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MTD 13 (20343)

Indian Standard

IRON ORE PELLETS FOR FEEDSTOCK OF BLAST FURNACE SPECIFICATION

1 SCOPE

1.1 This standard covers the specification of iron ore pellets to be used as feedstock of blast furnace for iron making

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:

IS No.	Title
1387:1993	General requirements for the Supply of metallurgical materials *(first revision)*
1493	Methods of chemical analysis of iron ores:
(Part 1) : 1981	Determination of common constituents *(first revision)*
(Part 3) : 1987	Determination of titanium chromium, vanadium, calcium and magnesium by atomic absorption spectrophotometry
(Part 5) : 1990	Determination of copper Content by atomic absorption spectrometric method
(Part 6) : 1990	Determination of sodium and/or potassium content by atomic absorption spectrometric method
6495 : 1984	Method of tumbler test for iron oxides pellets ores, sinter and pellets *(first revision)*
8604 : 1977	Determination of compression strength of iron ore pellets after reduction
8624 : 1995	Determination of compression strength of iron ore pellets after pellets
8625 : 1986	Method for determination of crushing strength of iron ore pellets
9101 : 1979	Method of sampling iron ore pellets
9660 : 1980	Guidelines for determination of softening characteristics of iron ore pellets
10823:1994	Methods for Determination of Thermal Degradation Index [TDI] & Reduction Degradation Index [RDI] of Lump iron Ores, Sinters & Pellets
11283 : 1985	Method for determination of softening point of iron oxides (in powder form) lump ore, sinter and pellets.
11292 : 1985	Method for determination of relative reducibility of iron oxides : lump ores, sinter and pellets
11348	Iron ore pellets - Apparent specific gravity, true specific gravity and porosity - Method for determination apparent.

3 Terminology:

3.1 Lump Ore: Iron ore (not being iron ore concentration products) which is nominally sized over 6.3mm and less than 30mm.

3.2 Iron Ore pellets: Spherical agglomerates formed by balling fine ores, usually finer than 100 µm, with various additives followed sometimes by hot or cold bonding induration.

3.3 Loss of Ignition (LOI): Change in mass of an ore held at 1000°C, excluding the loss due to absorbed water content of an ore (equilibrated with the laboratory atmosphere) that can be removed by heating for 2 hours at 105°C.

3.4 Cold Crushing Strength (CCS): Maximum load (applied under specified conditions at room temperature) divided by the area over which the load is applied, which a refractory can withstand before failure occurs.

3.5 Tumbler index: It is a relative measure of the resistance of lump ore (3.1), agglomerates or hot briquetted iron to size degradation by impact, referred to as TI and expressed as the percentage by mass of the +6.3mm fraction generated in the test portion after tumbling.

3.6 Abrasion index: the abrasion index is a relative measure of the resistance of lump ore (3.1), agglomerates or hot briquetted iron to size degradation by abrasion, referred to as AI and expressed as the percentage by mass of the −500µm fraction generated in the test portion after tumbling.

3.7 Apparent Porosity: The ratio of the volume of the open pores to the bulk volume of the solid material, expressed as a percentage.

3.8 Reduction Degradation Index (RDI): The degradation of the iron bearing materials because of reduction and related stresses introduced in the matrix due to phase changes. Measured as a percentage by mass.

3.9 Relative Reducibility: The final degree of reduction attained after a prescribed period of time and with other specified condition.

3.10 Swelling index: A relative measure of the volume increase of iron ore pellets which occurs during the free swelling test. The index is expressed as a percentage.

4 SUPPLY OF MATERIAL

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

5 CHEMICAL COMPOSITION

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

Table 1: chemical composition

Constituent	Percentage
Fe (Total)	64 *Min*
$SiO_2 + Al_2O_3$	6.0 *Max*
Ratio of Al_2O_3/ SiO_2	Less than 1
CaO + MgO	0.5 *Min* and shall be as agreed mutually between the manufacturer and the purchaser.
S	0.01 *Max*
P	0.08 *Max*
Total of Pb, Zn, Cu, Sn, Cr and As	0.02 *Max*
Alkali ($Na_2O + K_2O$)	To be agreed upon between the supplier and the purchaser

However, the supply of material of a composition with limits outside those specified in **5.1**, the specification of the iron ore pellets required shall have to be agreed between the purchaser and the supplier.

Moisture — 3 percent *Max* during dry season and 6 percent *Max* during rainy season or as agreed upon in both cases.

5.2 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) or as per latest version of any other established, instrumental/chemical method. In case of

dispute, the procedure given in the latest edition of IS 1493 and its relevant parts for chemical analysis shall be the Referee Method.

6 PHYSICAL CHARACTERISTICS

6.1 SIZE:

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:

+18mm	5 percent, *Max*
-18 & +5mm	90 percent, *Min*
-5 mm	5 percent, *Max*

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. In case of any dispute, the test sieves used for sizes distributions shall be in accordance with IS 460 (relevant parts).

5.2 Cold crushing strength (CCS)

The average cold crushing 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 220 kg per pellet. Pellets with strength less than 80 kg/pellet shall not exceed 5 percent of the number of pellet selected for testing. The random selection of test portion pellets excluding broken or chipped pellets comprising of pellets with less than 80kg/pellet shall be treated as unfired.

5.3 Tumbler Index

Tumbler index of iron ore pellets shall be 92 percent *Minimum* and Abrasion Index shall be less than 6 percent. The tumbler index shall be in accordance with IS 6495 and Abrasion index is -0.5 mm sized material obtained after 200 revolution.

5.4 Apparent Porosity

Apparent porosity of iron ore pellets shall be 25 percent *Minimum*. The apparent porosity should be determined in accordance with IS 11348 or Porosity meter higher porosity is desirable with sufficient strength.

6 Metallurgical Characteristics

6.1 Reduction Degradation Index (RDI):

Reduction degradation Index (RDI) of iron ore pellets shall be less than 20 percent. Lower reduction degradation index is desirable for feed to blast furnace. RDI should be determined in accordance with IS 10823, lower Reduction Degradation Index (RDI) indicate Good strength of pellet under mild reducing condition at 550^0C temperature.

6.2 Thermal Degradation Index (TDI):

(For fine generation due to thermal shock at the time of charging of pellet inside the blast furnace) and/or Low Temperature Breaking Test (LTBT) in Linder Apparatus may be considered for the high temperature strength assessment with/without reduction of iron ore pellet.

6.3 Relative Reducibility

The relative reducibility of the iron ore pellets shall be minimum 60 percent, the iron ore pellet subjected to reducing atmosphere at 900^0C temperature for three hours. Oxygen removed from the iron ore pellets after three hours of reduction recorded as Relative Reducibility in accordance with IS 11292. Higher relative reducibility with requisite strength pellet is desirable.

6.4 SWELLING INDEX

The swelling index of the iron ore pellets shall be less than 18 percent, the permeability of iron bearing burden inside the blast furnace depends upon swelling index, and lower swelling index promotes better permeability. Hence lower swelling index of iron ore pellet is desirable. The swelling index of pellet shall be determined in accordance with IS 8624.

6.5 SOFTENING CHARACTERISTICS

Softening characteristics of iron ore pellets shall be determined in accordance with IS 9660, softening temperature of iron ore pellets should be more than 1125°C under intense reducing condition. Softening temperature of iron bearing material has direct impact on size shape and location of cohesive zone inside the blast furnace.

7 SAMPLING

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