
Welding consumables — Solid wire electrodes, solid strip electrodes, solid wires and solid rods for fusion welding of nickel and nickel alloys — Classification

Produits consommables pour le soudage — Fils-électrodes pleins, feuillets pleins, fils pleins et baguettes pleines pour le soudage par fusion du nickel et des alliages de nickel — Classification

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 18274 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 3, *Welding consumables*.

This second edition cancels and replaces the first edition (ISO 18274:2004), of which it constitutes a technical revision. It also incorporates the Technical Corrigenda ISO 18274:2004/Cor.1:2005 and ISO 18274:2004/Cor.2:2006.

Requests for official interpretation of any aspect of this International Standard should be directed to the Secretariat of ISO/TC 44/SC 3 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

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Introduction

For nickel welding consumables, there is no unique relationship between the product form (solid wire electrode, solid strip electrode, solid wire or solid rod) and the welding process used (e.g. gas shielded metal arc welding, gas tungsten arc welding, plasma arc welding, submerged arc welding, strip overlay welding, laser welding or other welding processes). For this reason, the solid wire electrode, solid strip electrode, solid wire or solid rod may 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.

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Welding consumables — Solid wire electrodes, solid strip electrodes, solid wires and solid rods for fusion welding of nickel and nickel alloys — Classification

1 Scope

This International Standard specifies requirements for classification of solid wire electrodes, solid strip electrodes, solid wires and solid rods for fusion welding of nickel and nickel alloys. The classification of the solid wire electrodes, solid strip electrodes, solid wires and solid rods is based on their chemical composition.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 544, *Welding consumables — Technical delivery conditions for filler materials and fluxes — Type of product, dimensions, tolerances and markings*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*
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ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Classification

The classification is divided into two parts:

- a) the first part indicates the product form, being solid wire electrode, solid strip electrode, solid wire or solid rod, see 4.1;
- b) the second part gives a numerical symbol indicating the chemical composition of the solid wire electrode, solid strip electrode, solid wire or solid rod, see Table 1.

4 Symbols and requirements

4.1 Symbols for the product form

The symbol for the solid wire electrode, solid wire or solid rod shall be “S”. The symbol for the solid strip electrode shall be “B”.

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

4.2 Symbol for the chemical composition

The initial symbol "Ni" in Table 1 identifies the welding consumable as a nickel base alloy. The following four digits indicate the chemical composition of the solid wire electrode, solid strip electrode, solid wire or solid rod, determined under conditions given in Clause 6. The first digit is an indicator of the alloy group as follows:

- 1 significant molybdenum addition without significant chromium addition (nickel-molybdenum alloys);
- 2 no significant alloy addition;
- 4 significant copper addition (nickel-copper alloys);
- 5 significant copper additions with aluminium and titanium for precipitation hardening;
- 6 significant chromium addition, with iron less than 25 % (by mass) (nickel-chromium-iron and nickel-chromium-molybdenum alloys);
- 7 same as 6, but with aluminium and titanium for precipitation hardening;
- 8 significant chromium addition, with iron more than 25 % (by mass) (nickel-iron-chromium alloys).

The remaining digits indicate the alloy composition of the welding consumable. A description of common uses of each welding consumable alloy is given in Annex A. The basis of the system of designation is described in Annex B.

NOTE In addition, the chemical symbol can be used.

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Table 1 — Symbols and chemical composition requirements for solid wire electrodes, solid strip electrodes, solid wires and solid rods

