SLOVENSKI STANDARD
SIST ISO 10277:2000

01-junij-2000

Aluminijeve rude - Poskusne metode za preverjanje natanļ nosti vzorļ enja

Aluminium ores -- Experimental methods for checking the precision of sampling

Minerais alumineux -- Méthodes expérimentales de contrôle de la fidélité d'échantillonnage

Ta slovenski standard je istoveten z: ISO 10277:1995

ICS:

73.060.40 Aluminijeve rude Aluminium ores

SIST ISO 10277:2000 **en**

INTERNATIONAL STANDARD

ISO 10277

First edition
1995-03-15

Aluminium ores — Experimental methods for checking the precision of sampling

Minerais alumineux — Méthodes expérimentales de contrôle de la fidélité d'échantillonnage

Reference number
ISO 10277:1995(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 10277 was prepared by Technical Committee ISO/TC 129, *Aluminium ores*, Subcommittee SC 1, *Sampling*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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Printed in Switzerland

Aluminium ores — Experimental methods for checking the precision of sampling

1 Scope

This International Standard specifies the experimental methods to be applied for checking the precision of sampling of aluminium ores, expressed in terms of the standard deviation, being carried out in accordance with the methods prescribed in ISO 8685.

NOTE 1 These methods may also be applied for the purpose of checking the precision of preparation of samples being carried out in accordance with the methods prescribed in ISO 6140.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 10277. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 10277 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 6139:1993, *Aluminium ores — Experimental determination of the heterogeneity of distribution of a lot.*

ISO 6140:1991, *Aluminium ores — Preparation of samples.*

ISO 8685:1992, *Aluminium ores — Sampling procedures.*

3 Symbols

The following symbols are used throughout this International Standard:

d_2 factor to estimate the standard deviation from the range ($d_2 = 1{,}128$ for a pair of determinations)

n number of increments

R_1 absolute difference between determinations on subsample A and subsample B

$\overline{R}_1$ mean absolute difference between determinations on subsamples A and B for n_s sampling units

R_2 absolute difference between determinations on divided subsamples B_1 and B_2

$\overline{R}_2$ mean absolute difference between determinations on divided subsamples B_1 and B_2 for n_s sampling units

R_3 absolute difference between determinations on the same divided subsample B_2

$\overline{R}_3$ mean absolute difference between determinations on the same divided subsample B_2 for n_s sampling units

x subsample values

$\bar{x}$ mean value of a quality characteristic

x_1 determination on subsample A

x_2 determination on subsample B

x_3 determination on divided subsample B_1

x_4 determination on divided subsample B_2

x_i value of non-reference member of ith pair

x_{ri} value of reference member of ith pair

σ_S standard deviation of sampling

$\hat{\sigma}$ estimated value of σ

$\hat{\sigma}_M$ estimated standard deviation of measurement

$\hat{\sigma}_P$ estimated standard deviation of sample preparation

$\hat{\sigma}_{PM}$ estimated standard deviation of sample preparation and measurement

$\hat{\sigma}_S$ estimated standard deviation of sampling

$\hat{\sigma}_{SPM}$ estimated overall standard deviation of sampling, sample preparation and measurement

4 General conditions

4.1 General

The determination of precision of sampling is based on duplicate sampling from lots. If sample preparation and analysis is also carried out in duplicate, it is possible to determine the errors associated with those parameters in addition to the errors due to sampling.

4.2 Number of lots for the experiment

In order to reach a reliable conclusion, it is recommended that the experiment be carried out on more than 20 lots of the same type of aluminium ore. However, if this is impracticable, at least 10 lots should be covered and each lot shall be divided into several parts to produce more than 20 parts for the experiment. The experiment shall be carried out on each part, considering each part as a separate lot in accordance with ISO 8685.

4.3 Number of increments and number of gross samples

The minimum number of increments required for the experiment shall be twice the number specified in ISO 8685. Thus, if the number of increments required for the routine sampling is n and one gross sample is constituted, the minimum number of increments required for the experiments shall be $2n$ and two gross samples shall be constituted.

