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Fluorspar — Experimental methods for evaluation of quality variation

Spaths fluor — Méthodes expérimentales pour l'évaluation de la variation de qualité

Reference number
ISO 9497:1993(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.

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Fluorspar — Experimental methods for evaluation of quality variation

1 Scope

This International Standard specifies experimental methods for the evaluation of quality variation of fluorspar lots from the same source. These methods are to be used in conjunction with the sampling procedures specified in ISO 8868.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 8868:1989, *Fluorspar — Sampling and sample preparation.*

3 General conditions

3.1 Quality variation

The quality variation of fluorspar shall be determined by standard deviation within strata on stratified sampling and systematic sampling (denoted σ_w).

Two-stage sampling is employed in the sampling of wagons of fluorspar, in accordance with ISO 8868. However for the purposes of this International Standard an acceptable approximation of the formula for stratified sampling and systematic sampling will be used for sampling from wagons. Accordingly, the method for evaluation of variance between wagons by the two-stage sampling method is not specified in this International Standard.

3.2 Quality characteristics

The quality characteristics chosen for determining the quality variation are generally the calcium fluoride (CaF_2) content and the silica (SiO_2) content; however, it should be recognized that the moisture content, particle size distribution and other quality characteristics may have to be taken into account.

3.3 Sampling, sample preparation and testing

Sampling, sample preparation and testing of the sample for this investigation shall be carried out in accordance with the relevant International Standards.

3.4 Execution of investigation

The sample taken for routine determination of the quality of the lot may also be used for the present investigation.

The quality may vary as a result of changes in the following:

a) ore bodies in a mine;

b) method of mining;

c) method of ore dressing;

d) method of forming and reclaiming a pile;

e) method of loading and unloading;

f) mass of the lot.

Accordingly, it is recommended that the quality variation of lots of any given fluorspar be checked from time to time.

4 Method of investigation

The procedures for evaluating the standard deviation within strata (σ_w), applicable to both stratified sampling and systematic sampling, are described below.

4.1 Type of investigation

4.1.1 Type 1

When large lots are infrequently delivered, the quality variation may be determined from a single lot.

Divide the lot into a minimum of 10 parts of approximately equal mass. Then compose a pair of partial samples for each part by combining the increments involved in each part as shown in figure 1 and example 1.

4.1.2 Type 2

When small lots are frequently delivered, the quality variation is derived from several lots of approximately equal mass.

Divide each lot into a minimum of 10 parts of approximately equal mass. Then compose a pair of partial samples for each part by combining the increments involved in each part as shown in figure 2 and example 2.

4.1.3 Type 3

When lots are frequently delivered and the investigation by type 1 or type 2 is uneconomical, the quality variation is derived from a larger number of lots of approximately equal mass.

Compose a pair of partial samples for each lot as shown in figure 3 and example 3.

4.1.4 Type 4

In the case of sampling from a wagon-borne lot and when the increments are collected from all of the wagons of the lot or the wagons selected from the lot, the sampling scheme may be regarded as being equivalent to the method of stratified sampling.

Compose a pair of partial samples for each lot as shown in figure 4 and example 4.

In the case of sampling from a bagged lot, the sampling scheme may be regarded as being the same as sampling from a wagon-borne lot.

4.2 Number of increments and composition of partial samples

4.2.1 Number of increments

The number of increments to be collected from one or several lots for this investigation shall be twice the number of increments specified in ISO 8868:1989, table 3 and the increments shall be combined as specified in ISO 8868:1989, clause 7. The number of increments, N, shall never be less than 20.

4.2.1.1 In the case of investigation type 1, the increments shall be divided into at least 10 parts, each comprising a pair of partial samples (see figure 1 and example 1).

The number of increment(s) in a partial sample is then determined by the equation

$$\bar{n} = \frac{2N}{2k_a} \qquad \ldots (1)$$

where

$\bar{n}$ is the number of increment(s) in a partial sample;

$2N$ is the number of increments to be taken from a lot for the investigation, where N is the minimum number of increments given in ISO 8868:1989, table 3;

k_a is the number of parts to be created for a lot.

