भारतीय मानक
Indian Standard

IS 13502 : 2022

कच्चा लोहा — विशिष्टि

(पहला पुनरीक्षण)

Pig Iron — Specification

(First Revision)

ICS 73.080

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Pig Iron and Cast Iron Sectional Committee, MTD 06

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Pig Iron and Cast Iron Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1992 and during the formulation of this standard following three Indian Standards on Pig Iron were amalgamated, namely:

a) IS 224 : 1977 Foundry pig iron for general purposes (*fourth revision*)

b) IS 2841 : 1978 Pig iron for special purposes (*second revision*)

c) IS 2842 : 1980 Basic pig iron for steel making purposes (*second revision*)

In the preparation of the standard necessary assistance was derived from ISO 9147 : 1987 'Pig iron – Definition and classification'.

Grade designation of pig iron was modified on the basis of IS 2084 : 1991 'Code for designation of pig iron (*second revision*)'. Silicon (Si) content is represented by a single integer (X) obtained after rounding off twice the average percentage of silicon content. Manganese (Mn) content is indicated as four time, the average percentage of manganese rounded off to the nearest integer. Phosphorus (P) content is indicated as hundred times the maximum percentage of phosphorus.

This revision has been brought out to bring the standard in the latest style and format of the Indian Standards. In addition, the following changes have been made:

a) Clause **4.1**, IS 228 : 1959 replaced with IS 12308 (relevant parts); and
b) Suitable standard IS 460 (Part 1) for IS sieve incorporated at Clause **A-1.2** and **A-2.3**.

The composition of the committee responsible for the formulation of this standard is listed in Annex B.

For the purpose of deciding whether a particular requirement 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 values (*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

PIG IRON — SPECIFICATION

(First Revision)

1 SCOPE

This standard covers requirements of pig iron for steel making and for foundry purposes.

2 REFERENCES

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

IS No.	*Title*
IS 397	Method of statistical quality control during production:
(Part 1) : 2003	Control charts for variables (*second revision*)
(Part 2) : 2003	Control charts for attributes (*third revision*).
IS 460 (Part 1) : 2020	Specification for test sieves: Part 1 Wire cloth test sieves (*fourth revision*)
IS 1387 : 1993	General requirement for supply of Metallurgical materials (*second revision*)
IS 2084 : 1991	Code of designation of pig iron (*second revision*)
IS 12308 (relevant parts)	Chemical analysis of cast iron and pig iron

3 DEFINITIONS

3.1 Pig Iron

An iron-carbon alloy with more than 2 percent carbon and with contents of other elements equal to or less than the limits given in Table 1. It is intended for further processing in the molten condition into steel or cast-iron. Pig iron is delivered either in the molten state or in the solid state in primary forms such as pigs or similar solid pieces and granulates.

Table 1 Limits of Alloy Elements for Pig Iron
(*Clause* 3.1)

Element (1)	**Limit* (Percent)** (2)
Manganese	≤ 30.0
Silicon	≤ 8.0
Phosphorus	≤ 3.0
Chromium	≤ 10.0
Other alloying elements (Total)	≤ 10.0

*Iron with higher contents than specified above are ferro alloys and not ‘pig iron’.

4 GRADES

4.1 The pig iron shall meet the requirements of the grades as given in Table 2. The chemical composition of pig iron shall be determined either by the methods specified in IS 12308 (relevant parts) or any established instrumental/chemical method. In case of dispute the procedure given in the latest version of IS 12308 (relevant parts) shall be the referee method. However, where the method is not given in IS 12308 (relevant parts) the referee method shall be agreed to between the purchaser and the manufacturer.

4.2 In case of doubt the correct classification of the pig iron into one of the grade indicated in Table 2 shall be determined by check analysis. The conditions for sampling, including the conditions for the number of tests, shall correspond to the conditions usually applied in cases of dispute for deliveries of disputed chemical composition.

