भारतीय मानक **IS 2782 : 2023**

Indian Standard

परिष्कृत निकल — विशिष्टि

(पहला पुनरीक्षण)

Refined Nickel — Specification

(First Revision)

ICS 77.120.40

भारतीय मानक ब्यूरो
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October 2023 **Price Group 6**

Ores and Feed Stock for Non-Ferrous (Excluding Aluminium and Copper) Industry, their Metals/Alloys and Products Sectional Committee, MTD 09

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Ores and Feed Stock for Non-Ferrous (Excluding Aluminium and Copper) Industry, their Metals/Alloys and Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

The standard was first published in 1964. While reviewing the standard the committee felt to revise this standard keeping in view the latest developments in the nickel production and refining process and also to modify the grades in the standard which have international acceptance and traded on various commodity exchanges. In this current revision following modification have been made:

a) All the amendments issued to previous versions of this standard have been incorporated;

b) The title and scope of the standard has been modified in order to harmonize with international standards and global trade practices. The scope of the standard now covers the requirements of refined nickel irrespective of the raw materials used for manufacturing the refined nickel as compared to the earlier version of the standard which covered the requirements of primary nickel produced from ore or matte or similar raw materials but not from scrap. The title of the standard has been changed from 'specification for primary nickel' to 'specification for refined nickel';

c) The terminology clause has been incorporated;

d) The references clause has been incorporated;

e) The standard now includes six grades of refined nickel irrespective of the source that is whether it is produced via primary or secondary route as compared to previous versions containing only four grades namely Grade 1, Grade 2, Grade 3 and Grade 4 now designated as NR9900, NR9960, NR9980 and NR9982 respectively. The two new grades added are NR9995 and NR 9990. Some of these grades like NR 9980 and NR 9982 are also being traded on various commodity exchange platforms both globally and locally; and

f) Clause for ordering has been incorporated.

This standard covers six grades of refined nickel primarily produced from ore or matte, or similar raw materials by refining processes. These grades of nickel are commonly used for the manufacture of nickel anodes, electroplating, alloy steels, nickel based alloys, for production of ferrous and non-ferrous alloys and is especially used in production of stainless steel.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirements of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical value (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

REFINED NICKEL — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers minimum requirements of refined nickel primarily produced from ore or matte or similar raw materials.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

IS No.	*Title*
IS 460 (Part 1) : 2020	Test sieves — Specification: Part 1 Wire cloth test sieves (*fourth revision*)
IS 1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
IS 2766 (Part 1) : 1968	Methods of chemical analysis of primary nickel: Part 1

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply:

3.1 Electrolytic Cathode — Refinery shape made by electrolytic deposition.

3.2 Briquette — Refinery product of any shape formed by compaction and sintering of powder.

3.3 Shot — Refinery product, usually irregularly shaped, composed of particles generally of 2 mm to 50 mm in size, usually produced by shotting, atomization or crushing.

3.4 Powder — Refinery product composed of particles less than 0.1 mm in size, usually produced by hydro metallurgy, vapors metallurgy, electrolysis, atomization or crushing.

3.5 Ingot — Cast product intended and suitable for remelting or forming by hot or cold working.

3.6 Refined Nickel — Metallic nickel that is produced from ore or matte or similar raw materials by refining processes such as electrolytic, carbonyl decomposition, reduction or precipitation processes.

3.7 Refinery Shape — Unwrought products obtained by refining or by refining and casting processes.

4 GRADES

Refined nickel shall be of six grades, designated as, NR9995, NR9990, NR9982, NR9980, NR9960 and NR9900 based on the minimum percentage of nickel in each grade as given in Table 1.

5 SUPPLY OF MATERIAL

5.1 General requirements relating to the supply of refined nickel shall be as laid down in IS 1387.

5.2 Information to be Given by the Purchaser

5.2.1 *Basis for Order/Enquiry*

Orders for refined nickel conforming to this document/specification should include the following information:

a) The number of this Indian Standard;
b) The grade of the refined nickel required (*see* **4**);
c) The form and size of the refined nickel required (*see* **6**);
d) Test and test reports;
e) Specific marking and packaging requirements (*see* **9**); and
f) Any additional requirements.

6 FORM AND SIZE

The form of material and sizes shall be mutually agreed to between the purchaser and the manufacturer. Typical forms include briquettes, cathodes, granules, pellets, powders or shots.

NOTE — Forms are generally related to the refining process and thus not all forms may be available for each of the grades mentioned in Table 1.

7 CHEMICAL COMPOSITION

7.1 The chemical composition of the material shall conform to the requirements as given in Table 1.

7.2 The chemical composition shall be determined either by the methods specified in IS 2766 (Part 1) or any other established instrumental/chemical method as agreed between the purchaser and the manufacturer. In case of dispute, the procedure specified in IS 2766 (Part 1) shall be the referee method. However, if the method of analysis for a particular element is not given in IS 2766 (Part 1), the referee method for the analysis shall be as mutually agreed to between the purchaser and the manufacturer.

