SLOVENSKI STANDARD
oSIST prEN ISO 14172:2022

01-november-2022

Dodajni in pomožni materiali za varjenje - Oplaščene elektrode za ročno obločno varjenje niklja in njegovih zlitin - Razvrstitev (ISO/DIS 14172:2022)

Welding consumables - Covered electrodes for manual metal arc welding of nickel and nickel alloys - Classification (ISO/DIS 14172:2022)

Schweißzusätze - Umhüllte Stabelektroden zum Lichtbogenhandschweißen von Nickel und Nickellegierungen - Einteilung (ISO/DIS 14172:2022)

Produits consommables pour le soudage - Électrodes enrobées pour le soudage manuel à l'arc du nickel et des alliages de nickel - Classification (ISO/DIS 14172:2022)

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ICS:

25.160.20	Potrošni material pri varjenju	Welding consumables
77.120.40	Nikelj, krom in njune zlitine	Nickel, chromium and their alloys

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Welding consumables — Covered electrodes for manual metal arc welding of nickel and nickel alloys — Classification

Produits consommables pour le soudage — Électrodes enrobées pour le soudage manuel à l'arc du nickel et des alliages de nickel — Classification

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

This fourth edition cancels and replaces the third edition (ISO 14172:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— To be added after DIS ballot

Welding consumables — Covered electrodes for manual metal arc welding of nickel and nickel alloys — Classification

1 Scope

This document prescribes requirements for the classification of nickel and nickel-alloy covered electrodes for manual metal arc welding and overlaying. The classification of the covered electrodes is based on the chemical composition of their deposited all-weld metal. It includes those compositions in which the nickel content exceeds that of any other element.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6847, *Welding consumables — Deposition of a weld metal pad for chemical analysis*

ISO 14344, *Welding consumables — Procurement of filler materials and fluxes*

ISO 15792-1:2020, *Welding consumables — Test methods — Part 1: Test methods for all-weld metal test specimens in steel, nickel and nickel alloys*

ISO 80000-1:2009, *Quantities and units — Part 1: General*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Classification

A covered electrode shall be classified in accordance with the chemical composition of the all-weld metal as given in Table 1. The required mechanical properties for the classification's all-weld metal are listed in Table 2.

The symbol for the classification is divided into two parts:

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

b) the second part gives a symbol indicating the chemical composition of the all-weld metal.

5 Symbols and requirements

5.1 Symbol for the product/process

The symbol for covered electrodes used for manual metal arc welding shall be the letter “E”.

5.2 Symbol for the chemical composition of the all-weld metal

The symbol for the chemical composition of the all-weld metal shall comprise “Ni” plus four digits, as shown in Table 1. The first digit is an indicator of the class of alloy deposited, where:

1 indicates significant molybdenum addition without significant chromium addition (nickel-molybdenum alloys);

2 indicates no significant alloy addition;

4 indicates significant copper addition (nickel-copper alloys);

6 indicates significant chromium addition, with iron less than 25 % (nickel-chromium-iron and nickel-chromium-molybdenum alloys);

8 indicates significant chromium addition, with iron more than 25 % (nickel-iron-chromium alloys).

The remaining digits indicate the particular alloy deposited. The basis of the system of designation is described in Annex A.

NOTE In addition, the chemical symbol can be used.

6 Chemical analysis

Chemical analysis shall be performed on any suitable all-weld metal test specimen. In case of dispute, the test specimen specified in ISO 6847 shall be used. The test results shall meet the requirements of Table 1 for the classification under test. Any analytical technique can be used; but, in case of dispute, reference shall be made to established published methods.

7 Mechanical properties of the all-weld metal

Mechanical properties are not part of the designation, but they are required for classification. The mechanical properties of the all-weld metal, deposited using covered electrodes in accordance with Table 1, shall be determined using a test assembly type 1,3 in accordance with ISO 15792-1:2020 with 4,0 mm electrodes. The minimum tensile properties shall be in accordance with Table 2.

8 Rounding procedure

Actual test values obtained shall be subject to ISO 80000-1:2009, B.3, Rule A. If the measured values are obtained by equipment calibrated in units other than those of this document, the measured values shall be converted to the units of this document before rounding. If an average value is to be compared to the requirements of this document, rounding shall be done only after calculating the average. The rounded results shall fulfil the requirements of the appropriate table for the classification under test.

