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Mazdoor Kisan Shakti Sangathan
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”
Jawaharlal Nehru
“Step Out From the Old to the New”

Indian Standard

IRON ORE PELLETS FOR DIRECT REDUCTION PROCESSES — SPECIFICATION

(Second Revision)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 2001

Price Group 2
FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Sponge Iron and Smelting Reduction Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1984 and subsequently revised in 1991. In this revision, Fe, S, P and moisture contents have been upgraded in view of the present requirement of iron ore pellets for direct reduction.

In recent years, sponge iron has gained prominence as a feed stock for steel making in electric arc furnace or in oxygen steel making and other steel making processes. Quality of iron ore pellets plays a significant role for the production of sponge iron by direct reduction, and so it is essential to ensure the supply of suitable quality of iron ore pellets for direct reduction.

No marking clause has been included in this standard as iron ore is supplied loose.

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

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 2:1960 'Rules for rounding off numerical values (revised)'. 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

IRON ORE PELLETS FOR DIRECT REDUCTION PROCESSES — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the specification of iron ore pellets for both solid and gaseous reductant based direct reduction processes for production of sponge iron to be used in the production of steel in electric arc furnace, oxygen steel and other steel making processes, etc.

1.2 Requirements covered in this standard shall be met at the point of receipts, unless it is stated otherwise.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions 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 editions of the standards indicated below:

<table>
<thead>
<tr>
<th>IS No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 1387 : 1993</td>
<td>General requirements for the supply of metallurgical materials (first revision)</td>
</tr>
<tr>
<td>1493</td>
<td>Methods of chemical analysis of iron ores:</td>
</tr>
<tr>
<td>(Part 1): 1981</td>
<td>Determination of common constituents (first revision)</td>
</tr>
<tr>
<td>(Part 3): 1987</td>
<td>Determination of titanium chromium, vanadium, calcium and magnesium by atomic absorption spectrophotometry</td>
</tr>
<tr>
<td>(Part 4): 1988</td>
<td>Determination of aluminium by atomic absorption spectrophotometry</td>
</tr>
<tr>
<td>(Part 5): 1990</td>
<td>Determination of copper content by atomic absorption spectrometric method</td>
</tr>
<tr>
<td>(Part 6): 1990</td>
<td>Determination of sodium and/or potassium content by atomic absorption spectrometric method</td>
</tr>
<tr>
<td>6495 : 1984</td>
<td>Method of tumbler test for iron oxides pellets ores, sinter and pellets (first revision)</td>
</tr>
</tbody>
</table>

IS 8167 : 1989 Method for determination of reducibility of iron ore and sinter

IS 8604 : 1977 Determination of compression strength of iron ore pellets after reduction

IS 8624 : 1995 Method for determination of swelling index of iron ore pellets

IS 8625 : 1986 Method for determination of crushing strength of iron ore pellets

IS 9101 : 1979 Method of sampling iron ore pellets

IS 9660 : 1980 Guidelines for determination of softening characteristics of iron ore pellets

IS 11283 : 1985 Method for determination of softening point of iron oxides (in powder form) lump ore, sinter and pellets

IS 11292 : 1985 Method for determination of relative reducibility of iron oxides: lump ores, sinter and pellets

3 SUPPLY OF MATERIAL

The material shall be supplied in accordance with the provisions of IS 1387.

4 CHEMICAL COMPOSITION

4.1 The iron ore pellets shall conform to the following chemical analysis (dry LOI free basis):

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe (Total)</td>
<td>66.5 Min</td>
</tr>
<tr>
<td>SiO₂ + Al₂O₃</td>
<td>4.0 Max</td>
</tr>
<tr>
<td>CaO + MgO</td>
<td>0.5 Min</td>
</tr>
<tr>
<td>CaO + MgO</td>
<td>shall be as agreed</td>
</tr>
<tr>
<td>SiO₂ + Al₂O₃</td>
<td>mutually between the manufacturer and the purchaser</td>
</tr>
<tr>
<td>S</td>
<td>0.01 Max</td>
</tr>
<tr>
<td>P</td>
<td>0.04 Max</td>
</tr>
<tr>
<td>Total of Pb, Zn, Cu, Sn, Cr and As</td>
<td>0.02 Max</td>
</tr>
<tr>
<td>Alkali (Na₂O + K₂O)</td>
<td>to be agreed upon between the supplier and the purchaser</td>
</tr>
</tbody>
</table>

However, the actual specification of the ore required shall have to be agreed between the purchaser and the supplier.
IS 11092 : 2001

**Constituent**  
**Moisture**  

| Percentage | 3 percent Max during dry season and 6 percent Max during rainy season or as agreed upon in both cases |

4.2 The chemical analysis of the iron ore pellets shall be determined by the method specified in IS 1493 and IS 1493 (Parts 1, 3, 4, 5 & 6) as per latest version of any other established, instrumental/chemical method. In case of dispute, the procedure in the latest edition of IS 1493 for chemical analysis shall be the Referee Method.

5 SIZE

5.1 The size range for iron ore pellets at the point of dispatch shall be as follows. Requirements for the iron ore pellets at the point of dispatch is applicable to this clause only, as degradation of iron ore pellets may occur during transportation:

- +19 mm 5 percent, Max
- –19 +9 mm 85 percent, Min
- –9 +5 mm 5 percent, Max
- –5 mm 5 percent, Max

5.2 The screen analysis of the material at the point of receipt depends on the handling and transportation and shall, therefore, have to be agreed between the supplier and the purchaser.