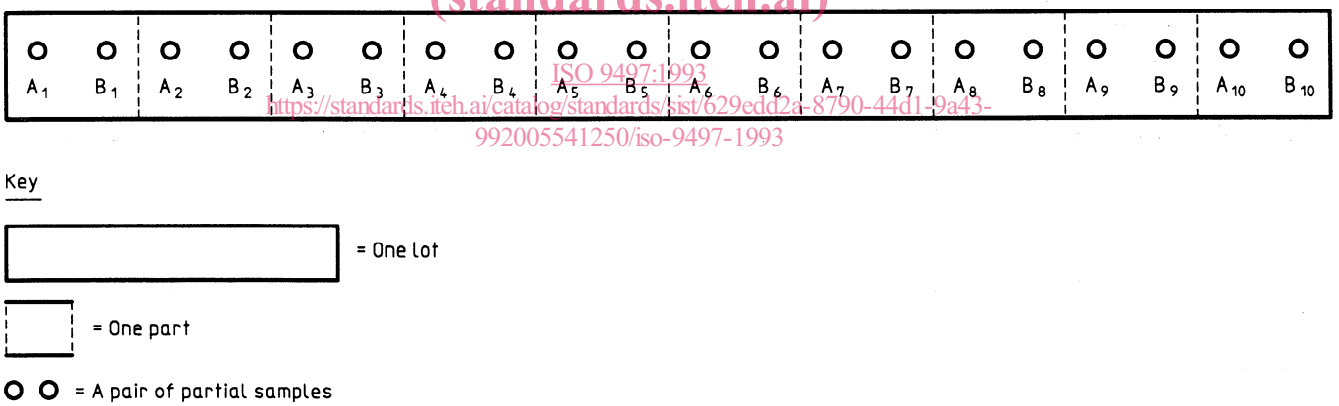

Figure 1 — Schematic diagram of investigation type 1 — One lot (example for 10 parts)

4.2.1.2 In the case of investigation type 2, the increments taken from each lot shall be subdivided into several parts on a stratum basis, with at least 10 parts in total, each comprising a pair of partial samples (see figure 2 and example 2).

The number of increment(s) in a partial sample is then determined by the equation

$$\bar{n} = \frac{2N}{2k_b} \quad \ldots (2)$$

where

$\bar{n}$ is the number of increment(s) in a partial sample;

$2N$ is the number of increments to be taken from each of several lots for the investigation, where N is the minimum number of increments given in ISO 8868:1989, table 3;

k_b is the number of parts to be created for each lot.

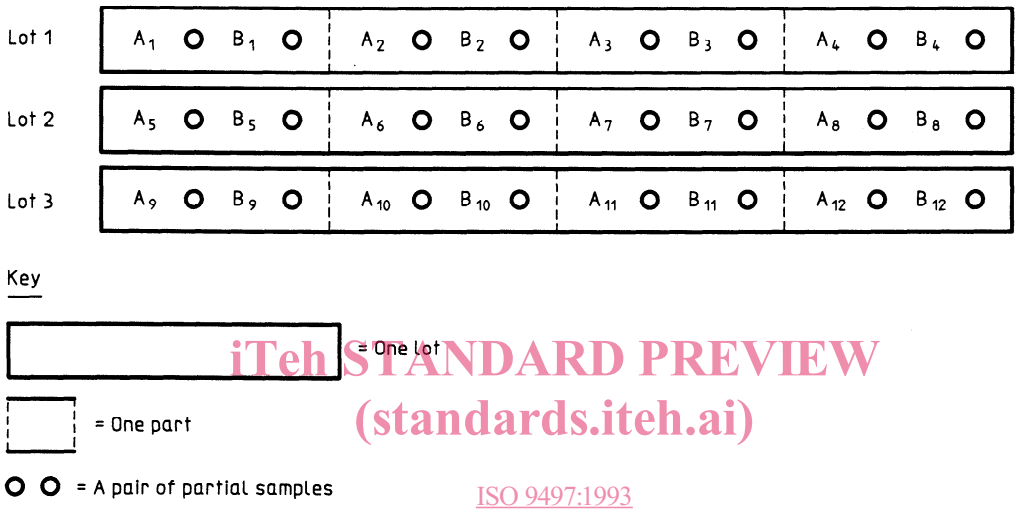

Figure 2 — Schematic diagram of investigation type 2 — Several lots (example for three lots and 12 parts)