4.3 The purchaser should clearly state the grade designation required both in the enquiry and in the order. Supply of material of composition within limits narrower than those covered in Table 2 may be mutually agreed between the purchaser and the manufacturer.

5 SUPPLY OF MATERIAL

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

6 SIZE AND MASS

6.1 The mass of pig shall be either 45 kg having two notches or 22.5 kg having one notch subject to mutual agreement between the purchaser and the manufacturer. The depth of the notches shall be such as to make the pig easily breakable. Any size smaller than that mentioned above shall be acceptable.

6.1.1 The dimensions of the two sizes of pigs as given in **6.1** and the particulars of the notches are shown in Fig. 1 and Fig. 2.

7 SAMPLING AND CRITERIA FOR CONFORMITY

7.1 The sampling methods for chemical analysis are described in Annex A.

7.2 A lot (*see* Table 3) shall be declared as conforming to the requirements of the specifications (*see* Table 2) if the test results of the analysis (*see* **4.1**) are found satisfactory.

8 MARKING

8.1 The material shall be legibly marked with the following:

a) Cast number/grade of the material, and

b) Manufacturer's name or trade-mark.

8.2 The material may be colour coded as agreed to between the purchaser and the manufacturer.

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

Table 2 Grade wise Classification and Designation of Pig Iron According to Chemical Composition
(*Clauses* 4.1 *and* 4.2)

Sl No.	Pig Iron for	Designation	Chemical Composition, Percent			
			Silicon	Manganese	Phosphorus	Sulphur, *Max*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1.1	Steel making	PG Si X Mn 1 P 40	*See* Note 1 Below	< 0.5	≤ 0.4	0.06
1.2		PG Si X Mn 3 P 40		0.5 to 1.0		
1.3		PG Si X Mn 5 P 40		1.0 to 1.5		
2.1	Foundry purpose	PG Si X Mn P 8		< 0.1	≤ 0.8	0.02
2.2		PG Si X Mn 1 P 8		0.1 to 0.5		
3.1		PG Si X Mn 3 P 8		0.5 to 1.0	< 0.08	0.06
3.2		PG Si X Mn 3 P 12			0.08 - 0.12	
3.3		PG Si X Mn 3 P 20			0.12 - 0.20	
3.4		PG Si X Mn 3 P 40			0.20 - 0.40	
3.5		PG Si X Mn 3 P 100			0.40 - 1.00	
3.6		PG Si X Mn 3 P 130			1.00 - 1.30	
3.7		PG Si X Mn 5 P 8		1.0 to 1.5	< 0.08	
3.8		PG Si X Mn 5 P 12			0.08 - 0.12	
3.9		PG Si X Mn 5 P 20			0.12 - 0.20	
3.10		PG Si X Mn 5 P 40			0.20 - 0.40	
3.11		PG Si X Mn 5 P 100			0.40 - 1.00	
3.12		PG Si X Mn 5 P 130			1.00-1.30	
4.0	PG-Any other purpose*					

