

# Methods of sampling iron ores —

## Part 1: Manual method of increment sampling

[ISO title: Iron ores — Increment sampling — Manual method]

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# Committees responsible for this British Standard

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- British Steel Industry
- Institution of Mining and Metallurgy
- Mechanical Handling Engineers' Association

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# Contents

|                                                                                            | Page               |
|--------------------------------------------------------------------------------------------|--------------------|
| Committees responsible                                                                     | Inside front cover |
| National foreword                                                                          | ii                 |
| 1 Scope                                                                                    | 1                  |
| 2 Field of application                                                                     | 1                  |
| 3 References                                                                               | 1                  |
| 4 Definitions                                                                              | 1                  |
| 5 General procedures for manual sampling                                                   | 2                  |
| 6 Fundamentals of sampling                                                                 | 2                  |
| 7 Apparatus                                                                                | 8                  |
| 8 Method of manual sampling                                                                | 8                  |
| 9 Packing and marking of sample                                                            | 10                 |
| Annex A Equation for number of increments                                                  | 11                 |
| Annex B Sampling from ships and stockpiles                                                 | 12                 |
| Figure 1 — The precision of sampling for each mass of consignment                          | 6                  |
| Figure 2 — Minimum number of increments required                                           | 7                  |
| Figure 3 — Example of increment shovel                                                     | 8                  |
| Table 1 — Overall precision, $\beta_{SDM}$                                                 | 3                  |
| Table 2 — Minimum mass of increment                                                        | 3                  |
| Table 3 — Classification of quality variation, $\sigma_w$ and $\sigma_b$                   | 4                  |
| Table 4 — Minimum number of increments required, $n_1$ , and sampling precision, $\beta_s$ | 5                  |
| Table 5 — Minimum number of wagons or containers to be selected, $n_2$ ,                   | 8                  |
| Table 6 — Dimensions of increment shovel                                                   | 8                  |
| Table 7 — Values of $\sigma_w$ and $\sigma_b$                                              | 11                 |
| Publications referred to                                                                   | Inside back cover  |

# National foreword

This Part of BS 5660 has been prepared under the direction of the Iron and Steel Standards Committee. It supersedes BS 5660:1979, which is withdrawn. It is identical with ISO 3081:1986 “*Iron ores — Increment sampling — Manual method*”, published by the International Organization for Standardization (ISO).

**Terminology and conventions.** The text of the International Standard has been approved as suitable for publication as a British Standard without deviation. Some terminology and certain conventions are not identical with those used in British Standards; attention is drawn especially to the following.

The comma has been used as a decimal marker. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be read as “Part of BS 5660”.

**Cross-references**

| International Standard | Corresponding British Standard                                                                                                                            |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| ISO 3082:1987          | BS 5660 <i>Methods of sampling iron ores</i><br>Part 2:1987 <i>Mechanical method of increment sampling and sample preparation</i><br>(Identical)          |
| ISO 3083:1986          | BS 5661:1987 <i>Method for preparation of samples of iron ores by manual means</i><br>(Identical)                                                         |
| ISO 3084:1986          | BS 5662 <i>Evaluation of sampling methods for iron ores</i><br>Part 1:1987 <i>Experimental methods for evaluation of quality variation</i><br>(Identical) |
| ISO 3085:1986          | Part 2:1987 <i>Experimental methods for checking the precision of sampling</i><br>(Identical)                                                             |
| ISO 3086:1986          | Part 3:1987 <i>Experimental methods for checking the bias of sampling</i><br>(Identical)                                                                  |

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 1 Scope

This International Standard specifies manual methods of increment sampling on a consignment of iron ore for the purpose of determining the quality characteristics of the consignment, and includes

- a) the underlying theory;
- b) the basic principles;
- c) the basic requirements for the device and its operation.

NOTE The theory and basic principles given in this International Standard are similar to those given in ISO 3082 and ISO 3083.

## 2 Field of application

The methods are applicable to the sampling of all iron ores, whether natural or processed (for example, concentrates and agglomerates such as pellets, sinters or briquettes), to obtain samples for the determination of particle size distribution, moisture content, chemical composition, and physical properties.

The methods are applicable to the taking of samples of iron ores from conveyors, railway wagons or containers (including trucks), ships and stockpiles, during bunker discharge or during the loading or discharging of a consignment in cases where manual sampling can be carried out safely.

## 3 References

ISO 3082, *Iron ores — Increment sampling and sample preparation — Mechanical method*<sup>1)</sup>.

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

ISO 3084, *Iron ores — Experimental methods for evaluation of quality variation*.

ISO 3085, *Iron ores — Experimental methods for checking the precision of sampling*.

ISO 3086, *Iron ores — Experimental methods for checking the bias of sampling*.