Alloy symbols		Chemical composition, % (by mass) ^a													
Numerical	Chemical	C	Mn	Fe	Si	Cu	Ni ^b	Co	Al	Ti	Cr	Nb ^c	Mo	W	Others ^{d, e}
Nickel															
Ni 2061	NiTi3	0,15	1,0	1,0	0,7	0,25	≥92,0	—	1,5	2,0 to 3,5	—	—	—	—	P 0,03
Nickel-Copper															
Ni 4060	NiCu30Mn3Ti	0,15	4,0	2,5	1,2	28,0 to 32,0	≥62,0	—	1,2	1,5 to 3,0	—	0,3	—	—	—
Ni 4061	NiCu30Mn3Nb	0,15	4,0	2,5	1,25	28,0 to 32,0	≥60,0	—	1,0	1,0	—	3,0	—	—	—
Ni 5504	NiCu25Al3Ti	0,25	1,5	2,0	1,0	≥20,0	63,0 to 70,0	—	2,0 to 4,0	0,3 to 1,0	—	—	—	—	P 0,03
Nickel-Chromium															
Ni 6072	NiCr44Ti	0,01 to 0,10	0,20	0,50	0,20	0,50	≥52,0	—	—	0,3 to 1,0	42,0 to 46,0	—	—	—	—
Ni 6073	NiCr38AlNbTi	0,03	0,50	1,0	0,30	0,30	≥63,0	1,0	0,75 to 1,20	0,25 to 0,75	36,0 to 39,0	0,25 to 1,00	0,50	—	P 0,02 S 0,015 B 0,003 Zr 0,02
Ni 6076	NiCr20	0,08 to 0,15	1,0	2,00	0,30	0,50	≥75,0	—	0,4	0,15 to 0,50	19,0 to 21,0	—	—	—	P 0,03
Ni 6082	NiCr20Mn3Nb	0,10	2,5 to 3,5	3,0	0,5	0,5	≥67,0	—	—	0,7	18,0 to 22,0	2,0 to 3,0	—	—	P 0,03
Nickel-Chromium-Iron															
Ni 6002	NiCr21Fe18Mo9	0,05 to 0,15	1,0	17,0 to 20,0	1,0	0,5	≥44,0	0,5 to 2,5	—	—	20,5 to 23,0	—	8,0 to 10,0	0,2 to 1,0	P 0,04 S 0,03
Ni 6025	NiCr25Fe10AlY	0,15 to 0,25	0,5	8,0 to 11,0	0,5	0,1	≥59,0	1,0	1,8 to 2,4	0,1 to 0,2	24,0 to 26,0	—	—	—	Y 0,05 to 0,12; Zr 0,01 to 0,10

Table 1 (continued)

Alloy symbols		Chemical composition, % (by mass) ^a													
Numerical	Chemical	C	Mn	Fe	Si	Cu	Ni ^b	Co	Al	Ti	Cr	Nb ^c	Mo	W	Others ^{d, e}
Ni 6030	NiCr30Fe15Mo5W	0,03	1,5	13,0 to 17,0	0,8	1,0 to 2,4	≥36,0	5,0	—	—	28,0 to 31,5	0,3 to 1,5	4,0 to 6,0	1,5 to 4,0	P 0,04 S 0,02
Ni 6043	NiCr30Fe9Nb2	0,04	3,0	7,0 to 12,0	0,5	0,30	≥54,0	—	0,50	0,5	28,0 to 31,5	1,0 to 2,5	0,50	—	—
Ni 6045	NiCr28Fe23Si3	0,05 to 0,12	1,0	21,0 to 25,0	2,5 to 3,0	0,3	≥40,0	1,0	0,30	—	26,0 to 29,0	—	—	—	P 0,020 S 0,010
Ni 6052	NiCr30Fe9	0,04	1,0	7,0 to 11,0	0,5	0,3	≥54,0	—	1,1	1,0	28,0 to 31,5	0,10	0,5	—	Al + Ti < 1,5
Ni 6054	NiCr29Fe9	0,04	1,0	7,0 to 11,0	0,50	0,30	≥51,0	0,12	1,10	1,0	28,0 to 31,5	0,5 to 1,0	0,50	—	P 0,02 S 0,015
Ni 6055	NiCr29Fe5Mo4Nb3	0,03	1,0	14,4	0,50	0,30	52,0 to 62,0	0,10	0,50	0,50	28,5 to 31,0	2,1 to 4,0	3,0 to 5,0	—	P 0,02 S 0,015 B 0,003 Zr 0,02
Ni 6062	NiCr15Fe8Nb	0,08	1,0	6,0 to 10,0	0,3	0,5	≥70,0	—	—	—	14,0 to 17,0	1,5 to 3,0	—	—	P 0,03
Ni 6176	NiCr16Fe6	0,05	0,5	5,5 to 7,5	0,5	0,1	≥76,0	0,05	—	—	15,0 to 17,0	—	—	—	—
Ni 6601	NiCr23Fe15Al	0,10	1,0	20,0	0,5	1,0	58,0 to 63,0	—	1,0 to 1,7	—	21,0 to 25,0	—	—	—	P 0,03
Ni 6693	NiCr29Fe4Al3	0,15	1,0	2,5 to 6,0	0,5	0,5	≥53,0	—	2,5 to 4,0	1,0	27,0 to 31,0	0,5 to 2,5	—	—	P 0,03 S 0,01
Ni 6701	NiCr36Fe7Nb	0,35 to 0,50	0,5 to 2,0	7,0	0,5 to 2,0	—	42,0 to 48,0	—	—	—	33,0 to 39,0	0,8 to 1,8	—	—	—
Ni 6975	NiCr25Fe13Mo6	0,03	1,0	10,0 to 17,0	1,0	0,7 to 1,2	≥47,0	—	—	0,70 to 1,50	23,0 to 26,0	—	5,0 to 7,0	—	P 0,03 S 0,03
Ni 6985	NiCr22Fe20Mo7Cu2	0,01	1,0	18,0 to 21,0	1,0	1,5 to 2,5	≥40,0	5,0	—	—	21,0 to 23,5	0,50	6,0 to 8,0	1,5	P 0,04 S 0,03