Table 1 — Symbols and all-weld metal chemical composition requirements

Alloy symbol		Chemical composition % (by mass)[a]														
Numerical symbol	Chemical symbol	C	Mn	Fe	Si	Cu	Ni[b]	Co	Al	Ti	Cr	Nb[c]	Mo	V	W	Notes[d, e]
Nickel																
Ni 2061	NiTi3	0,10	0,7	0,7	1,2	0,2	min. 92,0	—	1,0	1,0 to 4,0	—	—	—	—	—	—
Nickel-copper																
Ni 4060	NiCu30Mn3Ti	0,15	4,0	2,5	1,5	27,0 to 34,0	min. 62,0	—	0,75	1,0	—	—	—	—	—	—
Ni 4061	NiCu27Mn3NbTi	0,15	4,0	2,5	1,3	24,0 to 31,0	min. 62,0	—	1,0	1,5	—	3,0	—	—	—	
Nickel-chromium																
Ni 6056	NiCr27Nb3	0,05	2,5 to 4,5	2,0 to 3,0	0,50	0,3	59,0 min.	0,10	0,6	0,40	26,0 to 28,0	2,0 to 3,6	—	—	—	0,02 P
Ni 6082	NiCr20Mn3Nb	0,10	2,0 to 6,0	4,0	0,8	0,5	min. 63,0	—	—	0,5	18,0 to 22,0	1,5 to 3,0	2,0	—	—	
Ni 6172	NiCr50Nb	0,10	1,5	1,0	1,0	0,25	min. 41,0	—	—	—	48,0 to 52,0	1,0 to 2,5	—	—	—	0,02P 0,02S
Ni 6231	NiCr22W14Mo	0,05 to 0,10	0,3 to 1,0	3,0	0,3 to 0,7	0,5	min. 45,0	5,0	0,5	0,1	20,0 to 24,0	—	1,0 to 3,0	—	13,0 to 15,0	
Nickel-chromium-iron																
Ni 6025	NiCr25Fe10AlY	0,10 to 0,25	1,0	8,0 to 11,0	1,0	—	min. 55,0	1,0	1,5 to 2,2	0,4	24,0 to 26,0	—	—	—	—	0,15Y
Ni 6045	NiCr27Fe23Si	0,05 to 0,20	2,5	21,0 to 25,0	2,5 to 3,0	0,30	min. 38,0	1,0	0,30	—	26,0 to 29,0	—	—	—	—	0,04P 0,03S
Ni 6055	NiCr30Mo4Nb3	0,05	1,0	rem	0,7	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	—	—	
Ni 6062	NiCr15Fe8NbMo	0,08	3,5	11,0	0,7	0,5	min. 62,0	—	—	—	13,0 to 17,0	1,5 to 4,0	—	—	—	

[a] Single values for all elements except nickel are maxima. Two values shown indicate minimum and maximum limits for a range.

[b] Up to 1 % of the nickel content can be cobalt unless otherwise specified. For certain applications, lower cobalt levels can be required and should be agreed between contracting parties.

[c] Up to 20 % of the niobium content can be tantalum.

[d] The total of unspecified elements shall not exceed 0,5 %, excluding cobalt and tantalum.

[e] Phosphorus 0,020 max., sulfur 0,015 max. unless otherwise stated.

[f] Boron 0,005 % max., Zr 0,020 %.

Table 1 *(continued)*

Alloy symbol		Chemical composition % (by mass)[a]														
Numerical symbol	Chemical symbol	C	Mn	Fe	Si	Cu	Ni[b]	Co	Al	Ti	Cr	Nb[c]	Mo	V	W	Notes[d, e]
Ni 6093	NiCr15Fe8NbMo	0,20	1,0 to 5,0	12,0	1,0	0,5	min. 60,0	—	—	—	13,0 to 17,0	1,0 to 3,5	1,0 to 3,5	—	—	—
Ni 6093B	NiCr15Fe8NbMo	0,20	1,0 to 3,5	12,0	1,0	0,5	min. 60,0	—	—	—	13,0 to 17,0	1,0 to 3,5	1,0 to 3,5	—	—	
Ni 6094	NiCr14Fe4NbMo	0,15	1,0 to 4,5	12,0	0,7	0,5	min. 55,0	—	—	—	12,0 to 17,0	0,5 to 3,0	2,5 to 5,5	—	1,5	
Ni 6095	NiCr15Fe8NbMoW	0,20	1,0 to 3,5	12,0	0,7	0,5	min. 55,0	—	—	—	13,0 to 17,0	1,0 to 3,5	1,0 to 3,5	—	1,5 to 3,5	
Ni 6132	NiCr15Fe9Nb	0,08	3,5	11,0	0,75	0,50	min. 62,0	—	—	—	13,0 to 17,0	1,5 to 4,0	—	—	—	0,03P
Ni 6133	NiCr16Fe12NbMo	0,10	1,0 to 3,5	12,0	0,8	0,5	min. 62,0	—	—	—	13,0 to 17,0	0,5 to 3,0	0,5 to 2,5	—	—	—
Ni 6133B	NiCr16Fe12NbMo	0,10	1,0 to 3,5	12,0	0,7	0,5	min. 62,0	—	—	—	13,0 to 17,0	0,5 to 3,0	0,5 to 2,5	—	—	0,03 P 0,02 S
Ni 6152	NiCr30Fe9Nb	0,05	5,0	7,0 to 12,0	0,7	0,5	min. 50,0	—	0,5	0,5	28,0 to 31,5	1,0 to 2,5	0,5	—	—	f
Ni 6182	NiCr15Fe6Mn	0,10	5,0 to 10,5	10,0	1,0	0,5	min. 60,0	—	—	1,0	13,0 to 17,0	1,0 to 3,5	—	—	—	*0,3 max. Ta where specified
Ni 6182B	NiCr15Fe6Mn	0,10	5,0 to 9,5	10,0	1,0	0,5	min. 59,0	—	—	1,0	13,0 to 17,0	1,0 to 2,5	—	—	—	0,03 P *0,3 max. Ta where specified
Ni 6333	NiCr25Fe16Co-Mo3W	0,10	1,2 to 2,0	min. 16,0	0,8 to 1,2	0,5	44,0 to 47,0	2,5 to 3,5	—	—	24,0 to 26,0	—	2,5 to 3,5	—	2,5 to 3,5	

