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Nickel and nickel alloys — Refined nickel — Sampling

Nickel et alliages de nickel — Nickel raffiné — Échantillonnage

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Foreword

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This document was prepared by Technical Committee ISO/TC 155, *Nickel and nickel alloys*.

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.

Introduction

This document describes the sampling procedures previously established by ISO 7156:1991, which was withdrawn during a systematic review in 2016.

The aim of this document is to fill a void for refined nickel for which the specification and the analysis are standardized. The sampling represents the third area to fully cover the standardization of refined nickel.

Nickel and nickel alloys — Refined nickel — Sampling

1 Scope

This document specifies sampling procedures for up to 25 tonnes (metric tons) of refined nickel of the same composition, size and shape and manufactured under similar conditions of production.

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 6372, *Nickel and nickel alloys — Terms and definitions*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6372 apply.

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 http://www.electropedia.org/

3.2 Symbols

For the purposes of this document, the following symbols apply.

N	The number of units which constitute the primary sample. These units are the primary increments.
n	The number of increments taken from each of the primary increments.
$N \times n$	The number of secondary increments that constitute the secondary sample.
U	The total number of units of packaging in a lot of 25 tonnes or less. These units may be whole-sheet cathodes or drums
v_1	Within-lot variance (between primary increments) for a particulars impurity.
v_2	Within-unit variance (between secondary increments issued from one primary increment) for the same impurity.
v_e	Variance attributable to the selection of samples.
a	Feed per tooth, in mm/min.
D	Diameter of drill or milling cutter, in mm.

d Number of teeth.

V_1 Linear cutting speed, in m/min.

V_2 Rate of longitudinal feed or cross feed (milling) or vertical feed (drilling), in mm/min.

NOTE The justification of the number of primary and secondary increments is given in Annex A.

4 Presentation of the product

Refined nickel is usually delivered in one of the following forms:

— whole-sheet cathodes weighing about 50 kg for a thickness most often between 6 mm and 12 mm;

— drums containing metal pieces. The pieces may be cut cathodes (generally squares with 25 mm, 50 mm or 100 mm edges), briquettes, pellets, shot, granules or powder. The capacity of the drums is most often 50 kg, 250 kg or 1 000 kg.

5 Principle of sampling procedure

5.1 From the U units contained in the lot, N units are selected to constitute the primary sample. The selection of these units shall respect the rules of random sampling.

5.2 From each of the N primary increments, n secondary increments are taken. The ($N \times n$) secondary increments are combined and constitute the secondary sample.

5.3 An adequate complementary treatment to reduce the mass of the secondary sample results in the final laboratory sample for chemical analysis. Cathodes or briquettes are machined to obtain a final sample in the form of fine chips. Pellets, shot or granules are either taken as they are or, when their particle size analysis allows, machined to obtain chips. Powders are homogenized and reduced by riffling until the final sample is obtained.

6 Sample preparation

6.1 The laboratory sample shall be prepared as directed in the clauses dealing with various product forms.

6.2 The laboratory sample shall be of sufficient mass for the chemical analysis planned. For fine chips or powder, it is recommended to divide a sample of at least 200 g between two parties and to keep two portions in reserve in case of dispute. For larger pieces, such as pellets, granules or shot, a minimum mass of 500 g is recommended for each party and for reserve.

6.3 Precautions in sample preparation

6.3.1 Given the high purity of certain qualities of nickel, extremely strict precautions shall be taken in order not to contaminate the sample. Contamination of a sample may occur from tools, utensils and containers used in the sampling operation. Care shall therefore be taken in their selection and use to eliminate or minimize such contamination.

6.3.2 Contamination from cutting tools by elements such as cobalt, chromium, molybdenum, vanadium and tungsten shall be avoided. All machining operations shall be carried out without using lubricants. Experience has shown that high-speed steel cutting tools are better for nickel metal than tungsten carbide tools.

6.4 Final preparation of the laboratory sample

6.4.1 Any sample that has been through a mechanical preparation and, in particular, machining into chips, will inevitably be contaminated on the surface of the metal by, at least, the element iron. It is essential, therefore, that the chips or pieces are cleaned by etching with acid before the test sample is taken for analysis. Unless otherwise specified in the International Standard to be used for the analytical method, the laboratory shall be instructed to clean the test sample as directed in 6.4.2.