Table 1 Chemical Composition of Refined Nickel

(*Clauses* 4, 7.1 *and* 9.6)

Sl No.		Limit of Elements in Weight Percent					
	Grades / Elements	NR9995	NR9990	NR9982	NR9980	NR9960	NR9900*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Ni, *Min*	99.95	99.90	—	99.80	99.60	99.00
ii)	Ni + Co, *Min*	—	—	99.90	—	99.90	99.50
iii)	Ag, *Max*	0.000 1	0.001	—	—	—	—
iv)	Al, *Max*	0.000 5	0.001	—	—	—	—
v)	As, *Max*	0.000 1	0.004	0.001	0.005	—	—
vi)	Bi, *Max*	0.000 05	0.000 2	0.000 8	0.005	0.001	0.005
vii)	C, *Max*	0.015	0.015	0.01	0.03	0.03	0.1
viii)	Cd, *Max*	0.000 1	0.001	0.000 8	—	—	—
ix)	Co, *Max*	0.000 5	0.05	0.08	0.15	—	—
x)	Cu, *Max*	0.001	0.01	0.02	0.02	0.03	0.05
xi)	Fe, *Max*	0.015	0.015	0.02	0.02	0.03	0.20
xii)	Mn, *Max*	0.000 5	0.004	—	0.005	—	—
xiii)	N, *Max*	—	—	—	—	—	—
xiv)	P, *Max*	0.000 2	0.002	0.001	0.005	—	—
xv)	Pb, *Max*	0.000 1	0.001	0.001 5	0.005	0.003	0.005
xvi)	S, *Max*	0.001	0.002	0.001	0.01	0.005	0.02
xvii)	Sb, *Max*	0.000 1	0.000 5	0.000 8	0.005	0.001	0.005

Table 1 (*Concluded*)

Sl No.		Limit of Elements in Weight Percent					
	Grades / Elements	NR9995	NR9990	NR9982	NR9980	NR9960	NR9900*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
xviii)	Se, *Max*	0.000 1	0.001	—	—	—	—
xix)	Si, *Max*	0.001	0.002	0.002	0.005	—	—
xx)	Sn, max	0.000 1	0.000 1	0.000 8	0.005	—	—
xxi)	Te, *Max*	0.000 05	0.000 1	—	—	—	—
xxii)	Ti, *Max*	0.000 05	0.000 1	—	—	—	—
xxiii)	Zn, *Max*	0.000 5	0.001 5	0.002	0.005	—	—
xxiv)	Mg, *Max*	—	—	0.002	—	—	—

*The total percentage of other impurities in the NR9900 grade excluding those elements (Bi, C, Cu, Fe, Pb, S, Sb) whose limits have been specified above shall not exceed 0.1 percent.

8 SAMPLING AND ASSESSMENT OF THE GRADE

Sampling of refined nickel for chemical analysis shall be as agreed to between the purchaser and the manufacturer. A recommended sampling procedure for checking the conformity of the grade is given below:

9 Gross Samples (When the Ingots/ Packages/ Drums Carry the Melt or Cast Number)

9.1 The quantity of nickel of one grade manufactured at one place from the same melt or cast and offered for inspection at one time shall be considered as a lot. A lot may consist of the whole or part of the quantity of nickel ordered for. From each lot, drilling/shots or pellets/powder weighing about 500 g shall be collected as detailed in **9.2.2.1** to **9.2.2.4** to constitute a gross sample

9.2 Gross Samples (When the Material does not Carry the Melt or Cast Number)

9.2.1 The quantity of nickel of one grade manufactured at the same place and offered for inspection at one time shall be considered as a lot. A lot may consist of the whole or part of the quantity of nickel ordered for.

9.2.2 For the purpose of sampling, the quantity of nickel in a lot shallbe considered as divided into the number of sub-lots of approximately equal weight as specified in Table 2.

From each sub-lot, drillings/shots or pellets/ powder weighing about 500 g shall be collected as detailed in **9.2.2.1** to **9.2.2.4** to constitute a gross sample. Thus there will be as many gross samples as the number of sub-lots into which a lot has been divided.

Table 2 Number of Sub-lots into which a Lot is to be Divided

(*Clause* 9.2.2)

Sl No.	Weight of a Lot (kg)	Number of Sub-lots
(1)	(2)	(3)
i)	Up to 2 500	2
ii)	2 501 to 5 000	3
iii)	5 001 to 8 000	4
iv)	8 001 to 10 000	5

9.2.2.1 *Electrolytic cathodes*

When nickel is supplied in the form of cathode plates, complete or cut-up, approximately 5 percent of the cathodes in the sub-lot (subject to a minimum of 3 cathodes) shall be selected at random. Each of the sample cathodes so selected shall be drilled and the drillings obtained shall be thoroughly mixed so as to obtain a gross sample of 500 g for each of the sub-lots.