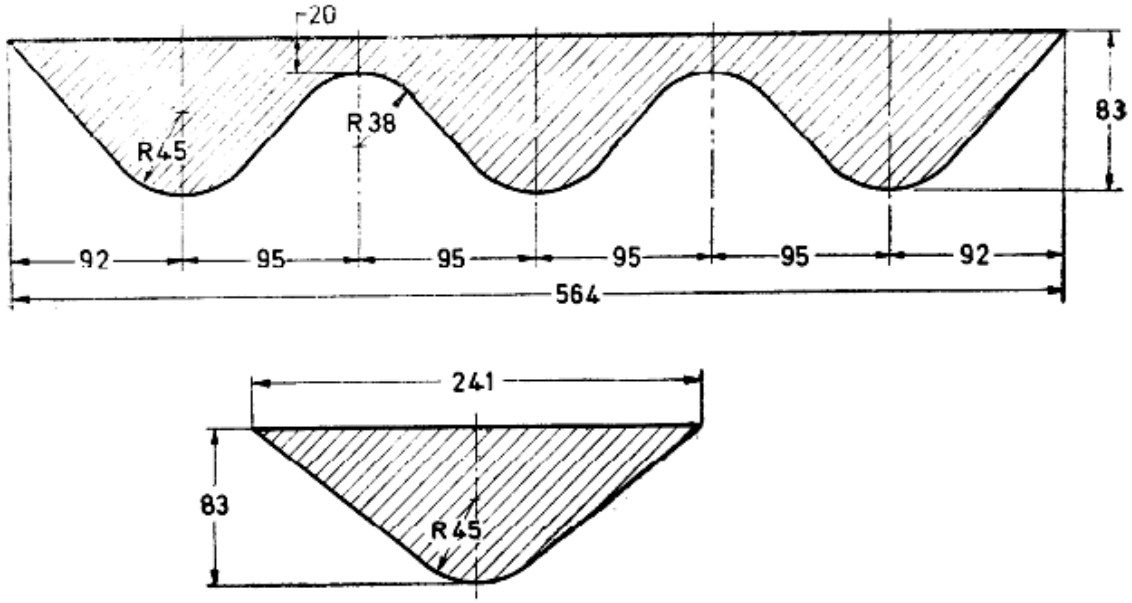
*Pig iron with limits given in Table 1.

NOTES

1 When ordering, the integer given below shall be substituted for the symbol 'X' in the designation to specify silicon range:

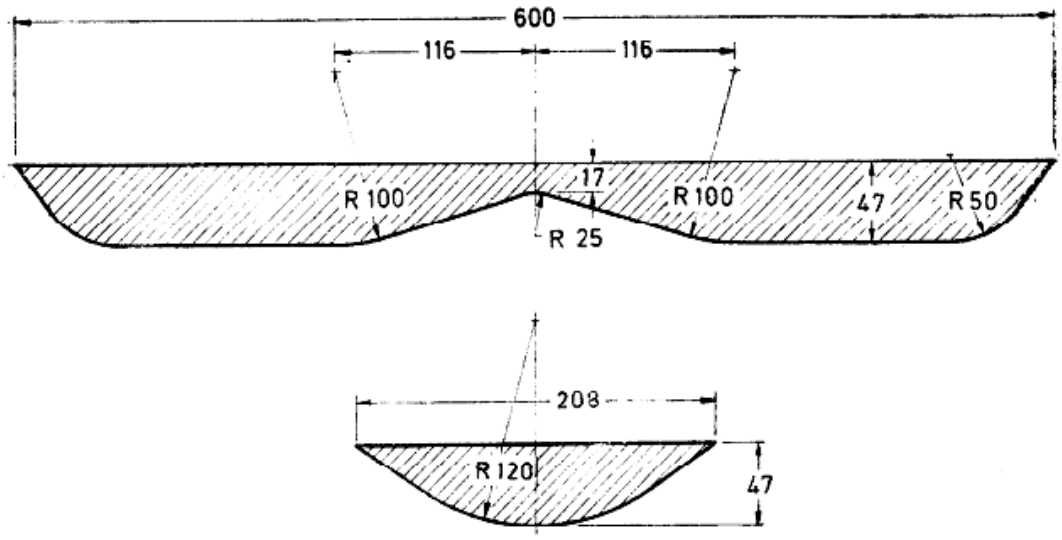
Integer	*Steel Marking Pig Iron*	*Foundry Pig Iron*
(1)	(2)	(3)
1	≤ 0.75	–
2	> 0.75 but ≤ 1.25	> 0.75 but ≤ 1.25
3	> 1.25 but ≤ 1.75	> 1.25 but ≤ 1.75
4	–	> 1.75 but ≤ 2.25
5	–	> 2.25 but ≤ 2.75
6	–	> 2.75 but ≤ 3.25
7	–	> 3.25 but ≤ 3.75
8	–	>3.75 but ≤ 4.25

2 Other elements such as Cr, Mo, Ni, Ti, V, etc., may be present in traces (total not exceeding 10%). The content of these elements shall not be used in the classification of pig iron.



