drähte und Stäbe zum Lichtbogenschweißen von nichtrostenden und hitzebeständigen Stählen - Einteilung

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Contents **Page**

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of an identical text or by endorsement, at the latest by April 2000, and conflicting national standards shall be withdrawn at the latest by April 2000.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

For stainless steel welding consumables there is no unique relationship between the product form (wire electrode, wire or rod) and the welding process used (gas shielded metal arc welding, gas tungsten arc welding, plasma arc welding or submerged arc welding). For this reason the wire electrodes, wires or rods can be classified on the basis of any of the above product forms and can be used as appropriate, for more than one of the above processes.

1 Scope

This standard specifies requirements for classification of wire electrodes, wires and rods for gas shielded metal arc welding, gas tungsten arc welding, plasma arc welding and submerged arc welding of stainless and heat resisting steels. The classification of the wire electrodes, wires and rods is based on their chemical composition.

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 759	Welding consumables - Technical delivery conditions for welding filler metals - Type of product, dimensions, tolerances and marking.
ISO 31-0:1992	Quantities and units - Part 0: General principles

3 Classification

A wire electrode, wire or rod shall be classified in accordance with its chemical composition in Table 1. The classification is divided into two parts:

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

b) the second part gives a symbol indicating the chemical composition of the wire electrode, wire or rod.

4 Symbols and requirements

4.1 Symbol for the product/process

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

NOTE: One product form can be used for more than one welding process.

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

The symbol in Table 1 indicates the chemical composition of the wire electrode, wire or rod, determined under conditions given in clause **6**.

5 Properties of the all-weld metal

Properties of the all-weld metal are not part of the classification.

NOTE 1: The influence of the shielding gas or flux on the chemical composition of the all-weld metal is considered. Differences between the chemical composition of the all-weld metal and the wire electrode, wire or rod can occur.

NOTE 2: Proof and tensile strength of the weld metal made by a consumable listed in Table 1 is expected to comply with the minimum requirements in annex A. Elongation and impact properties of the weld metal can deviate from the minimum values specified for the corresponding parent metal as a result of variations in the microstructure.

6 Chemical analysis

Chemical analysis shall be performed on any suitable 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 Bibliography.

7 Technical delivery conditions

Technical delivery conditions shall meet the requirements given in EN 759.

