

INTERNATIONAL  
STANDARD

**ISO**  
**4700**

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**Iron ore pellets — Determination of crushing strength**

*Boulettes de minerais de fer — Détermination de la résistance à l'écrasement*

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Reference number  
ISO 4700:1996(E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 4700 was prepared by Technical Committee ISO/TC 102, *Iron ores*, Subcommittee SC 3, *Physical testing*.

This second edition cancels and replaces the first edition (ISO 4700:1983), which has been technically revised.

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# Iron ore pellets — Determination of crushing strength

## 1 Scope

This International Standard specifies a method for the determination of the crushing strength of fired iron ore pellets.

This method is not applicable to cylindrical agglomerates, briquettes or reduced iron ore pellets.

## 2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10836:1994, *Iron ores — Method of sampling and sample preparation for physical testing*.

ISO 11323:1996, *Iron ores — Vocabulary*.

## 3 Definition

For the purposes of this International Standard, the following definition from ISO 11323 applies:

**3.1 crushing strength:** The value of the compressive load applied to individual pellets to cause breakage in a compression test.

## 4 Principle

A compressive load is applied to a single iron ore pellet at a specified speed of the compressive platen until the pellet is broken.

This procedure is repeated on all the pellets in the test sample.

## 5 Apparatus

### 5.1 Loading unit

**5.1.1** The loading capacity shall be 10 kN or greater.

**5.1.2** The compressive platens shall be flat and shall be installed in mutually parallel planes; the portion of the surface of the platens that will be in contact with the sample shall be made of surface-hardened steel.

**5.1.3** A device capable of setting the speed of the compressive platen at 10 mm/min to 20 mm/min over the entire test period shall be used.

NOTE 1 If the platen speed is not constant during the test cycle, results may differ depending upon the test machine used. More uniform results may be obtained using a test machine that applies a constant load increase.

### 5.2 Indicating unit

#### 5.2.1 Load transmission system

**5.2.1.1** The means for transmission of the applied load to the indicating unit shall be either a load cell or a lever.

**5.2.1.2** The capacity of the load cell shall be at least 10 kN.

#### 5.2.2 Load indicator or recorder

**5.2.2.1** The means for indicating the applied load shall be either an electric indicator (digital read-out device, recording chart, meter with needle rider or other suitable device) for the load cell type, or a mechanical indicator (gauge equipped with needle rider or other suitable device) for the lever type.

**5.2.2.2** When using a load cell, the chart-recorder pen-response time shall be 1,0 s or less for a full-scale deflection.

**5.2.2.3** The minimum graduation shall be 1/100 of the full scale.

**5.2.2.4** The compression device shall be calibrated regularly

## 6 Preparation of test samples

### 6.1 Taking of test sample

The test sample (test pieces) for determining the crushing strength shall be obtained at random, for example by the use of a random selection plate, on about 1 kg of the sample for physical testing which has been taken and prepared in accordance with ISO 10836.

The test sample shall be oven-dried at  $105\text{ °C} \pm 5\text{ °C}$  to constant mass and cooled to room temperature before testing.

### 6.2 Number of test pieces (iron ore pellets)

Sixty or more test pieces, as agreed upon at the time of order, shall be tested for each sample.

NOTE 2 A method of determining the exact number of test pieces to obtain a specific precision in the test results is to use the following equation:

$$n = \left( \frac{2\sigma}{\beta} \right)^2$$

where

$n$  is the number of test pieces;

$\sigma$  is the standard deviation, in newtons, derived from several experiments;

$\beta$  is the required precision, in newtons, for 95 % confidence levels.

### 6.3 Size range

The size range of the test pieces shall be  $-12,5\text{ mm}$  to  $+10,0\text{ mm}$ , or as agreed upon at the time of order.

## 7 Procedure

Place a test piece (single pellet) at the approximate centre of the surface-hardened portion of the lower platen. Apply the load at a constant platen speed between 10 mm/min and 20 mm/min throughout the test period.

The test is complete when:

- either the load falls to a value of 50 % or less of the maximum load recorded (see figure 1),
- or the platen gap has reduced to 50 % of the initial mean test piece diameter (see figure 2).

In either case, the crushing strength is the maximum load attained in the test.

## 8 Expression of results

The crushing strength of the sample is the arithmetic mean of all the measurements obtained. The result shall be expressed to at least one decimal place, in decanewtons per pellet.