6.4.2 Place the chips in a beaker and cover with a few millilitres of concentrated hydrochloric acid. Heat at low temperature and, as soon as dissolution starts (evolution of a few bubbles), add a large quantity of distilled or demineralized water to stop this dissolution. Pour off the diluted acid and wash the chips several times with water, by decantation of the water from the beaker, until acid-free. Wash the chips with high-purity acetone and dry them in a low-temperature oven. Take the test sample to be analysed from the clean chips and keep the remainder for future analyses.

7 Sampling of whole-sheet cathodes

7.1 Primary sampling

7.1.1 Determine the number of units U of whole-sheet cathodes in the lot and select, at random, N units (primary increments) using Table 1 as a guide. The number of units in a lot of a given mass and the number of units which constitute the primary sample in Table 1 are based on a unit mass of 50 kg.

7.1.2 If the mass per cathode is significantly different from 50 kg, the number of primary increments N shall be selected on the basis of the mass of the lot, as given in column 1 of Table 1, and the number N of selected units as given in column 3 of Table 1.

Table 1 — Sample selection from units of 50 kg

Mass of lot tonnes	Total number of units in lot	N[a]	n[b]	$N \times n$[c]
0,050	1	1	5	5
0,100	2	2	3	6
0,150	3	3	3 and 2	7
0,200	4	4	2	8
0,250	5	5	2 and 1	9
0,300 to 0,400	6 to 8	6	2 and 1	9
0,450 to 0,550	9 to 11	7	2 and 1	10
0,600 to 0,700	12 to 14	8	2 and 1	11
0,750 to 0,850	15 to 17	9	2 and 1	11
0,900 to 1,050	18 to 21	10	2 and 1	12
1,100 to 1,300	22 to 26	11	2 and 1	13
1,350 to 1,500	27 to 30	12	2 and 1	14
1,550 to 1,750	31 to 35	13	2 and 1	15

[a] N is the number of units sampled (primary increments).

[b] n is the minimum number of secondary increments from each of the N sampled units.

[c] The pairs of values for n (e.g. 3 and 2) shall be distributed randomly over the N sampled units so as to obtain the number ($N \times n$) of secondary increments indicated.

Table 1 *(continued)*

Mass of lot tonnes	Total number of units in lot	N[a]	n[b]	$N \times n$[c]
1,800 to 2,050	36 to 41	14	2 and 1	15
2,100 to 2,350	42 to 42	15	2 and 1	16
2,400 to 2,650	48 to 53	16	2 and 1	17
2,700 to 3,000	54 to 60	17	2 and 1	18
3,050 to 3,350	61 to 67	18	2 and 1	19
3,400 to 3,750	68 to 75	19	2 and 1	20
3,800 to 4,150	76 to 83	20	1	20
4,200 to 4,550	84 to 91	21	1	21
4,600 to 4,950	92 to 99	22	1	22
5,000 to 5,450	100 to 109	23	1	23
5,500 to 5,900	110 to 118	24	1	24
5,950 to 6,400	119 to 128	25	1	25
6,450 to 6,900	129 to 138	26	1	26
6,950 to 7,450	139 to 149	27	1	27
7,500 to 8,000	150 to 160	28	1	28
8,050 to 8,550	161 to 171	29	1	29
8,600 to 9,150	172 to 183	30	1	30
9,200 to 9,750	184 to 195	31	1	31
9,800 to 10,400	196 to 208	32	1	32
10,450 to 11,950	209 to 221	33	1	33
11,000 to 11,750	222 to 235	34	1	34
11,800 to 12400	236 to 248	35	1	35
12,450 to 13,150	249 to 263	36	1	36
13,200 to 13,850	264 to 277	37	1	37
13,900 to 14,600	278 to 292	38	1	38
14,650 to 15,400	293 to 308	39	1	39
15,450 to 16,150	309 to 323	40	1	40
16,200 to 17,000	324 to 340	41	1	41
17,050 to 17,800	341 to 356	42	1	42
17,850 to 18,650	357 to 373	43	1	43
18,700 to 19,550	374 to 391	44	1	44
19,600 to 20,400	392 to 408	45	1	45
20,450 to 21,350	409 to 427	46	1	46
21,400 to 22,250	428 to 445	47	1	47
22,300 to 23,200	446 to 464	48	1	48
23,250 to 24,150	465 to 483	49	1	49
24,200 to 25,000	484 to 500	50	1	50

[a] N is the number of units sampled (primary increments).

[b] n is the minimum number of secondary increments from each of the N sampled units.

[c] The pairs of values for n (e.g. 3 and 2) shall be distributed randomly over the N sampled units so as to obtain the number ($N \times n$) of secondary increments indicated.