Table 1 (continued)

Alloy symbols		Chemical composition, % (by mass) ^a													
Numerical	Chemical	C	Mn	Fe	Si	Cu	Ni ^b	Co	Al	Ti	Cr	Nb ^c	Mo	W	Others ^{d, e}
Ni 7069	NiCr15Fe7Nb	0,08	1,0	5,0 to 9,0	0,50	0,50	≥70,0	—	0,4 to 1,0	2,0 to 2,7	14,0 to 17,0	0,70 to 1,20	—	—	P 0,03
Ni 7092	NiCr15Ti3Mn	0,08	2,0 to 2,7	8,0	0,3	0,5	≥67,0	—	—	2,5 to 3,5	14,0 to 17,0	—	—	—	P 0,03
Ni 7718	NiCr19Fe19Nb5Mo3	0,08	0,3	24,0	0,3	0,3	50,0 to 55,0	—	0,2 to 0,8	0,7 to 1,1	17,0 to 21,0	4,8 to 5,5	2,8 to 3,3	—	B 0,006 P 0,015
Ni 8025	NiFe30Cr29Mo	0,02	1,0 to 3,0	30,0	0,5	1,5 to 3,0	35,0 to 40,0	—	0,2	1,0	27,0 to 31,0	—	2,5 to 4,5	—	—
Ni 8065	NiFe30Cr21Mo3	0,05	1,0	≥22,0	0,5	1,5 to 3,0	38,0 to 46,0	—	0,2	0,6 to 1,2	19,5 to 23,5	—	2,5 to 3,5	—	P 0,03 S 0,03
Ni 8125	NiFe26Cr25Mo	0,02	1,0 to 3,0	30,0	0,5	1,5 to 3,0	37,0 to 42,0	—	0,2	1,0	23,0 to 27,0	—	3,5 to 7,5	—	—
Nickel-Molybdenum															
Ni 1001	NiMo28Fe	0,08	1,0	4,0 to 7,0	1,0	0,5	≥55,0	2,5	—	—	1,0	—	26,0 to 30,0	1,0	V 0,20 to 0,40 S 0,03
Ni 1003	NiMo17Cr7	0,04 to 0,08	1,0	5,0	1,0	0,50	≥65,0	0,20	—	—	6,0 to 8,0	—	15,0 to 18,0	0,50	V 0,50 S 0,02
Ni 1004	NiMo25Cr5Fe5	0,12	1,0	4,0 to 7,0	1,0	0,5	≥62,0	2,5	—	—	4,0 to 6,0	—	23,0 to 26,0	1,0	V 0,60 P 0,04 S 0,03
Ni 1008	NiMo19WCr	0,1	1,0	10,0	0,50	0,50	≥60,0	—	—	—	0,5 to 3,5	—	18,0 to 21,0	2,0 to 4,0	—
Ni 1009	NiMo20WCu	0,1	1,0	5,0	0,5	0,3 to 1,3	≥65,0	—	1,0	—	—	—	19,0 to 22,0	2,0 to 4,0	—
Ni 1024	NiMo25	0,03	0,80	2,0	0,80	0,50	≥59,0	1,0	0,50	—	7,0 to 9,0	—	24,0 to 26,0	—	P 0,030 S 0,015