6 COMPRESSIVE STRENGTH

6.1 Compressive Strength Before Reduction

The average compressive strength of the iron ore pellets carried out on a specified number of individual pellets in a specified size range, when determined in accordance with IS 8625 shall not be less than 200 kg/pellets. Pellets with a strength less than 80 kg/pellet shall not exceed 5 percent.

6.2 Compressive Strength After Reduction

The average compressive strength of the pellets after reduction, when determined in accordance with IS 8604, shall not be less than 50 kg/pellet to minimize fines generation in furnace and handling system.

7 REDUCIBILITY

7.1 The reducibility of the iron ore pellets (dR/dt at 40 percent reduction) shall be 0.6 percent/min minimum, when determined by the method specified in IS 8167.

7.2 The relative reducibility of the iron ore pellets at the end of three hours shall be 65 percent, minimum when determined as per the method given in IS 11292.

8 SWELLING INDEX

The swelling index of the iron ore pellets when determined in accordance with IS 8624 shall be 18 percent, Max.

9 SOFTENING CHARACTERISTICS

9.1 Softening characteristics of iron ore pellets (in powder form) shall be determined in accordance with IS 9660 and its requirement shall be agreed to between the supplier and the purchaser. A typical value of the start of softening temperature should be 1 125°C minimum.

9.2 The softening point of the pellets (in powder form) when determined as per IS 11283 should show a softening start temperature of 1 125°C.

10 TUMBLER INDEX

Tumbler index of iron ore pellets shall be 92 percent Min on + 6.3 mm and 6 percent Max on –0.500 mm when determined in accordance with IS 6495.

11 SAMPLING

Representative samples of iron ore pellets shall be drawn according to the scheme of sampling given in IS 9101.

Reduction Degradation Index (RDI), Thermal Degradation Index (TDI) (For Shaft DRI processes) and/or Low Temperature Breaking Test (LTBT) in Linder Apparatus (for rotary kiln DRI processes) may be considered for the high temperature strength assessment with/without reduction of iron ore pellet for DRI processes. This is for lumps also.
ANNEX A

( Foreword )

COMMITTEE COMPOSITION

Sponge Iron & Smelting Reduction Sectional Committee, MTD 30

Organization

Tata Iron & Steel Co Ltd, Jamshedpur
Central Fuel Research Institute, Dhanbad
Essar Steels, Mumbai
Gas Authority of India, New Delhi
GSAL Ltd, Hyderabad
HEG Ltd, Durg
Ispat Industries Ltd (Nippo Denro), Raigad
Jindal Steel & Power Ltd, Raigarh
Kadremukh Iron Ore Co Ltd, Chikmaglur
MECON (India) Ltd, Ranchi
Ministry of Steel, New Delhi
M. N. Dastur & Co (P) Ltd, Kolkata
Monnet Ispat Ltd, Raipur
Mukand Ltd, Thane
National Metallurgical Laboratory, Jamshedpur
National Mineral Development Corporation Ltd, Hyderabad
Nova Iron & Steel Co Ltd, Bilaspur
Orissa Sponge Iron Ltd, Distt Keonjhar
Prakash Industries, New Delhi
Raipur Alloys, Raipur
SAIL, R&D Centre, Ranchi
Sponge Iron Manufacturers' Association, New Delhi
Sponge Iron India Ltd, Khammam
Steel Furnace Association of India, New Delhi
Sunflag India Ltd, Bhandara
TATA Sponge Iron, Distt Keonjhar
Usha (India) Ltd, New Delhi
Vikram Ispat, Mumbai
BIS Directorate General

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Representative
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Shri R. G. Rajan
Shri P. S. Saradhi (Alternate)
Shri K. P. Patnaik
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Shri V. V. Jain
Shri A. K. Saxena (Alternate)
Shri K. C. Tiwari
Shri U. Bhattacharjee (Alternate)
Shri T. R. R. Rao
Shri P. Bhattacharyya
Shri A. K. Agrawal (Alternate)
Shri D. K. Poddar
Shri S. K. Bhatnagar (Alternate)
Shri Adhip Sengupta
Ms Aditi Tarafdar (Alternate)
Shri B. L. Verma
Shri C. H. Sharma
Dr Swatantra Prakash
Representative
Shri A. Rajasekaran
Shri B. Gopichand (Alternate)
Shri N. K. Patnaik
Shri S. C. Jena (Alternate)
Representative
Shri N. Rath
Shri G. I. S. Chauhan
Dr K. K. Prasad (Alternate)
Shri S. S. Bhatnagar
Shri M. Amareeshwar Rao
Shri M. S. Unnikrishnan
Shri D. K. Gaur
Shri S. P. Das (Alternate)
Shri B. M. Sarangi
Shri B. K. Roy
Dr S. K. S. Yadav
Shri N. Mitra, Director & Head (MTD)
[Representing Director General (Ex-officio Member)]

Member Secretary
Shri Ram Awadh Ram
Deputy Director (MTD), BIS
Bureau of Indian Standards

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This Indian Standard has been developed from Doc: No. MTD 30 (4293).

Amendments Issued Since Publication

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<th>Date of Issue</th>
<th>Text Affected</th>
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Printed at Prabhat Offset Press, New Delhi-2