4.2.1.3 In the case of investigation type 3, the increments taken from each lot shall be subdivided into a pair of partial samples. The number of lots shall not be less than 10 (see figure 3 and example 3).

The number of increment(s) in a partial sample is then determined by the equation

$$\bar{n} = \frac{2N}{2k_c} \quad \ldots (3)$$

where

$\bar{n}$ is the number of increment(s) in a partial sample;

$2N$ is the number of increments to be taken from each of 10 or more lots for the investigation, where N is the minimum number of increments given in ISO 8868:1989, table 3;

k_c is 1 ($k_c = 1$), i.e. one lot is equal to one part.

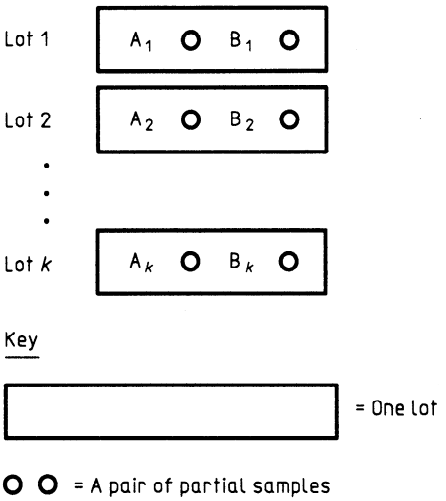

Figure 3 — Schematic diagram of investigation type 3 — k lots: one lot = one part

4.2.1.4 In the case of investigation type 4, the number of lots shall not be less than 10. The number of increments to be taken from each wagon or container shall be twice the number of increments specified in ISO 8868:1989, table 3. The increments taken from each wagon or container shall be divided into two parts, so as to comprise a pair of partial samples (see figure 4 and example 4).

The number of increment(s) in a partial sample is then determined by the equation

$$\bar{n} = \frac{2m \cdot n_w}{2k_d} \qquad \ldots (4)$$

where

$\bar{n}$ is the number of increment(s) in a partial sample;

m is the number of sample wagons or containers to be chosen from each of 10 or more lots for the investigation, that is,

$m = N$, when $W \geqslant N$

and

$m = W$, when $W < N$

N is the minimum number of increments given in ISO 8868:1989; table 3;

W is the number of wagons or containers in a lot;

n_w is the number of increments to be taken from each sample wagon or container specified in ISO 8868:1989, table 3;

k_d is 1 ($k_d = 1$), i.e. one lot is one part.