All dimensions in millimetres.

FIG. 1 45 KG PIG WITH TWO NOTCHES



All dimensions in millimetres.

FIG. 2 22.5 KG PIG WITH ONE NOTCH

ANNEX A
(*Clause* 7.1)

SAMPLING FOR CHEMICAL ANALYSIS OF PIG IRON FOR STEEL MAKING AND FOUNDRY PURPOSES

A-0 GENERAL

A-0.1 The reliability of conclusions reached by following any sampling plan is largely dependent on the homogeneity of the material sampled for reducing the quality fluctuations of pig-iron to a minimum, it is necessary to adopt a stable control of production. In this connection guidance may be obtained from IS 397 (Part 1) and IS 397 (Part 2).

A-0.2 For the grading of pig iron, it is recommended that representative samples be taken from the molten metal as described in **A-1**. However, if the purchaser so desires, he may ascertain the correct grading of the material by the procedure recommended in **A-2**.

A-1 SAMPLING MOLTEN METAL DURING PRODUCTION

A-l.1 Sampling of molten metal be done ladle wise either while collecting during tapping or while pouring it at the pig casting machine, depending upon the convenience of the manufacturer. In either case, spoon samples shall be taken from the flow, one in the beginning, the other in the middle and the third in the end and poured into suitable moulds (consisting of test ingot mould and bar or finger sample mould).

A-1.2 The surface of the test ingots shall be thoroughly cleaned and the ingots shall be drilled from a point on the control longitudinal line of the upper surface to within 6 mm of the bottom. The drillings so obtained from different test ingots (each representing a ladle) shall be mixed and crushed if necessary, to pass through 500-micron IS Sieve conforming to IS 460 (Part 1).

A-1.3 The average sample obtained as in **A-l.2** shall be analysed and the grade of pig iron cast from any ladle shall be determined on the basis of the average test result obtained for that ladle.

A-2 SAMPLING OF PIGS

A-2.1 Lot in any consignment, all the pigs of the same grade from the same manufacturer shall be grouped together to constitute a lot of not more than 1 000 tonnes.

A-2.2 The number of pigs to be selected from a lot shall depend on the size of the lot as given in Table 3. The sample shall be selected at random from different locations throughout the bulk.

Table 3 Scale of Sampling
(*Clause* A-2.2)

Sl No.	Mass of the Lot (In tonnes)	No. of Pigs to be Selected
(1)	(2)	(3)
i)	Up to 25	4
ii)	26 to 50	5
iii)	51 to 100	7
iv)	101 to 150	10
v)	151 to 300	15
vi)	301 to 500	20
vii)	501 and above	25

A-2.3 From each of the pigs chosen according to **A-2.2**, drillings shall be obtained in the following manner.

The entire surface of the pigs shall be thoroughly cleaned with a strong wire-brush prior to drilling to prevent any extraneous matter getting mixed up with the drillings. Two holes shall be drilled in each pig with a suitable drill to a depth of 6 mm without the use of any cutting fluid and the drillings discarded. The drill shall then be replaced in the holes and the pigs drilled until the drill almost penetrates to a depth of 6 mm from the other side. These drillings shall be collected, and approximately the same mass of drillings shall be taken from each pig and mixed together. The mixed drillings, shall then be crushed gently in an iron mortar until the whole quantity passes through 500 micron IS Sieve conforming to IS 460 (Part 1). After thorough mixing, the bulk of the crushed drillings may be reduced in quantity by coning and quartering method till a suitable mass of sample is obtained for analysis.

A-2.3.1 Should any pig be found too hard for drilling, the sample may be prepared by annealing before drilling as specified in **A-2.3** or by breaking and crushing in to small portions from the pig and crushing.