## 9 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) the crushing strength, expressed as the mean value, in decanewtons, of all the measurements;
- c) the standard deviation of the measurements;
- d) the size distribution of the sample for physical testing and the size range(s) of the test pieces;
- e) a table of the relative frequency, in percent, of the measurements, classified at 50 daN intervals;
- f) the number of test pieces in each specified size range tested;
- g) the platen speed used, expressed in millimetres per minute.

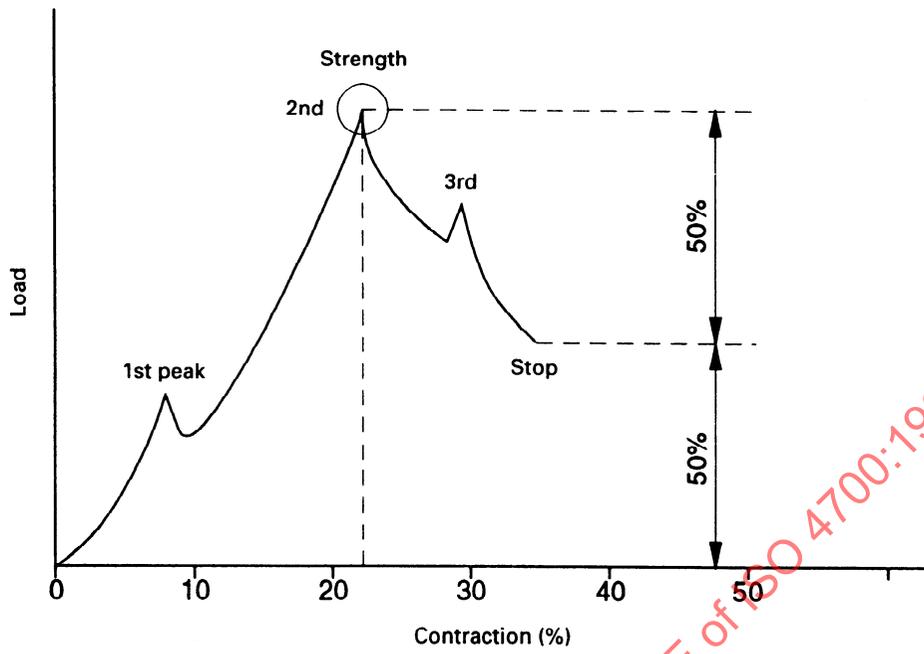


Figure 1 — Measurement of crushing strength as explained in the procedure (example 1)

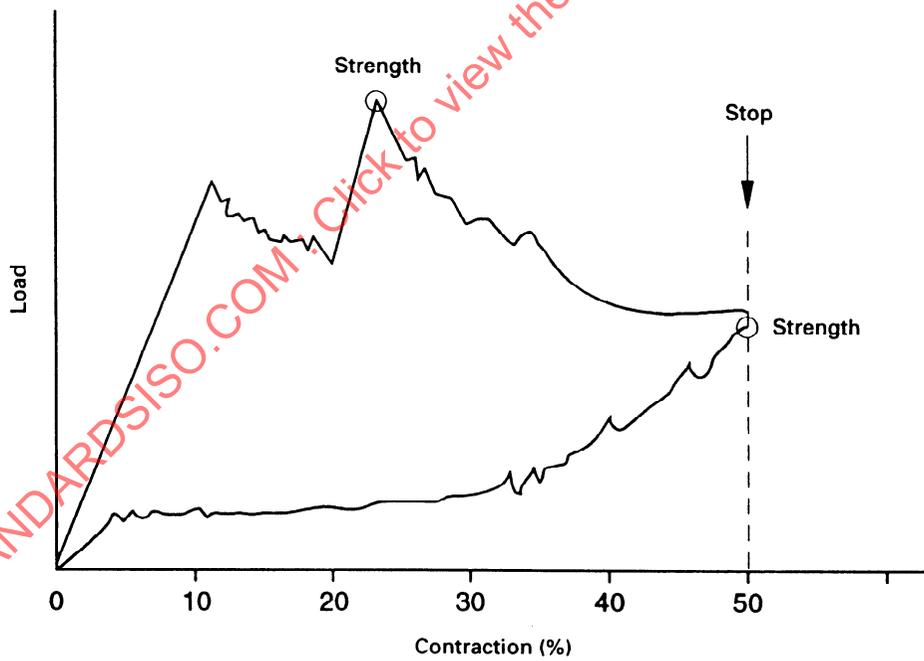


Figure 2 — Measurement of crushing strength as explained in the procedure (example 2)

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