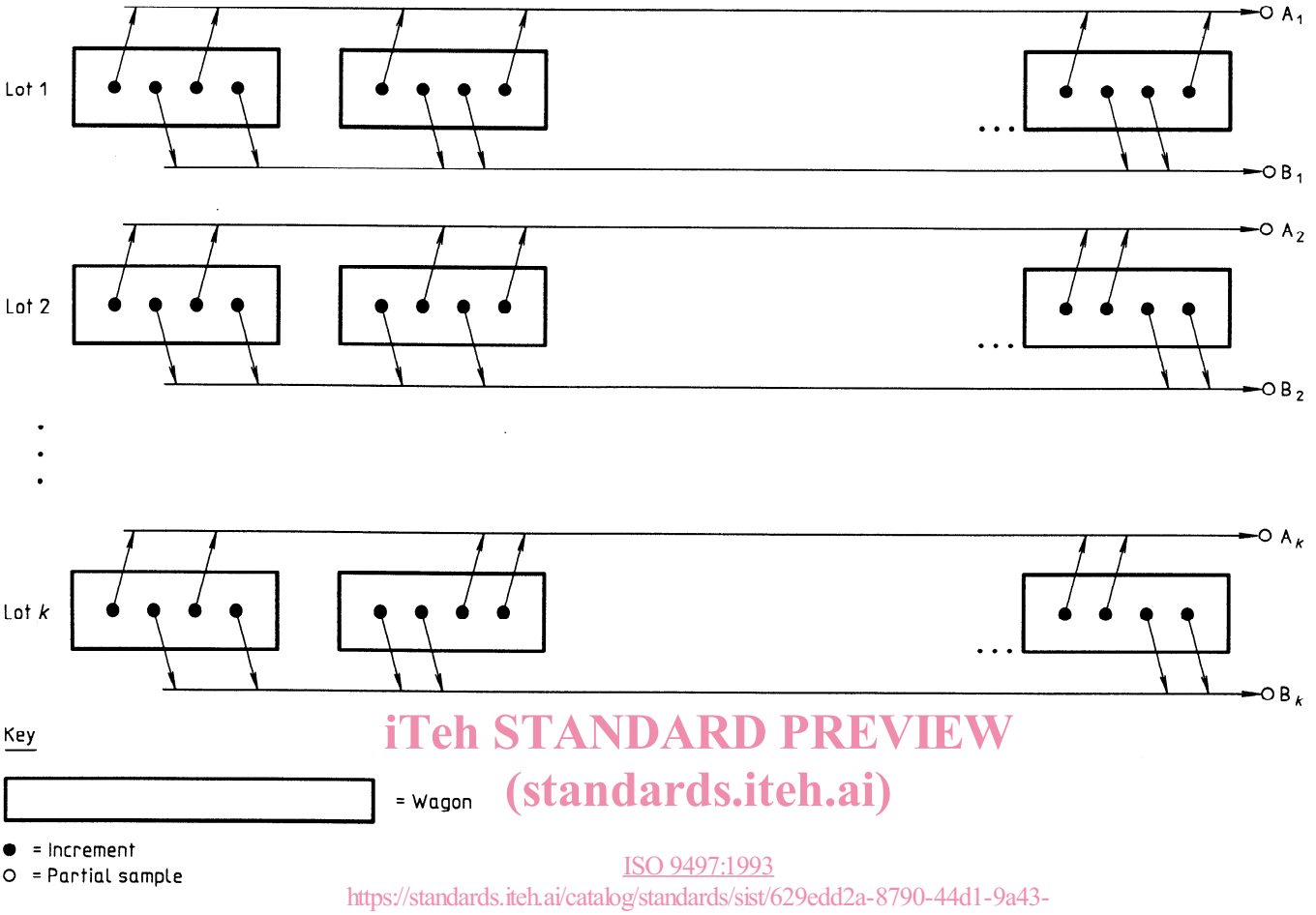

Figure 4 — Schematic diagram of investigation type 4 — Wagon-borne lots by stratified sampling

4.2.2 Composition of partial samples

The partial samples shall be composed in accordance with the following procedure:

a) number the increments of each part in sequence in the order of collection;

b) compose a pair of partial samples from consecutive odd-number increments (denoted as subsample A) and consecutive even-number increments (denoted as subsample B) for each part (see figure 5);

c) for each investigation, prepare k sets of paired samples,

where

$k = k_a$ for the investigation type 1,

$k = k_b \times$ number of lots for the investigation type 2,

$k = k_c \times$ number of lots for the investigation type 3 and

$k = k_d \times$ number of lots for the investigation type 4.