Table 1: Symbol for the chemical composition of wire electrodes, wires and rods

Alloy symbols	Chemical composition in % (m/m)[1)2)3)4)]								
	C	Si	Mn	P[5)]	S[5)]	Cr	Ni	Mo	Other elements
Martensitic/ferritic									
13	0,15	1,0	1,0	0,03	0,02	12,0 to 15,0	-	-	-
13 L	0,05	1,0	1,0	0,03	0,02	12,0 to 15,0	-	-	-
13 4	0,05	1,0	1,0	0,03	0,02	11,0 to 14,0	3,0 to 5,0	0,4 to 1,0	-
17	0,12	1,0	1,0	0,03	0,02	16,0 to 19,0	-	-	-
Austenitic									
19 9 L[6)]	0,03	0,65	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	-	-
19 9 Nb[6)]	0,08	0,65	1,0 to 2,5	0,03	0,02	19,0 to 21,0	9,0 to 11,0	-	Nb[7)]
19 12 3 L[6)]	0,03	0,65	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	-
19 12 3 Nb[6)]	0,08	0,65	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,5 to 3,0	Nb[7)]
Austenitic-ferritic. High corrosion resistance									
22 9 3 N L[8)]	0,03	1,0	2,5	0,03	0,02	21,0 to 24,0	7,0 to 10,0	2,5 to 4,0	N 0,10 to 0,20
25 7 2 L	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	6,0 to 8,0	1,5 to 2,5	-
25 9 3 Cu N L[8)]	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	8,0 to 11,0	2,5 to 4,0	Cu 1,5 to 2,5;N 0,10 to 0,20
25 9 4 N L[8)]	0,03	1,0	2,5	0,03	0,02	24,0 to 27,0	8,0 to 10,5	2,5 to 4,5	N 0,20 to 0,30;Cu 1,5;W 1,0
Fully austenitic. High corrosion resistance									
18 15 3 L[9)]	0,03	1,0	1,0 to 4,0	0,03	0,02	17,0 to 20,0	13,0 to 16,0	2,5 to 4,0	-
18 16 5 N L[9)]	0,03	1,0	1,0 to 4,0	0,03	0,02	17,0 to 20,0	16,0 to 19,0	3,5 to 5,0	N 0,10 to 0,20
19 13 4 L[9)]	0,03	1,0	1,0 to 5,0	0,03	0,02	17,0 to 20,0	12,0 to 15,0	3,0 to 4,5	-
20 25 5 Cu L[9)]	0,03	1,0	1,0 to 5,0	0,03	0,02	19,0 to 22,0	24,0 to 27,0	4,0 to 6,0	Cu 1,0 to 2,0
20 16 3 Mn L[9)]	0,03	1,0	5,0 to 9,0	0,03	0,02	19,0 to 22,0	15,0 to 18,0	2,5 to 4,5	-
25 22 2 N L[9)]	0,03	1,0	3,5 to 6,5	0,03	0,02	24,0 to 27,0	21,0 to 24,0	1,5 to 3,0	N 0,10 to 0,20
27 31 4 Cu L[9)]	0,03	1,0	1,0 to 3,0	0,03	0,02	26,0 to 29,0	30,0 to 33,0	3,0 to 4,5	Cu 0,7 to 1,5
Special types									
18 8 Mn[9)]	0,20	1,2	5,0 to 8,0	0,03	0,03	17,0 to 20,0	7,0 to 10,0	-	-
20 10 3	0,12	1,0	1,0 to 2,5	0,03	0,02	18,0 to 21,0	8,0 to 12,0	1,5 to 3,5	-
23 12 L[6)]	0,03	0,65	1,0 to 2,5	0,03	0,02	22,0 to 25,0	11,0 to 14,0	-	-
23 12 Nb	0,08	1,0	1,0 to 2,5	0,03	0,02	22,0 to 25,0	11,0 to 14,0	-	Nb[7)]
23 12 2 L	0,03	1,0	1,0 to 2,5	0,03	0,02	21,0 to 25,0	11,0 to 15,5	2,0 to 3,5	-
29 9	0,15	1,0	1,0 to 2,5	0,03	0,02	28,0 to 32,0	8,0 to 12,0	-	-
Heat resisting types									
16 8 2	0,10	1,0	1,0 to 2,5	0,03	0,02	14,5 to 16,5	7,5 to 9,5	1,0 to 2,5	-
19 9 H	0,04 to 0,08	1,0	1,0 to 2,5	0,03	0,02	18,0 to 21,0	9,0 to 11,0	-	-
19 12 3 H	0,04 to 0,08	1,0	1,0 to 2,5	0,03	0,02	18,0 to 20,0	11,0 to 14,0	2,0 to 3,0	-
22 12 H	0,04 to 0,15	2,0	1,0 to 2,5	0,03	0,02	21,0 to 24,0	11,0 to 14,0	-	-
25 4	0,15	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	4,0 to 6,0	-	-
25 20[9)]	0,08 to 0,15	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	18,0 to 22,0	-	-
25 20 Mn	0,08 to 0,15	2,0	2,5 to 5,0	0,03	0,02	24,0 to 27,0	18,0 to 22,0	-	-
25 20 H[9)]	0,35 to 0,45	2,0	1,0 to 2,5	0,03	0,02	24,0 to 27,0	18,0 to 22,0	-	-
18 36 H[9)]	0,18 to 0,25	0,40 to 2,0	1,0 to 2,5	0,03	0,02	15,0 to 19,0	33,0 to 37,0	-	-

[1)] If not specified: Mo < 0,3 %, Cu < 0,3 % and Ni < 0,3 %.
[2)] Single values shown in the table are maximum values.
[3)] Wire electrodes not listed in the table shall be symbolized similarly and prefixed by the letter Z.
[4)] 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.
[5)] The sum of P and S may not exceed 0,050 %, except for 25 7 2 L, 18 16 N L, 20 16 3 Mn L, 18 8 Mn and 29 9.
[6)] Si shall be added to the alloy symbol in case Si > 0,65 to 1,2 %.
[7)] Nb min. 10 x % C, max. 1,0 %; up to 20 % of the amount of Nb can be replaced by Ta.
[8)] Wire electrodes under this symbol are usually selected for specific properties and may not be directly interchangeable.
[9)] The all-weld metal is in most of the cases fully austenitic and therefore can be susceptible to microfissuring or hot cracking. The occurrence of fissuring/cracking is reduced by increasing the weld metal manganese level and in recognition of this the manganese range is extended for a number of the grades.

