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Kromove rude ï Vzorļenje z delitvijo vzorca

Chromium ores -- Increment sampling

Minerais de chrome -- Échantillonnage par prélèvements

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6153 was prepared by Technical Committee ISO/TC 65, *Manganese and chromium ores.*

Annex A forms an integral part of this International Standard.

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Chromium ores — Increment sampling

1 Scope

This International Standard specifies the methods for taking samples of chromium ores to be used at the places of dispatch and acceptance of ores for determining the chemical composition and moisture content of a consignment.

The methods are applicable to both the manual and mechanical sampling of all chromium ores, whether natural or processed.

Details of the hammer and shovel method for sampling ores containing lumps of + 100 mm in size are given in annex A.

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 listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 565 : 1983, *Test sieves — Woven metal wire cloth, perforated plate and electroformed sheet — Nominal sizes of openings.*

ISO 6154 : 1989, *Chromium ores — Preparation of samples.*

ISO 8541 : 1986, *Manganese and chromium ores — Experimental methods for checking the bias of sampling and sample preparation.*

ISO 8542 : 1986, *Manganese and chromium ores — Experimental methods for evaluation of quality variation and methods for checking the precision of sampling.*

3 Definitions

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

3.1 lot : A definite quantity of an ore, processed or produced under conditions which are presumed uniform.

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

3.3 increment :

(1) A quantity of an ore taken by a sampling device at one time from a consignment.

(2) A quantity taken by the increment division method.

3.4 sub-sample :

(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 has been optionally crushed and/or optionally divided as necessary.

3.5 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 sub-samples each of which has been optionally crushed and/or optionally divided as necessary.

3.6 test sample : Any sample, for the determination of moisture content or chemical composition, which is prepared from each increment, each sub-sample, or from the gross sample in accordance with the specified method for that type of sample.

3.7 nominal top size : The smallest sieve in the range included in the R 20 series (in table 1 of ISO 565, square hole) such that not more than 5 % of the ore is retained.

3.8 increment sampling : The process in sampling whereby a sample is obtained by combining a number of increments from a consignment and meant for representing the consignment.

3.9 manual sampling : The sampling by human effort with sampling devices, including mechanically assisted devices.

3.10 stratified sampling : For a consignment which can be divided into strata, sampling carried out in such a way that specified proportions of the sample are drawn from different strata.

NOTE — The stratum is a part of a consignment which is derived by division of the consignment according to specific criteria.

3.11 periodic systematic sampling : The sampling in which increments are taken from a consignment at regular intervals. When the mass interval is adopted, it is called "periodic systematic sampling on mass basis", and when the time interval is adopted, it is called "periodic systematic sampling on time basis".

3.12 two-stage sampling : The 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.

4 General rules

The rules given below are general and obligatory for the parties concerned.

a) Sampling should be carried out by qualified samplers or mechanical sampling devices authorized by the seller and/or purchaser.

b) Sampling shall preferably be carried out during handling immediately before or immediately after weighing.

c) Sampling shall be carried out by the systematic method with a random start. The sampling of ores from wagons shall be conducted by the two-stage method or stratified method.

d) The mass of the increment shall be determined in accordance with the nominal top size of the ore in order to avoid the introduction of bias at the time of collecting the sample.

e) The number of increments to be taken from a consignment shall be determined according to classification of the quality variation of the ore and the required precision of sampling.

f) Throughout the procedure of sampling, the samples shall be protected from any contamination.

g) All sampling methods shall be confirmed to have no bias in accordance with ISO 8541.

h) When the planned number of increments has been taken before the handling has been completed, the taking of increments should continue at the same interval until the handling operation of the consignment has been completed.

i) Sampling shall be carried out in conformity with national safety standards.

5 Methods of sampling in general

5.1 General sampling procedure

The procedure shall be as follows.

a) Identify the consignment to be sampled.

b) Ascertain the nominal top size of the consignment.

c) Determine the mass of increment.

d) Ascertain the classification of quality variation of the consignment.

e) Determine the minimum number of increments to be taken from the consignment in the case of systematic and stratified sampling. In the case of two-stage sampling, allocate the wagons or containers to be selected from the 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) The gross sample or sub-sample shall be constituted according to ISO 6154. An example is given in figure 1.

5.2 Sampling precision and overall precision

This International Standard is designed to obtain the sampling precision (β_s) given in table 3. The sampling precision is one component of the overall precision (β_{SDM}), which shall be based on the fact that sample preparation has been undertaken in accordance with ISO 6154 and that measurement has been carried out in accordance with methods given in the appropriate International Standards.

The overall precision defines with 95 % probability the average value of the quality characteristics of a consignment. The sampling precision means that on average, in 95 % of cases the chromium oxide content of the gross sample shall not differ from that of the analysed consignment by more than β_s %.