9.2.2.2 *Shots or pellets or rondelles or briquettes and cutup cathodes*

When the nickel is supplied in the form of shots or pellets or rondelles or briquettes and cut-up cathodes, a minimum of two cases or drums shall be selected at random for each sub-lot. From each of the drums so selected, small quantities of the material shall be collected from the top, centre and bottom portions so as to make the required weight of the gross sample. For the purpose of obtaining the sawings from the pellets, a mechanical saw of 1.00 mm pitch shall be used. The saw-blade shall be previously cleaned with emery cloth ether and shall be used to cut a few odd pellets to remove any residable contamination lodged in the teeth. Actual sample sawings shall be collected in a clean receiver. Fundamental precautions, such as the handling of pellets with forceps, inspection of the saw after cutting each sample to ensure that there are no teeth missing, etc, shall be scrupulously followed.

9.2.2.3 *Ingots*

When the nickel is supplied in the form of ingots, the weight of the gross sample shall be made up by drilling sufficient number of ingots selected at random through their total thickness. The ingots may be drilled from both directions; top and bottom, if necessary. Drillings shall be so regulated as to avoid excess heat and consequent oxidation of the sample obtained. No lubricant shall be used while drilling.

9.2.2.4 *Powder*

When the nickel is supplied in the form of powder, one drum for every five or part there of (subject to a minimum of 5 drums) shall be chosen for drawing the sample. From each of the drums so chosen, adequate quantity of the material shall be drawn with the help of a 12 mm diameter probe so as to obtain a gross sample of 500 g for each sub-lot.

9.3 Laboratory Sample

Each of the gross samples obtained as in **9.1** or **9.2.2** shall be mixed well and reduced by the method of

coning and quartering, to weight about 100 g. This shall be crushed in stages to pass through the 850 µm IS Sieve [*see* IS 460 (Part 1)], which will constitute a laboratory sample.

9.4 Number of Tests

Where there are more than one laboratory samples representing a lot (*see* **9.2**), all these samples shall be subjected to chemical analysis individually for important chemical characteristics. For the remaining characteristics, a composite sample, prepared by mixing equal quantities of material from each of the laboratory samples representing a lot, shall be analyzed. The importance or otherwise of the various chemical characteristics of the refined nickel shall be specified by the purchaser for this purpose.

9.5 Reporting of Test Results

9.5.1 In those cases, where only one laboratory sample has been tested from each lot or where a composite sample has been tested, only one result will be available for each characteristic and that result shall be reported as the value of the characteristic for the lot sampled.

9.5.2 When only two laboratory samples have been analyzed individually from a lot, the average of the two available test results shall be reported as the value of the characteristic for the lot sampled. The individual test results shall also be reported to give an indication of the range of variation in quality.

9.5.3 When three or more laboratory samples have been analyzed individually from a lot, the following procedure shall be followed to assess the average quality and its limits of variation:

Let $x_1, x_2, x_3 \ldots\ldots\ldots\ldots x_n$ be the results of analysis of '*n*' laboratory samples for a particular characteristic

Calculate

$$\text{Average } (\overline{x}) = \frac{(x_1 + x_2 + \cdots\ldots\ldots\ldots x_n)}{n}, \text{ and}$$

Range (R) = the difference between the maximum and the minimum values.

The average level of that characteristic in the lot shall be reported as equal to ($\overline{x}$).

The limits of variation in the average level of that characteristic of nickel in the lot shall be reported as ($\overline{x} \pm hR$), where '*h*' is a factor, the value of which depends upon the number of laboratory samples analyzed. The appropriate value of the factor '*h*' shall be selected from Table 3.

Table 3 Value of the Factor *'h'*

(*Clause* 9.5.3)

Sl No.	Number of Laboratory Sampled Analyzed	Value of the Factor '*h*'
(1)	(2)	(3)
i)	3	1.36
ii)	4	0.72
iii)	5	0.51

9.6 Assessment of the Grade

Wherever, three or more laboratory samples have been analyzed individually for assessing the grade of the nickel in the lot, the limits of variation as obtained under **9.5.3** shall be compared with the quality limits, specified for the grade in Table 1.

10 PACKING

The material shall be supplied packed in suitable containers in quantities mutually agreed to between the purchaser and the supplier**.**

11 MARKING

11.1 Each item/package of the product shall be legibly marked with the following indelible markings:

a) Form/shape of the material;

b) Grade of refined nickel;

c) Cast/lot number; and

d) Indication of the source of manufacture.

11.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.'

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Ores and Feed Stock for Non-Ferrous (Excluding Aluminium and Copper) Industry, their Metals/Alloys and Products Sectional Committee, MTD 09

Organization	*Representative(s)*
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Organization	*Representative(s)*
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Review of Indian Standards

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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