

Iron ores — Experimental methods for checking the bias of sampling

ICS 73.060.10

Confirmed November 2009

National foreword

This British Standard is the UK implementation of ISO 3086:2006. It supersedes BS ISO 3086:1998 and BS 5662-3:1987 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/58, Iron ores.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2006

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ISBN 978 0 580 69922 1

Amendments/corrigenda issued since publication

Date	Comments
28 February 2010	Supersession text amended

INTERNATIONAL STANDARD

**ISO
3086**

Fourth edition
2006-04-15

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Reference number
ISO 3086:2006(E)

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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.

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The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 3086 was prepared by Technical Committee ISO/TC 102, *Iron ore and direct reduced iron*, Subcommittee SC 1, *Sampling*.

This fourth edition cancels and replaces the third edition (ISO 3086:1998), which has been technically revised.

Iron ores — Experimental methods for checking the bias of sampling

1 Scope

This International Standard specifies experimental methods for checking the bias of sampling of iron ores, when sampling is carried out in accordance with the methods specified in ISO 3082, having as reference a stopped-belt sampling method.

It is recommended that an inspection of the mechanical sampling system be carried out before conducting bias testing.

Sampling systems not completely in accordance with ISO 3082 are not always expected to be biased. Therefore, bias checking may be done when there is some disagreement about the importance of some departure from the conditions of ISO 3082. If one party argues that the bias is likely to be substantial under some particular set of conditions then bias testing should mostly be done when those conditions apply.

NOTE The method for analysis of experimental data described here may also be applied:

- a) for checking the bias of sample preparation of iron ores, having as reference the methods for sampling preparation according to ISO 3082;
- b) for checking the bias of size distribution of iron ores by sieving, having as reference the hand sieving methods according to ISO 4701;
- c) for checking a possibly significant difference in the results obtained from the samples of one lot collected at different places, for example, a loading point and unloading point.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3082:2000, *Iron ores — Sampling and sample preparation procedures*

ISO 3085:2002, *Iron ores — Experimental methods for checking the precision of sampling, sample preparation and measurement*

ISO 11323:2002, *Iron ore and direct reduced iron — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11323 apply.

4 Principle

The results obtained from the method to be checked (referred to as method B) are compared with the results of a reference method (referred to as method A) which is considered to produce practically unbiased results, from technical and empirical viewpoints.

In the event of there being no significant difference, in a statistical sense, between the results obtained by method B and method A, method B may be adopted as a routine method. This difference is assessed by comparing a 90 % confidence interval for the true average bias with the relevant bias, δ (see 5.2).

5 General conditions

5.1 The number of paired sets of measurement shall not be less than ten. The number of further tests required depends on the results of the outlier test and of the statistical analysis of the confidence interval for the true average bias, based on at least ten paired sets.

NOTE A paired set of measurement is a paired measurement data of samples, which are sampled by methods A and B, and prepared and measured in the same way, for identical material.

5.2 The relevant bias, δ , which is considered large enough to justify the likely expense of reducing the average bias, shall be decided beforehand. As a guide, δ is likely to be less than σ_{SPM} , the standard deviation for sampling, sample preparation and measurement, determined according to ISO 3085.

NOTE If the experiment is aimed at checking sample preparation only, the value of δ is likely to be less than σ_{PM} , determined according to ISO 3085.

5.3 Quality characteristics, such as total iron content, moisture content, size distribution and physical properties, may be used.

6 Sampling and sample preparation methods

6.1 Sampling

The reference method, method A, for checking the bias of sampling is a stopped-belt sampling method in accordance with ISO 3082.

Method A: take each increment from the full width and thickness of the ore stream on the stopped conveyor at a specified place, for a length of belt more than three times the nominal top size or 30 mm, whichever is the greater.

The method to be checked, method B, carried out according to ISO 3082 as far as possible, shall be compared with method A for the same material.

Method B: sampling methods, such as sampling from moving conveyors with a mechanical sampler and sampling during the transfer to or from ships and wagons, are examples of method B.

Samples from Methods A and B shall be taken as close together as possible. This is particularly important for ore streams which are known to be variable.

6.2 Sample preparation

6.2.1 Increments obtained from one lot, in accordance with methods A and B, are made up into two gross samples, A and B.

6.2.2 The gross samples, A and B, are subjected, in the same manner, to sample preparation as specified in ISO 3082, and tested as specified in the relevant International Standards separately, and a pair of measurements obtained.

6.2.3 The above procedure is performed on ten or more lots (see 5.1).

When increments for methods A and B can be taken from closely adjacent portions of the ore, it is recommended that sample preparation and testing be carried out on individual increments or on combinations of a small number of adjacent increments. This allows comparisons of ten or more pairs of measurements to be made more quickly than if measurements were only made on entire lots. The above comparison of measurements should be made on pairs of increments taken from several lots, preferably of the same type of ore. However, it is not permitted to combine a number of paired results, originating from both increments and gross samples. It should be either a number of pairs from increments or from gross samples.

NOTE Given the cost and inconvenience of stopped-belt sampling, it is generally economic to conduct sample preparation and measurement in duplicate and with great care so that the number of stopped-belt samples might be reduced.

7 Analysis of experimental data

NOTE The procedures described in 7.1 to 7.5 are also shown in the form of a flowsheet in Annex A (normative).

7.1 Computation of the differences

7.1.1 Denote measurements obtained in accordance with methods A and B, by x_{Ai} and x_{Bi} , respectively. When sampling preparation and measurement have been conducted in duplicate, these measurements will be averaged.

7.1.2 Calculate the difference, d_i , between x_{Ai} and x_{Bi} using the equation:

$$d_i = x_{Bi} - x_{Ai} \quad i = 1, 2, \dots, k \quad (1)$$

where k is the number of paired sets of measurements.

7.2 Determination of the mean and the standard deviation of the differences

7.2.1 Calculate the mean of the differences, $\bar{d}$, with one decimal place more than that used in the measurements themselves:

$$\bar{d} = \frac{1}{k} \sum d_i \quad (2)$$

7.2.2 Calculate the sum of squares, SS_d , and the standard deviation of the differences, S_d , with one decimal place more than that used in the measurements themselves:

$$SS_d = \sum d_i^2 - \frac{1}{k} \left(\sum d_i \right)^2 \quad (3)$$

$$S_d = \sqrt{\frac{SS_d}{(k-1)}} \quad (4)$$

7.3 Test for outliers – Grubbs' test

7.3.1 Sort d_i into ascending order.