β_s is a measure of the precision of sampling and is equal to twice the standard deviation of sampling, expressed as an absolute percentage.

β_{SDM} is a measure of the overall precision of sampling, sample division and measurement, and is equal to twice the standard deviation of the overall process of sampling, sample division and measurement, expressed as an absolute percentage.

The sampling precision shall be checked in accordance with ISO 8542.

5.3 Mass of increment

5.3.1 The minimum mass of increment in manual sampling, depending on maximum particle size is specified in table 1.

Table 1 — Mass of increment in manual sampling

Nominal top size mm	Minimum mass of increment kg
150 and over	30
100	15
50,0	5
22,4 (20,0)	2
10,0	0,5
2,8 (3,0)	0,2

The increments shall be taken in such a manner as to ensure that they have an almost uniform mass.

NOTE — "Almost uniform mass" means that the variation in mass shall be less than 20 % in terms of coefficient of variation.

The coefficient of variation (CV) is defined as the ratio of the standard deviation (σ) to the mean value (x) of the mass of increments, expressed as a percentage.

$$CV(\%) = \frac{\sigma}{\bar{x}} \times 100 < 20\ \% \qquad \ldots (1)$$

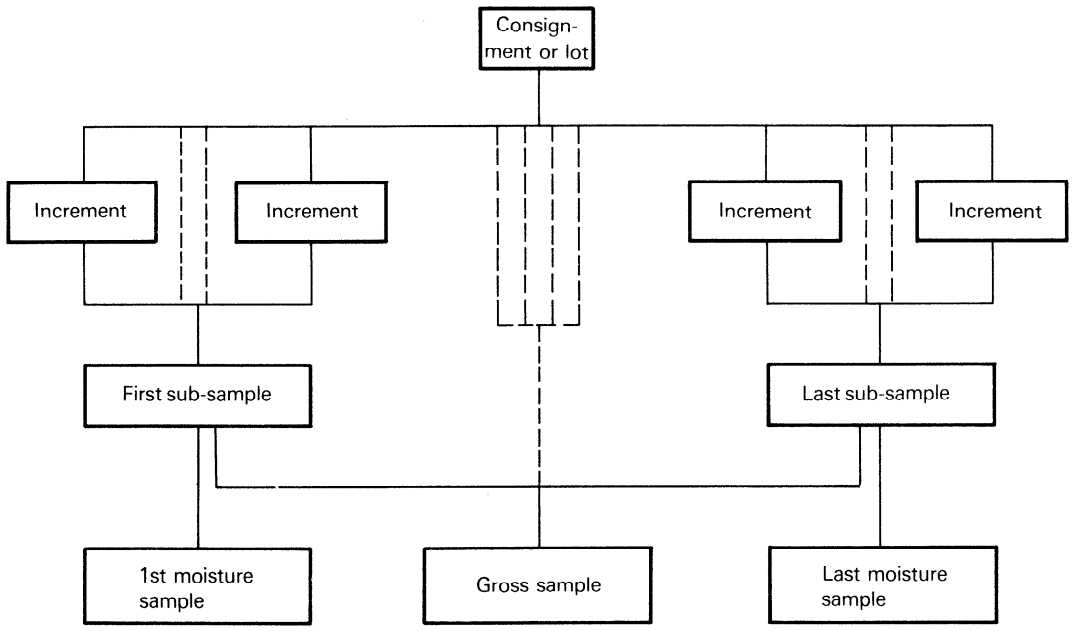

Figure 1 — Sampling plan

5.3.2 The mass of increment taken by means of mechanical samplers from the ore stream is directly proportional to the flow rate of the belt conveyor and to the opening aperture of the sampler, and inversely proportional to the cutter speed of the sampler; it may be calculated from the equation

$$m = \frac{q_m \cdot l}{3{,}6 \cdot v} \qquad \ldots (2)$$

where

m is the mass of an increment, in kilograms;

q_m is the flow rate of the belt conveyor, in tonnes per hour;

l is the cutting aperture of the sampler, in metres;

v is the cutter speed of the sampler, in metres per second.

5.4 Classification of quality variation

The quality variation is a measure of the heterogeneity of a consignment.

5.4.1 In the case of systematic sampling and stratified sampling the quality variation, σ_w, is the standard deviation of a quality characteristic between increments taken from within the strata of the consignment.

In the case of two-stage sampling, the quality variation is expressed by σ_b and σ_w. σ_b is the quality variation between wagons or containers selected from the consignment in terms of standard deviation. σ_w is the quality variation in terms of standard deviation between increments taken from within wagons or containers selected.

5.4.2 The values of σ_w and σ_b should be estimated for each type or each brand of chromium ore and for each handling system, under normal operating conditions in accordance with ISO 8542, and the chromium ore should be classified with respect to the magnitude of quality variation as specified in table 2.