NOTE 2 If this is impracticable, n increments may be taken and divided into two parts, each comprising $n/2$ increments.

4.4 Sample preparation and testing

The preparation of samples shall be in accordance with ISO 6140 and the testing of samples shall be carried out in accordance with the methods prescribed in the relevant International Standards.

4.5 Replication of experiment

It is recommended that, even after a series of experiments has been conducted, the experiments should be repeated at regular intervals and when there is a change in ore quality. The experiment should also be repeated when there is a change in equipment or of ore supplier.

Because of the large amount of work involved in this method, it is recommended that the procedure should be carried out as a part of routine work of sampling and measurement.

5 Experimental

5.1 Duplicate samples

Each alternate primary increment is set aside in order to form gross samples A and B. The number of divided increments per primary increment is the same as that taken for routine sampling. An example of a sampling plan for gross samples A and B is shown in figure 1.

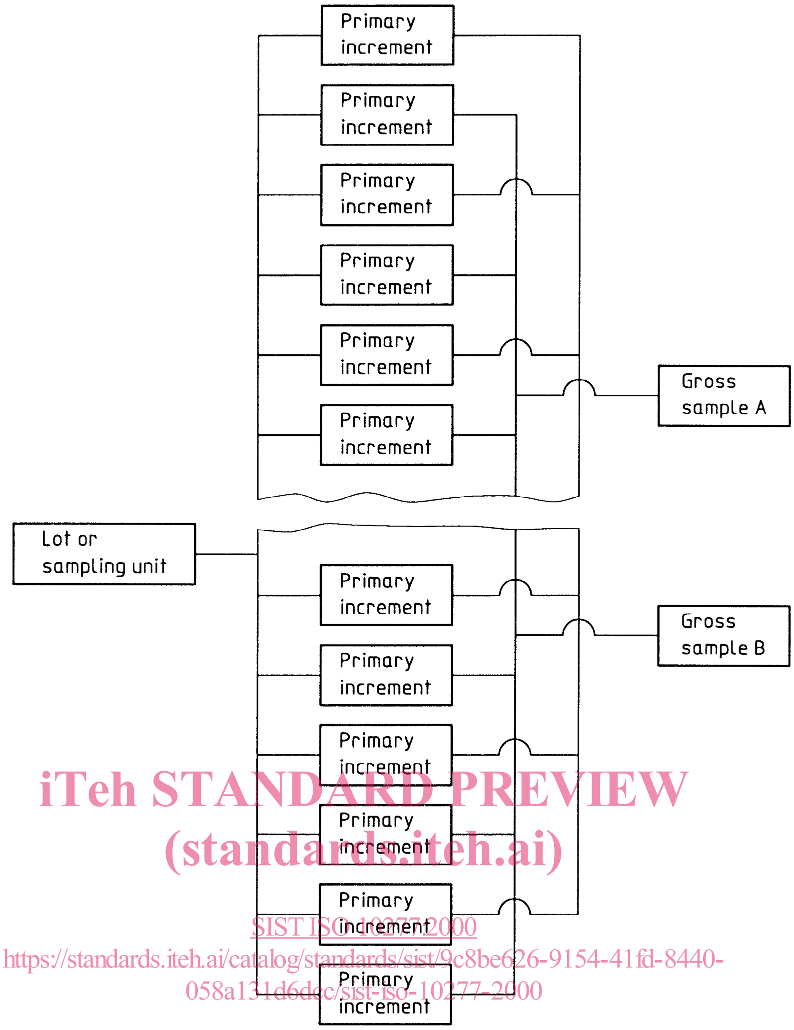

Figure 1 — Example of a plan of duplicate sampling

5.2 Sample division and testing

The two gross samples A and B taken in accordance with 5.1 shall be divided separately and subjected to either type 1, type 2 or type 3 testing as described in 5.2.1, 5.2.2 or 5.2.3 respectively.