A-2.3.2 The sample for analysis shall then be divided into three equal parts in the presence of the supplier and the purchaser or their representatives, if they so desire. One of these three parts shall be marked for the purchaser, another for the supplier and the third as referee sample to be used in case of any dispute between the purchaser and the manufacturer.

ANNEX B
(*Foreword*)

COMMITTEE COMPOSITION
Pig Iron and Cast Iron Sectional Committee, MTD 06

Organization	*Representative*(*s*)
Metal and Steel Factory, Kolkata	SHRI A. K. HAZRA (***Chairperson***)
CSIR – National Metallurgical Laboratory, Jamshedpur	DR SATADAL GHORAI
Central Public Works Department, New Delhi	SHRI SEETARAMA RAO MANTRALA SHRI CHANDRA SHEKHAR AZAD (*Alternate*)
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Indian Ordnance Factory, Grey Iron Foundry, Jabalpur	SHRI A. K. LALA SHRI RAM ACHAL (*Alternate*)
Jai Balaji Group, Kolkata	SHRI BIVASH CHAKRABORTY
Jayaswal Neco Industires Limited, Nagpur	SHRI PRAVEEN BHALMEY SHRI K. K. SINGH (*Alternate*)
Jindal Saw Limited, New Delhi	SHRI MANEESH KUMAR SHRI ULHAS NAIK (*Alternate*) SHRI RAJEEV RANJAN (*Young Professional*)
Kejriwal Casting Limited, Kolkata	SHRI SANDEEP KEJRIWAL SHRI RAJEEV KEJRIWAL (*Alternate*)
Kiswok Industries Private Limited, Kolkata	SHRI RAJ KEJRIWAL
Kolkata Metropolitan and Development Authority, Kolkata	SHRI A. N. BASAK
Lokesh Industries Limited, Andhra Pradesh	SHRI B. LOKESH PATRUDU SHRI R. L. DUBEY (*Alternate*)
Military Engineer Services, New Delhi	SHRI RAM VERMA
Ministry of Commerce and Industry, Department of Commerce, New Delhi	SHRI K. K. SINHA SHRI M. Z. KHAN (*Alternate*)
Orient Trading Company, Kolkata	SHRI ARABINDA CHATTERJEE
Public Health Engineering Department, Government of Haryana, Panchkula	SHRI PRADEEP PUNIA SHRI DINESH KUMAR SAINI (*Alternate*)
Rural Water Supply and Sanitation Department, Government of Andhra Pradesh, Vijayawada	SHRI YEDLA GOVINDA RAO SHRI A. SRINIVASA RAO (*Alternate*)
Research Designs and Standards Organization, Lucknow	SHRI L. K. SRIVASTAVA
Steel Authority of India Limited, Research & Development Centre for Iron & Steel, Ranchi	SHRI ARITRA MALLICK
Steel Authority of India Limited, New Delhi	SHRI R. P. BHALOTIA
Tata Consulting Engineers Limited, Navi Mumbai	SHRI G. S. RAVISHANKAR SHRI BRATINDRA NARAYAN DEY (*Alternate*)
Tata Metaliks Limited, Kolkata	SHRI SANTANU BANERJEE SHRI ARASHDEEP CHAWLA (*Alternate*)

Electrotherm Private Limited, Gujarat	SHRI TEJAS PATEL SHRI KALPESH MADHU (*Alternate*) SHRI RAHUL CHAVAN (*Young Professional*)
Tru-Form Engineers, Nagpur	SHRI MAHESH G. NICHWANI SHRI ANUP K. SHIWANKAR (*Alternate*)
BIS Directorate General	SHRI SANJIV MAINI, SCIENTIST 'F'/SENIOR DIRECTOR AND HEAD (METALLURGICAL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI RONGALI TIRUMALA RAO
SCIENTIST 'D'/JOINT DIRECTOR
(METALLURGICAL ENGINEERING), BIS

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

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Amendments Issued Since Publication

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