Table 2 — Classification of quality variation

Quality variation	Standard deviation of chromium oxide standard (Cr_2O_3)
Large	σ_w or $\sigma_b \geqslant 1{,}0$
Small	σ_w or $\sigma_b < 1{,}0$

5.4.3 Any type and/or brand of chromium ore whose estimated value of quality variation is unknown shall be considered as having "large" quality variation. In this case, the experiment shall be conducted at the earliest possible opportunity in accordance with ISO 8542, and the classification of quality variation shall be determined.

5.5 Number of increments

5.5.1 In the case of systematic sampling under the theory of stratified sampling, the number of increments is calculated from the equation

$$n = \left(\frac{2\sigma_w}{\beta_s}\right)^2 \qquad \ldots (3)$$

where

n is the number of increments;

2 is the factor related to two-sigma (approximately 95 %) probability level;

σ_w is the standard deviation within strata, % absolute;

β_s is the two-sigma precision of sampling, % absolute.

Table 3 — Minimum number of increments and sampling precision depending on quality variation (% Cr_2O_3)

Mass of consignment		Precision of sampling	Number of increments at quality variation	
over	up to and including		large $\sigma_w = 1{,}5$	small $\sigma_w = 0{,}7$
30 000	45 000	0,33	85	20
15 000	30 000	0,37	65	15
5 000	15 000	0,39	60	15
2 000	5 000	0,42	50	10
1 000	2 000	0,55	30	7
500	1 000	0,60	25	6
	500	0,65	20	5

NOTE — The number of increments may be increased by agreement between the parties concerned, for example if a greater precision is required.

5.5.2 In the case of two-stage sampling the number of increments shall be calculated according to 7.1.2.3.

5.6 Method of taking increments

Each increment shall be taken at one time by a single motion of a sampling device, but, if it is difficult, it may be taken by several motions of the sampling device from a point selected at random (with equal probability). The latter shall be proven to have no bias with each type of ore before being applied.

6 Equipment

6.1 Manual sampling shall be conducted using the following tools :

a) shovels (see figure 2 and table 4);

b) hammer, mass 400 g to 900 g;

c) probe (see figure 3);

d) sampling frame.

NOTE — The probe is a piece of pipe 250 mm long attached to a wooden handle. The pipe may be whole or have two slots. In the latter, a locking ring is fitted on the pipe. At 140 mm from the end of the pipe, the angle is welded for knocking the sample out of the probe. The scoop probe may be made from a pipe which is cut into two equal parts. The sharp end, which is inserted into the ore, is cone-shaped and is separated from the main cavity by a partition welded inside the pipe.

6.2 Mechanical sampling shall be conducted using mechanical sampling devices (rotary-arc, bucket, cutter-chute sampler etc.), which meet the following requirements :

a) a sampling device shall travel at a uniform speed during the course of cutting a complete cross-section of the stream;

b) the capacity of the sampling device shall be sufficient for taking the complete increment at one time and shall be filled to no more than 2/3 of its volume;

c) the effective opening of the sampling device shall have a minimum dimension of three times the nominal top size of the ore and shall not be less than 10 mm;

d) the sampler shall be designed so as to permit its cleaning and checking.

NOTE — Other sampling devices, including mechanical assisted devices, may be used to take increments. These devices should have a minimum opening equivalent to column (c) in table 4 and, in the case of over 100 mm, at least three times the nominal top size.

The volume of the device in the effective collection area should be sufficient to contain at least twice the minimum mass of increment in table 1.

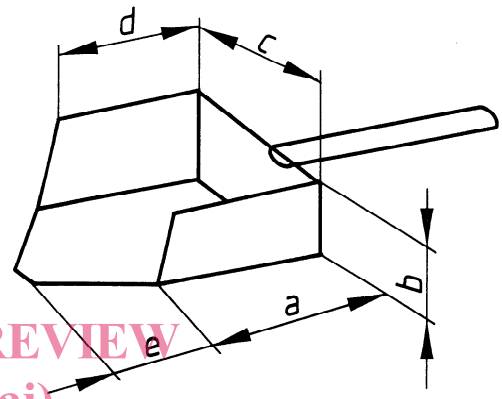

Figure 2 — Increment shovel

Table 4 — Dimensions of increment shovels

Nominal top size, mm		Shovel No.	Dimensions of shovel, mm				
over	up to and including		a	b	c	d	e
50	100	100	300	110	300	220	100
40	50	50	150	75	150	130	65
31,5 (30)	40	40	110	65	110	95	50
22,4 (20)	31,5 (30)	30	90	50	90	80	40
10	22,4 (20)	20	80	45	80	70	35
2,8 (3,0)	10	10	60	35	60	50	25
	< 2,8 (3,0)	3	40	25	40	30	15