a Single values for all elements except nickel are maxima. Two values shown indicate minimum and maximum limits for a range.

b Up to 1 % of the nickel content can be cobalt unless otherwise specified. For certain applications, lower cobalt levels can be required and should be agreed between contracting parties.

c Up to 20 % of the niobium content can be tantalum.

d The total of unspecified elements shall not exceed 0,5 %, excluding cobalt and tantalum.

e Phosphorus 0,020 max., sulfur 0,015 max. unless otherwise stated.

f Boron 0,005 % max., Zr 0,020 %.

Table 1 *(continued)*

Alloy symbol		Chemical composition % (by mass)[a]														
Numerical symbol	**Chemical symbol**	C	Mn	Fe	Si	Cu	Ni[b]	Co	Al	Ti	Cr	Nb[c]	Mo	V	W	Notes[d, e]
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 6702	NiCr28Fe6W	0,35 to 0,50	0,5 to 1,5	6,0	0,5 to 2,0	—	47,0 to 50,0	—	—	—	27,0 to 30,0	—	—	—	4,0 to 5,5	
Ni 6704	NiCr25Fe10Al3YC	0,15 to 0,30	0,5	8,0 to 11,0	0,8	—	min. 55,0	—	1,8 to 2,8	0,3	24,0 to 26,0	—	—	—	—	0,15Y
Ni 8025	NiCr29Fe26Mo	0,06	1,0 to 3,0	30,0	0,7	1,5 to 3,0	35,0 to 40,0	—	0,1	1,0*	27,0 to 31,0	1,0	2,5 to 4,5	—	—	*or Nb
Ni 8165	NiFe30Cr25Mo	0,03	1,0 to 3,0	30,0	0,7	1,5 to 3,0	37,0 to 42,0	—	0,1	1,0	23,0 to 27,0	—	3,5 to7,5	—	—	
Nickel-molybdenum																
Ni 1001	NiMo28Fe5	0,07	1,0	4,0 to 7,0	1,0	0,5	min. 55,0	2,5	—	—	1,0	—	26,0 to 30,0	0,6	1,0	
Ni 1004	NiMo25Cr3Fe5	0,12	1,0	4,0 to 7,0	1,0	0,5	min. 60,0	2,5	—	—	2,5 to 5,5	—	23,0 to 27,0	0,6	1,0	
Ni 1008	NiMo19WCr	0,10	1,5	10,0	0,7	0,5	min. 60,0	—	—	—	0,5 to 3,5	—	17,0 to 20,0	—	2,0 to 4,0	
Ni 1009	NiMo20WCu	0,10	1,5	7,0	0,7	0,3 to 1,3	min. 62,0	—	—	—	—	—	18,0 to 22,0	—	2,0 to 4,0	
Ni 1062	NiMo24Cr8Fe6	0,02	1,0	4,0 to 7,0	0,7	—	min. 60,0	—	—	—	6,0 to 9,0	—	22,0 to 26,0	—	—	
Ni 1066	NiMo28	0,02	1,7	2,2	0,2	0,5	min. 64,5	1,0	—	—	1,0	—	26,0 to 30,0	—	1,0	
Ni 1067	NiMo30Cr	0,02	2,0	1,0 to 3,0	0,2	0,5	min. 62,0	3,0	—	—	1,0 to 3,0	—	27,0 to 32,0	—	3,0	
Ni 1069	NiMo28Fe4Cr	0,02	1,0	2,0 to 5,0	0,7	—	min. 65,0	1,0	0,5	—	0,5 to 1,5	—	26,0 to 30,0	—	—	—

[a] Single values for all elements except nickel are maxima. Two values shown indicate minimum and maximum limits for a range.

[b] Up to 1 % of the nickel content can be cobalt unless otherwise specified. For certain applications, lower cobalt levels can be required and should be agreed between contracting parties.

[c] Up to 20 % of the niobium content can be tantalum.

[d] The total of unspecified elements shall not exceed 0,5 %, excluding cobalt and tantalum.

[e] Phosphorus 0,020 max., sulfur 0,015 max. unless otherwise stated.

[f] Boron 0,005 % max., Zr 0,020 %.