8 Designation

The designation of wire electrodes, wires and rods shall follow the principle given in the examples below.

EXAMPLE 1:

A wire electrode for gas shielded metal arc welding, also applicable to submerged arc welding, with the chemical composition within the limits of the alloy symbol 20 10 3 of Table 1 is designated:

Wire electrode EN 12072 - G 20 10 3 and/or S 20 10 3.

EXAMPLE 2:

A rod for tungsten arc welding with the chemical composition within the limits of the alloy symbol 20 10 3 of Table 1 is designated:

Welding rod EN 12072 - W 20 10 3.

EXAMPLE 3:

A wire electrode for gas shielded metal arc welding with the chemical composition 19 12 3 L of Table 1 with silicon > 0,65 to 1,2 % is designated:

Wire electrode EN 12072 - G 19 12 3 L Si.

where:

EN 12072	= standard number;
G	= product/process symbol, G for gas shielded metal arc welding (see **4.1**);
19 12 3 L Si	= chemical composition of wire electrode (see Table 1).

Annex A (informative) Minimum tensile properties of all-weld metal

Table A.1: Minimum tensile properties of all-weld metal

Alloy symbol	Minimum proof strength $R_{p0.2}$ N/mm^2	Minimum tensile strength R_m N/mm^2	Minimum[1)] elongation A %	Post weld heat treatment
13	250	450	15	[2)]
13 L	250	450	15	[2)]
13 4	500	750	15	[3)]
17	300	450	15	[4)]
19 9 L	320	510	30	None
19 9 Nb	350	550	25	"
19 12 3 L	320	510	25	"
19 12 3 Nb	350	550	25	"
22 9 3 N L	450	550	20	None
25 7 2 L	500	700	15	"
25 9 3 Cu N L	550	620	18	"
25 9 4 N L	550	620	18	"
18 15 3 L	300	480	25	None
18 16 5 N L	300	480	25	"
19 13 4 L	350	550	25	"
20 25 5 Cu L	320	510	25	"
20 16 3 Mn L	320	510	25	"
25 22 2 N L	320	510	25	"
27 31 4 Cu L	240	500	25	"
18 8 Mn	350	500	25	None
20 10 3	400	620	20	"
23 12 L	320	510	25	"
23 12 Nb	350	550	25	"
23 12 2 L	350	550	25	"
29 9	450	650	15	"
16 8 2	320	510	25	None
19 9 H	350	550	30	"
19 12 3 H	350	550	25	"
22 12 H	350	550	25	"
25 4	450	650	15	"
25 20	350	550	20	"
25 20 Mn	350	550	20	"
25 20 H	350	550	10[5)]	"
18 36 H	350	550	10[5)]	"

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

[2)] 840 °C to 870 °C for 2 h. Furnace cooling down to 600 °C then air cooling.

[3)] 580 °C to 620 °C for 2 h. Air cooling.

[4)] 760 °C to 790 °C for 2 h. Furnace cooling down to 600 °C then air cooling.

[5)] These wire electrodes deposit high carbon weld metal for service at high temperatures. Room temperature elongation has little relevance to such applications.

NOTE: Weld metal can have elongation lower than that of the parent metal.

Bibliography

[1] Handbuch für das Eisenhüttenlaboratorium, VdEh, Düsseldorf.

[2] BS 6200-3 Sampling of iron, steel and other ferrous metals - Part 3: Methods of analysis.

[3] CEN/CR 10261 ECISS Information Circular 11 - Iron and Steel - Review of available methods of chemical analysis.

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