## 4 Definitions

For the purpose of this International Standard, the following definitions apply:

### 4.1

#### lot

a definite quantity of an ore, processed or produced under conditions which are presumed uniform

### 4.2

#### consignment

a quantity of an ore delivered at one time. The consignment may consist of one or more lots or parts of lots

### 4.3

#### increment

a quantity of an ore taken by a sampling device at one time from a consignment

### 4.4

#### increment sampling

the process in sampling whereby a sample is taken by combining a number of increments from a consignment and intended to represent the consignment

### 4.5

#### manual sampling

sampling by human effort with sampling devices, including mechanically assisted devices

### 4.6

#### subsample

- 1) A quantity of an ore consisting of two or more increments taken from a consignment.
- 2) An aggregation of two or more increments each of which may have been individually crushed and/or divided as necessary.

### 4.7

#### gross sample

- 1) The quantity of an ore consisting of all the increments taken from a consignment.
- 2) An aggregation of all the increments or all the subsamples each of which may have been individually crushed and/or divided as necessary.

### 4.8

#### test sample

any sample, for the determination of size distribution, moisture content, chemical composition or other physical properties, which is prepared from each increment, each subsample, or from the gross sample in accordance with the specified method for that type of sample

### 4.9

#### maximum particle size

the particle size expressed in terms of the size of opening of the sieve on which approximately 5 % (*m/m*) of iron ore is retained

NOTE The maximum particle size of the consignment shall be ascertained either from past experience or by experiment. However, if no information is available, visual estimation is acceptable.

### 4.10

#### stratified sampling

for a consignment which can be divided into strata, sampling carried out in such a way that specified numbers of increments in proportion to the mass of each stratum are drawn from each stratum

<sup>1)</sup> At present at the stage of draft.

in this International Standard, the method can be applied to sampling from ships, and to sampling from wagons or containers

NOTE A stratum is part of a consignment partitioned according to specific criteria.

#### 4.11

##### systematic sampling

sampling in which increments are taken from a consignment at regular intervals

when a mass interval is adopted, it is called **systematic sampling on a mass basis**, and when a time interval is adopted, it is called **systematic sampling on a time basis**

the theory of systematic sampling is based on that of stratified sampling and is applied, in this International Standard, to sampling from conveyors and from bunker discharge

#### 4.12

##### two-stage sampling

sampling by which primary sampling units are selected first from a consignment and then secondary sampling units are taken from those selected primary sampling units

in this International Standard, the method can be applied to sampling from wagons or containers in which a certain number of wagons or containers are selected first as primary sampling units and then increments are taken from those selected wagons or containers as secondary sampling units

## 5 General procedures for manual sampling

Sampling shall be carried out while a consignment is being transferred.

The general sampling procedure shall be as follows:

- identify the consignment or part of the consignment to be sampled;
- ascertain the maximum particle size of the consignment;
- determine the mass of increment according to the maximum particle size;
- ascertain the classification of quality variation of the consignment (see ISO 3084);
- determine the minimum number of increments to be taken from the consignment, in the cases of systematic and stratified sampling; in the case of two-stage sampling, allocate the wagons or containers to be selected to the entire consignment and the increments to be taken to the points of the wagons or containers selected;

f) determine the interval of taking increments in the case of systematic sampling and stratified sampling or the interval of selecting the wagons or containers on a mass basis;

g) determine the point of sampling and the method of taking increments;

h) take increments having almost uniform mass during the whole period of handling the consignment.

Increments taken by this International Standard shall be prepared in accordance with ISO 3082 or ISO 3083.

## 6 Fundamentals of sampling

### 6.1 Overall precision

This International Standard is designed to attain an overall precision,  $\beta_{\text{SDM}}$ , as given in Table 1, at a probability level of 95 %, with respect to the mean values of the total iron content, moisture content and size fraction of a consignment.<sup>2)</sup> However, the overall precision may be agreed upon between the interested parties.

The overall precision of an intermediate mass of consignment other than those shown in Table 1 may be obtained by linear interpolation.

Variations from the other tables in this International Standard may be made, provided it can be demonstrated that the overall precision limits given in Table 1 can be met. The precision should be determined in accordance with ISO 3085.

Generally, for chemical elements other than total iron, the values of overall precision will be smaller than those for the total iron content specified in Table 1.

The overall precision,  $\beta_{\text{SDM}}$ , is a measure of the combined precision of sampling, sample division and measurement, and is twice the overall precision in terms of standard deviation,  $\sigma_{\text{SDM}}$ , expressed as an absolute percentage, i.e.

$$\beta_{\text{SDM}} = 2\sigma_{\text{SDM}} = 2 \sqrt{\sigma_{\text{S}}^2 + \sigma_{\text{D}}^2 + \sigma_{\text{M}}^2}$$

where

$\sigma_{\text{S}}$  is the precision of sampling in terms of standard deviation;

$\sigma_{\text{D}}$  is the precision of sample division in terms of standard deviation;

$\sigma_{\text{M}}$  is the precision of measurement in terms of standard deviation.

<sup>2)</sup> The overall precision of physical properties will be added to Table 1 in the future.