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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 24531-2009

**Iron ores for blast furnace and direct reduction feedstocks --
Determination of the tumble and abrasion indices**

高炉和直接还原用铁矿石 转鼓和耐磨指数的测定

(English Translation)

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1 Scope

This Standard specifies a method to evaluate the resistance of iron ores to size degradation by impact and abrasion. It covers the determination of the tumble and abrasion indices.

This Standard is applicable to lump ores, sinters and hot-bonded pellets.

2 Normative references

The following documents contain provisions which, through reference in this

Standard, constitute provisions of this Standard. For the dated references, their subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, the parties who enter into agreement based on this

Standard are encouraged to investigate whether the latest editions of these documents are applicable. For undated reference documents, the latest editions apply to this Standard.

GB/T 6003.1 Test sieves of metal wire cloth (GB/T 6003.1-1997, eqv ISO 3310-1:1990)

GB/T 6003.2 Test sieves of perforated metal plate (GB/T 6003.2-1997, eqv ISO 3310-2:1990)

GB/T 10322.1 Iron ores - Sampling and sample preparation procedures (GB/T 10322.1-2000, idt ISO 3082:1998)

GB/T 10322.7 Iron ore - Determination of size distribution by sieving (GB/T 10322.7-2004, ISO 4701:1999, IDT)

For sinters and lump ores, the test sample shall be separated into 4 fractions by sieving through 25.0 mm, 16.0 mm and 10.0 mm sieves. From the material on the 3 sieves, at least 4 test portions, each of $15 \text{ kg} \pm 0.15 \text{ kg}$ mass, shall be reconstituted by taking a proportionate mass of material from each of the 3 fractions. Register the mass and number of each test portion.

6.1 General

The test apparatus shall comprise:

- a) ordinary laboratory equipment, such as an oven, hand tools and safety equipment;
- b) a tumble drum and rotation equipment;
- c) test sieves;
- d) a weighing device.

6.2 Tumble drum

It is made of steel plate at least 5 mm in thickness, having an internal diameter of 1000 mm and an internal length of 500 mm. Two equally spaced L-shaped steel lifters 50 mm flat x 50 mm high x 5 mm thick and 500 mm long shall be solidly attached longitudinally inside the drum by welding, in such a manner as to prevent accumulation of material between the lifter and drum. Each lifter shall be fastened so that it points towards the axis of the drum, with its attached leg pointing away from the direction of rotation, thus providing a clear unobstructed shelf for lifting the sample. The door shall be so constructed as to fit into the drum to form a smooth inner surface. The door shall be rigidly fastened and sealed to prevent loss of the sample. The drum shall be rotated on stub axles attached to its ends by flanges welded so as to provide smooth inner surfaces.

The drum shall be replaced, in any case, when the thickness of the plate is reduced to 3 mm in any area. The lifters shall be replaced when the height of the shelf is reduced to less than 47 mm.

Figure 1 shows an example of a tumble drum.

7.1 Number of determinations for the test

Carry out the test as many times as required by the procedure in Annex A.

7.2 Tumbling

Take, at random, one of the test portions prepared in 5.2, record its mass (m_0) and place it in the tumble drum (6.2). Tightly fasten the door and rotate the drum at $25 \text{ r/min} \pm 1 \text{ r/min}$ for a total of 200 revolutions. Stop the drum and keep the door fastened for 2 min before opening, to allow the dust to settle.

DANGER: Tumbling can be noisy and care must be taken to protect the hearing of the operator.

It is recommended that putty, clay or rubber be used to seal the door, to prevent the loss of fines from the drum.

7.3 Sieving

Remove all the material carefully from the drum and hand sieve it on the 6.30 mm and 500 μm sieves (6.4), in accordance with GB/T 10322.7. Determine and record the mass of each fraction retained on the 6.30 mm (m_1) and 500 μm (m_2) sieves to the nearest 1 g. Material lost during sieving shall be considered to be part of the -500 μm fraction.

Note: Scalping sieves can be used to lessen the load on the critical sieves.

The difference between the initial mass of the test portion and the total mass of the fractions shall not exceed 1.0 %. If this difference exceeds 1.0 %, the test shall be rejected.

8.1 Calculation of the tumble index (TI) and abrasion index (AI)

The tumble index, TI, and the abrasion index, AI, expressed as percentages by mass, are calculated from the formulas (1) and (2):