5.2.1 Division-testing type 1 (see figure 2)

5.2.1.1 The two gross samples A and B shall be divided separately to prepare two final samples.

5.2.1.2 The four final samples A_1, A_2 and B_1, B_2 shall each be tested in duplicate. A total of eight tests shall be run in random order.

NOTE 3 In type 1 testing, the standard deviations of sampling, preparation and measurement are obtained separately.

5.2.2 Division-testing type 2 (see figure 3)

5.2.2.1 The gross sample A shall be divided to prepare two final samples, A_1 and A_2, and from the gross sample B, one final sample shall be prepared.

5.2.2.2 The final sample A_1 shall be tested in duplicate and the other final samples A_2 and B shall be tested individually.

NOTE 4 In type 2 testing, the standard deviations of sampling, preparation and measurement are obtainable separately. However, the precision for estimating the standard deviations of sampling, preparation and measurement will be lower than that attainable in type 1 testing.

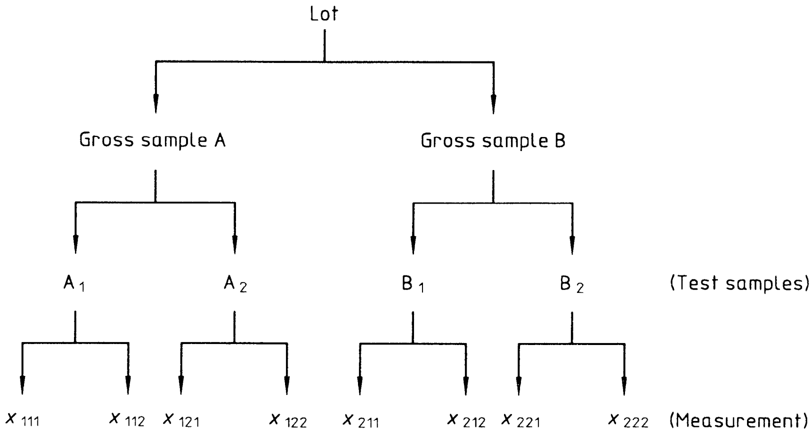

Figure 2 — Flowsheet for division-testing type 1

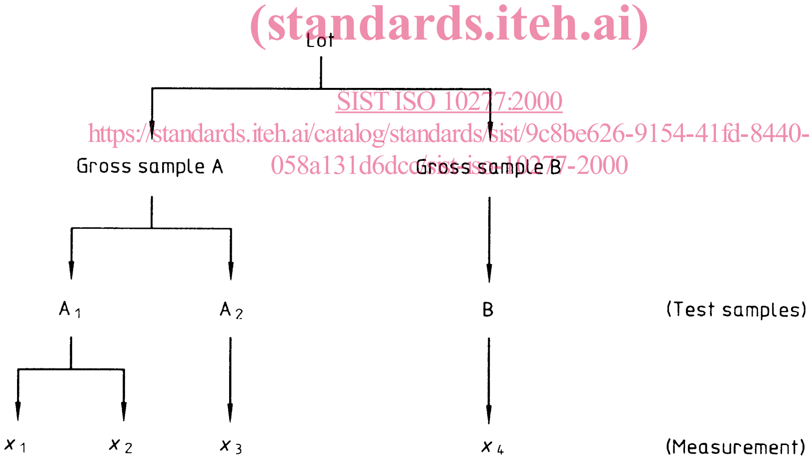

Figure 3 — Flowsheet for division-testing type 2

5.2.3 Division-testing type 3 (see figure 4)

5.2.3.1 From each of the two gross samples A and B, one final sample shall be prepared.

5.2.3.2 The two final samples A and B shall be tested individually.

NOTE 5 In type 3 testing, only the overall standard deviation of sampling, preparation and measurement is obtained.