Table 1 (continued)

Alloy symbols		Chemical composition, % (by mass) ^a														
Numerical	Chemical	C	Mn	Fe	Si	Cu	Ni ^b	Co	Al	Ti	Cr	Nb ^c	Mo	W	Others ^{d, e}	
Ni 1062	NiMo24Cr8Fe6	0,01	1,0	5,0 to 8,0	0,1	0,5	≥62,0	—	0,5	—	6,0 to 10,0	—	21,0 to 25,0	—	—	
Ni 1066	NiMo28	0,02	1,0	2,0	0,1	0,5	≥64,0	1,0	—	0,5	1,0	—	26,0 to 30,0	1,0	P 0,04 S 0,03	
Ni 1067	NiMo30Cr	0,01	3,0	1,0 to 3,0	0,1	0,2	≥65,0	3,0	0,5	0,2	1,0 to 3,0	0,2	27,0 to 32,0	3,0	V 0,20 P 0,03	
Ni 1069	NiMo28Fe4Cr	0,01	1,0	2,0 to 5,0	0,1	0,5	≥65,0	1,0	0,1 to 0,5	0,3	0,5 to 1,5	0,5	26,0 to 30,0	—	—	
Nickel-Chromium-Molybdenum																
Ni 6012	NiCr22Mo9	0,05	1,0	3,0	0,5	0,5	≥58,0	—	0,4	0,4	20,0 to 23,0	1,5	8,0 to 10,0	—	—	
Ni 6022	NiCr21Mo13Fe4W3	0,01	0,5	2,0 to 6,0	0,08	0,5	≥49,0	2,5	—	—	20,0 to 22,5	—	12,5 to 14,5	2,5 to 3,5	V 0,3	
Ni 6035	NiCr33Mo8	0,05	0,5	2,0	0,6	0,30	≥49,0	1,00	0,40	0,20	32,25 to 34,25	0,50	7,60 to 9,00	0,60	V 0,20 P 0,030 S 0,015	
Ni 6057	NiCr30Mo11	0,02	1,0	2,0	1,0	—	≥53,0	—	—	—	29,0 to 31,0	—	10,0 to 12,0	—	V 0,4 P 0,04 S 0,03	
Ni 6058	NiCr21Mo20	0,01	0,5	1,5	0,10	0,50	≥52,0	0,3	0,4	—	20,0 to 23,0	—	19,0 to 21,0	0,3	N 0,02 to 0,15 P 0,015 S 0,010	
Ni 6059	NiCr23Mo16	0,01	0,5	1,5	0,1	0,5	≥56,0	0,3	0,1 to 0,4	0,5	22,0 to 24,0	—	15,0 to 16,5	—	V 0,3	
Ni 6200	NiCr23Mo16Cu2	0,01	0,5	3,0	0,08	1,3 to 1,9	≥52,0	2,0	0,5	—	22,0 to 24,0	—	15,0 to 17,0	—	P 0,025	
Ni 6205	NiCr25Mo16	0,03	0,5	1,0	0,5	0,2	≥55,0	0,2	0,4	0,4	24,0 to 26,0	—	14,0 to 16,0	0,3	—	