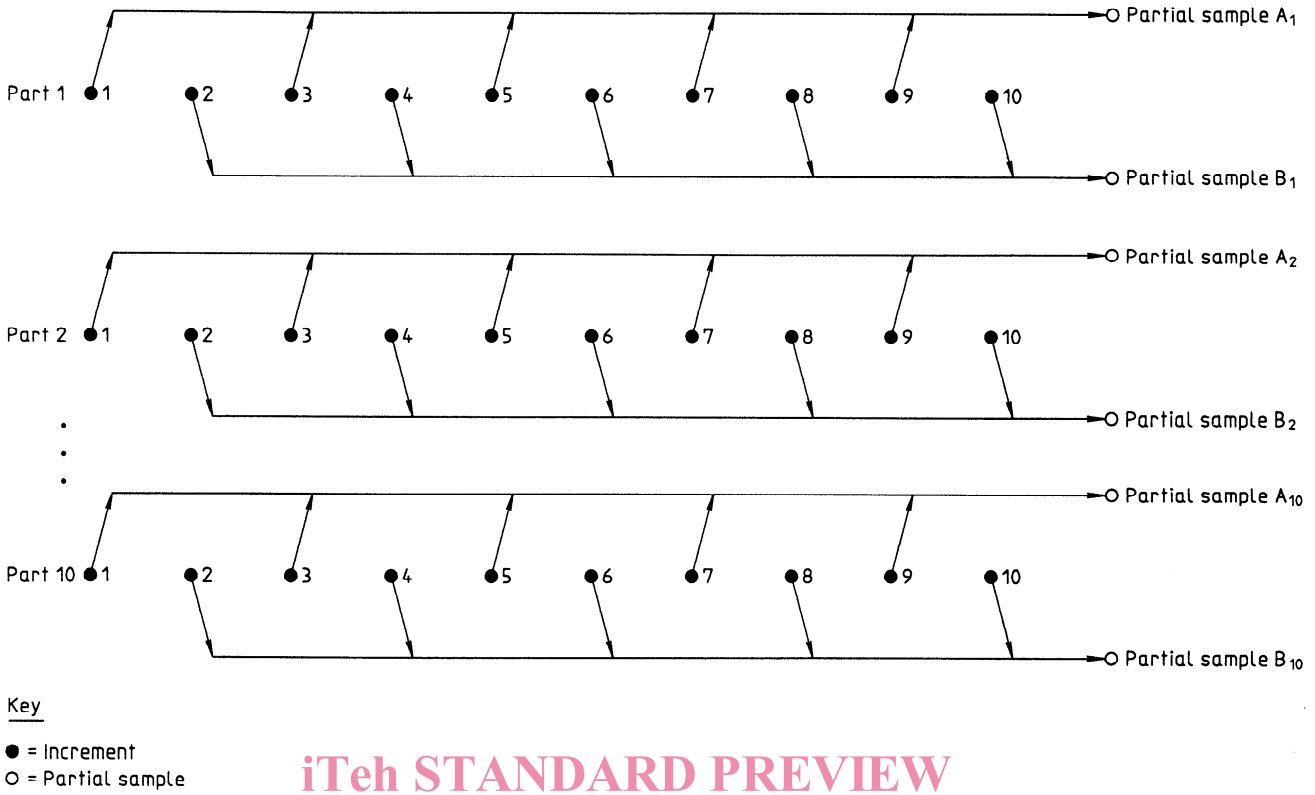

Figure 5 — Example of schematic diagram for composition of pairs of partial samples (type 1)

NOTE 1 Figure 5 is based on an example for a single lot of 8 000 tonnes of acid-grade fluorspar. The required minimum number of increments to be taken for routine sampling is 30 (from ISO 8868:1989, table 3) and the number of increments to be collected for the investigation is 60 (i.e. 2 × 30). Partial samples A and B for 10 parts, each comprising three increments, are prepared.

4.3 Preparation of test samples and testing

Test samples shall be prepared separately from all the pairs of partial samples A and B. The test sample may be a sample for chemical analysis, moisture determination, particle-size determination or other physical tests, as required.

5 Calculation of standard deviation within strata

5.1 Data sheet

The experimental data for calcium fluoride content, silica content, moisture determination, or particle-size determination as measured on the individual test samples shall be recorded in a suitable form (see examples 1 to 4).

5.2 Calculation

The estimated variance within strata shall be calculated from the following equations.

The range of paired measurements, R_i, is given by

$$R_i = |A_i - B_i| \quad \ldots (5)$$

where

R_i is the range;