



SLOVENSKI STANDARD
SIST ISO 4698:1998

01-maj-1998

Peletirana železova zrna - Ugotavljanje relativnega prostega indeksa nabrekanja

Iron ore pellets -- Determination of relative free-swelling index

Boulettes de minerais de fer -- Détermination de l'indice relatif de gonflement libre

Ta slovenski standard je istoveten z: ISO 4698:1994

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ICS:

73.060.10 Železove rude Iron ores

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en

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INTERNATIONAL
STANDARD

ISO
4698

First edition
1994-02-01

**Iron ore pellets — Determination of
relative free-swelling index**

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*Boulettes de minerais de fer — Détermination de l'indice relatif de
gonflement libre*

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Reference number
ISO 4698:1994(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 4698 was prepared by Technical Committee ISO/TC 102, *Iron ores*, Sub-Committee SC 3, *Physical testing*.

Annexes A and B form an integral part of this International Standard.

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Introduction

The method for the determination of the free-swelling index is one of several procedures used to evaluate the behaviour of iron ore pellets under specific reducing conditions. The conditions involved in this test are:

reduction under isothermal heating in an unconstrained state using a gaseous reductant;

a sample of specified size range.

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Iron ore pellets — Determination of relative free-swelling index

1 Scope

This International Standard specifies a method for the determination of the free-swelling index during unconstrained reduction of fired 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 3081:1986, *Iron ores — Increment sampling — Manual method*.

ISO 3082:1987, *Iron ores — Increment sampling and sample preparation — Mechanical method*.

ISO 3083:1986, *Iron ores — Preparation of samples — Manual method*.

ISO 3310-1:1990, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 free-swelling: A volume increase of fired iron ore pellets which occurs during reduction under unconstrained conditions.

3.2 free-swelling test: The determination of the unconstrained volume increase of iron ore pellets which occurs during reduction under specified conditions.

3.3 free-swelling index: A measure of the volume increase of fired iron ore pellets which occurs during reduction under unconstrained conditions, expressed as a percentage.

4 Principle

Determination of swelling of fired iron ore pellets of a specified size range under isothermal reduction, determination of the volume of pellets before and after reduction at a temperature of 900 °C, using a reducing gas consisting of carbon monoxide and nitrogen. Calculation of the free-swelling index, expressed as a percentage, using the difference between the two volumes.

5 Test conditions

5.1 General

The gas volumes and flow rates used in this International Standard are measured at a temperature of 0 °C and at atmospheric pressure [101,325 kPa¹⁾].

5.2 Composition of reducing gas

The composition of the reducing gas to be fed to the furnace shall be:

CO: 30 % ± 0,5 % (V/V)

N₂: 70 % ± 0,5 % (V/V)

1) 1 mmHg = 0,133 3 kPa; 1 atm = 0,101 325 MPa

5.3 Purity of reducing gas

The purity of the reducing gas shall be ensured by confirming that impurities do not exceed the following:

H₂: 0,2 % (V/V)

CO₂: 0,2 % (V/V)

O₂: 0,1 % (V/V)

H₂O: 0,2 % (V/V)

5.4 Flow rate of reducing gas

The flow rate of the reducing gas during the test period shall be maintained at 15 l/min \pm 1 l/min.

5.5 Reducing temperature

The temperature of the test portion shall be 900 °C \pm 10 °C during the test period. The reducing

gas shall be preheated before feeding to the furnace in order to maintain this temperature.

6 Apparatus (see figure 1)

6.1 Furnace, electrically heated, with a heating capacity that is sufficient to maintain the entire test portion and the gas contacting it at 900 °C \pm 10 °C.

6.2 Reduction tube, made of non-scaling, heat-resistant metal to withstand a temperature higher than 900 °C. The internal diameter of the reduction tube shall be 75 mm \pm 1 mm. The details of the reduction tube with the test portion holder are shown in figure 2.