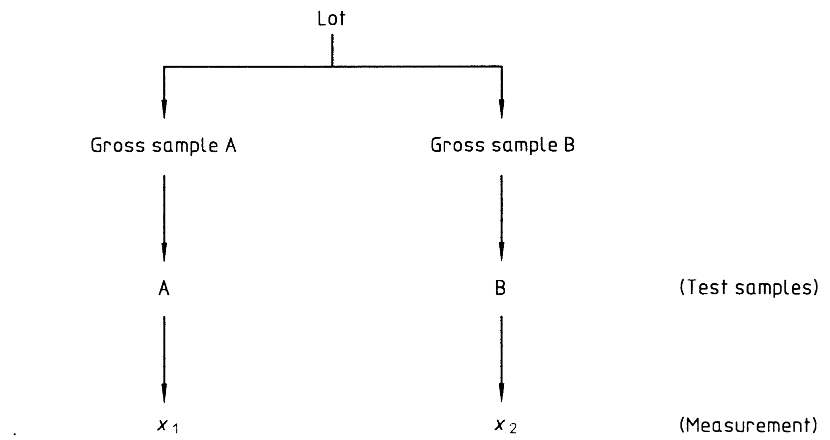

Figure 4 — Flowsheet for division-testing type 3

6 Analysis of experimental data

The procedure for the analysis of experimental data shall be as specified in 6.1 to 6.3 or in annex A for the type of division-testing selected. A procedure for treating data containing rogue results is included in the procedure (see example clause 7). When the data do not contain rogue values, the method in annex A may be used.

6.1 Division-testing type 1 (see figure 2 and sheet 2)

The estimated values of approximately 95 % probability standard deviation (hereinafter referred to simply as standard deviation) of sampling, preparation and measurement shall be calculated in accordance with the procedure given below:

a) Denote the pair of four measurements (such as Al_2O_3 as a percentage by mass) of a pair of two duplicate samples, prepared from the two gross samples A and B, as x_{111}, x_{112}, x_{121}, x_{122} and x_{211}, x_{212}, x_{221}, x_{222}.

b) Calculate the mean and the range for each pair of duplicate measurements:

$$\bar{x}_{ij.} = \frac{1}{2}(x_{ij1.} + x_{ij2}) \qquad \ldots (1)$$

$$R_1 = |x_{ij1} - x_{ij2}| \qquad \ldots (2)$$

where

$i = 1$ and 2, stands for gross samples A and B respectively;

$j = 1$ and 2, stands for final samples A_1, B_1 and A_2, B_2 respectively.

c) Calculate the mean and the range for each pair of duplicate samples:

$$\bar{\bar{x}}_{i..} = \frac{1}{2}(\bar{x}_{i1.} + \bar{x}_{i2.}) \qquad \ldots (3)$$

$$R_2 = |\bar{x}_{i1.} - \bar{x}_{i2.}| \qquad \ldots (4)$$

d) Calculate the mean and the range for each pair of gross samples, A and B:

$$\bar{\bar{\bar{x}}} = \frac{1}{2}(\bar{\bar{x}}_{1..} + \bar{\bar{x}}_{2..}) \qquad \ldots (5)$$

$$R_3 = |\bar{\bar{x}}_{1..} - \bar{\bar{x}}_{2..}| \qquad \ldots (6)$$

e) Calculate the overall mean and the mean of ranges ($\bar{R}_1$, $\bar{R}_2$ and $\bar{R}_3$):

$$\overline{\overline{\overline{\overline{x}}}} = \frac{1}{k}\sum \overline{\overline{\overline{x}}} \qquad \ldots (7)$$

$$\bar{R}_1 = \frac{1}{4k}\sum R_1 \qquad \ldots (8)$$

$$\bar{R}_2 = \frac{1}{2k}\sum R_2 \qquad \ldots (9)$$

$$\bar{R}_3 = \frac{1}{k}\sum R_3 \qquad \ldots (10)$$

where k is the number of lots.

Calculate the control limits to construct the control charts for means and ranges.

Control limits for $\bar{x}$-chart:

$$\overline{\overline{\overline{\overline{x}}}} \pm A_2\bar{R}_1,\ \overline{\overline{\overline{\overline{x}}}} \pm A_2\bar{R}_2,\ \overline{\overline{\overline{\overline{x}}}} \pm A_2\bar{R}_3 \qquad \ldots (11)$$