6.3 Test portion holder, a wire basket made of non-scaling, heat-resistant metal to withstand a temperature higher than 900 °C. It shall have room for 18 pellets at three levels, each level holding six pellets in the size range of 10,0 mm to 12,5 mm.

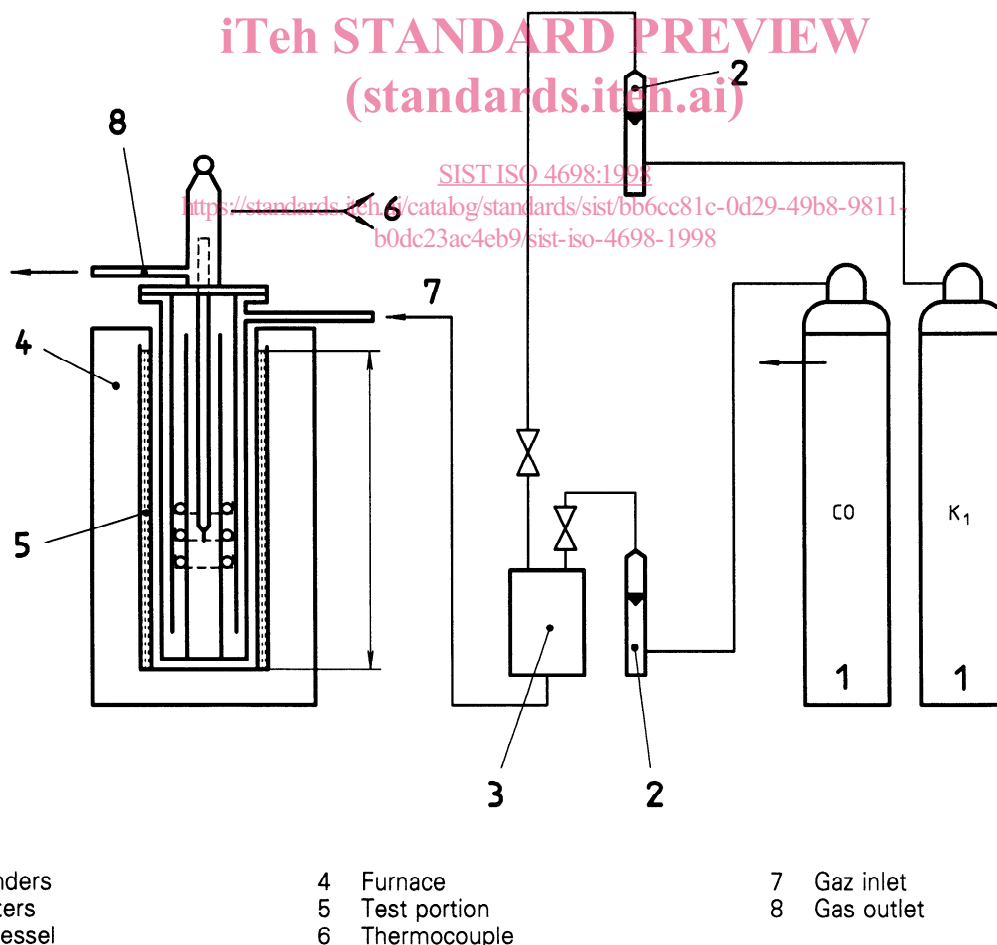
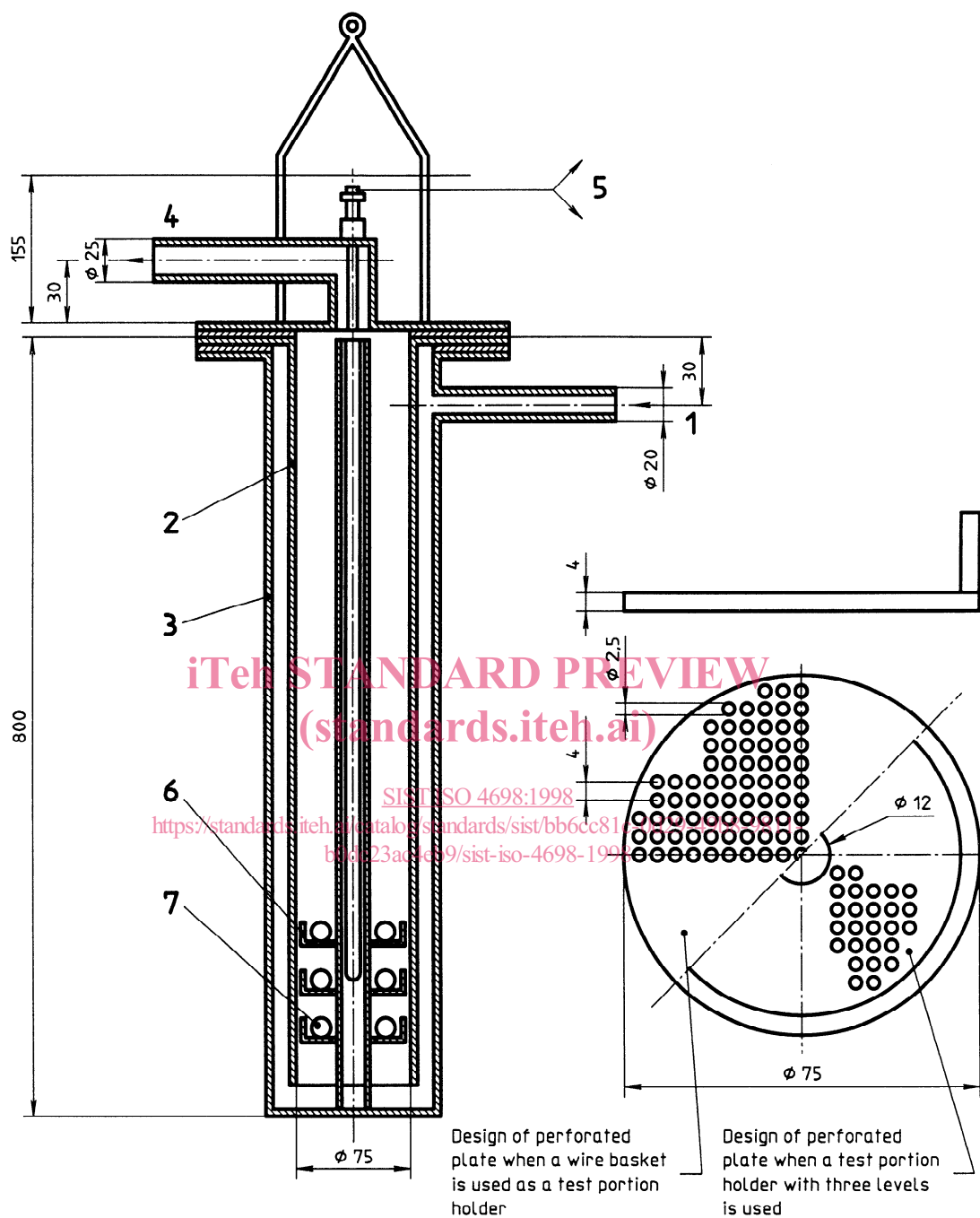


Figure 1 — Example of apparatus used for the reduction test

Dimensions in millimetres

**a) Reduction tube**

Key

- 1 Gas inlet
- 2 Inner retort
- 3 Outer retort
- 4 Gas outlet
- 5 Thermocouple
- 6 Test portion holder
- 7 Test portion

b) Perforated plate/test portion holder

Key

- | | |
|---------------------|----------------------|
| Hole diameter | 2,5 mm |
| Pitch between holes | 4 mm |
| Number of holes | 241 |
| Total hole area | 11,8 cm ² |
| Thickness of plate | 4 mm |
| Border | 3 × 7 mm |

Figure 2 — Example of reduction tube with test portion holder