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ISO RECOMMENDATION

R 1213

VOCABULARY OF TERMS RELATING TO SOLID MINERAL FUELS

PART II

TERMS RELATING TO COAL SAMPLING AND ANALYSIS

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BRIEF HISTORY

The ISO Recommendation R 1213/II, *Vocabulary of terms relating to solid mineral fuels – Part II – Terms relating to coal sampling and analysis*, was drawn up by Technical Committee ISO/TC 27, *Solid mineral fuels*, the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question led to the adoption of Draft ISO Recommendation No. 1882, which was circulated to all the ISO Member Bodies for enquiry in May 1970.

The Draft was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

Australia	India	Spain
Belgium	Iran	Sweden
Canada	Italy	Switzerland
Chile	Netherlands	Thailand
Denmark	New Zealand	Turkey
France	Poland	U.A.R.
Germany	Portugal	United Kingdom
Greece	South Africa, Rep. of	U.S.A.

No Member Body opposed the approval of the Draft.

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

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ISO Recommendation R 1213 November 1971

VOCABULARY OF TERMS RELATING TO SOLID MINERAL FUELS

PART II

TERMS RELATING TO COAL SAMPLING AND ANALYSIS

INTRODUCTION

Part II of this ISO Recommendation consists of a systematic list of terms commonly employed in coal sampling and analysis. Definitions are given for those terms whose meaning is not self-evident and an alphabetical index is also provided, with a numerical cross-reference. Terms already defined in ISO Recommendation R 1213, *Vocabulary of terms relating to solid mineral fuels – Part I : Terms relating to coal preparation*, are not included.

The use of the terms printed in italics is deprecated.

1. GENERAL

1-01 commodity

No definition

1-02 consignment

A quantity of some commodity delivered at one time. The consignment may be composed of one or more batches.

1-03 isolated consignment

A consignment that is to be sampled without knowledge of its sampling characteristics, for example, standard deviation, obtained from previous sampling of the same product.

1-04 batch

A quantity of some commodity produced at one time under relatively uniform conditions.

1-05 unit (of a commodity)

The total quantity of a commodity is frequently regarded as being made up of a number of discrete units (wagons, sections of belt, daily production) for the purpose of sampling. Each sample relates to a particular unit.

1-06 order

(*a*) **Command**. A quantity of a commodity ordered at the same time from the supplier, which may consist of one or more consignments.

(*b*) **Sequence**. The arrangement of a number of observations in a particular manner.

1-07 **run-of-mine coal**
through-and-through coal
Coal produced by mining operations, before preparation.

1-08 **raw coal**
uncleaned coal
Coal which has received no preparation other than possibly screening.

1-09 **cleaned coal**
Coal which has been treated by a wet or dry cleaning process.

1-10 **washed coal**
Coal which has been treated by a wet cleaning process.

1-11 **large coal**
lump coal
Coal above an agreed size, without any upper size limit.

1-12 **sized coal**
graded coal
Coal screened between specified size limits.

1-13 **through coal**
Coal with a specified top size, usually above 50 mm and below 150 mm, and having no lower size limit.

1-14 **smalls**
slack
Coal with a specified top size, usually below 50 mm, and no lower size limit. Sold as washed, cleaned or untreated smalls.

1-15 **coking smalls**
Coal of a specified top size, usually 10 mm, used for coke production.

1-16 **fines**
Coal having a maximum particle size usually less than 1.5 mm and rarely above 3 mm.

1-17 **granular material**
No definition

1-18 **high-rank coal**
1-19 **low-rank coal**
The rank of coal is its position relative to other coals in the coalification series from brown coal (low rank) to anthracite (high rank), indicating its maturity in terms of its general chemical and physical properties.

1-20 **shale**
One of the impurities associated with coal seams; this term should *not* be used as a general term for washery rejects.

1-21 **dirt band**
shale band
A layer of mineral matter lying parallel to the bedding plane in a seam of coal and thicker than a parting.

1-22 **parting**
A lamina, for example, of ankerite or fusain, occurring on or at an angle to the bedding plane of a seam of coal; usually less than 3 mm thick.

1-23 **homogeneity**

A material is said to be homogeneous if particles having different values of a certain characteristic are distributed evenly through it.

1-24 **heterogeneity**

A material is said to be heterogeneous if particles having different values of a certain characteristic are distributed unevenly through it.

1-25 **uniformity**

A material is said to be uniform with regard to a certain characteristic if all the particles have identical values for that characteristic.

1-26 **non-uniformity**

A material is said to be non-uniform with regard to a certain characteristic if the particles have different values for that characteristic. The material may be *homogeneous* or *heterogenous*.

1-27 **trend**

A material is said to show trend if the average value of the characteristic varies unidirectionally over some interval of time, mass or space in the material.

1-28 **variability**

No definition

1-29 **segregation**

The unintended separation and redistribution of particles within a bulk material as a result of different physical characteristics.

1-30 **variation**

No definition

1-31 **standard**
standard specification

No definition

1-32 **purchasing specification**

No definition

1-33 **sampling specification**

A sampling specification indicates the way in which the sample must be taken (including number and size of increments) and how it must be dealt with (method of storing, preparation, labelling, etc.).

1-34 **conveyor**

Equipment on which coal is transported by means of an endless belt, overlapping hinged steel plates, or similar device. The apparatus as a whole may be fixed or movable.

1-35 **discharge point**

The position where the coal leaves a conveyor or bunker.

1-36 **falling stream**

No definition.

1-37 **chute**

An inclined trough for conveying coal to a lower level.

1-38 **thickness of layer**

No definition.

1-39 **stratum**

No definition.

2. SAMPLING AND SAMPLE PREPARATION

2-01 **to sample** (a commodity)

No definition.

2-02 **sampler** (person)

No definition.

2-03 **sampling**

The collection of a representative portion of coal for analysis and testing.

2-04 **sampling point**

No definition.

2-05 **regular sampling**

The sampling of the same commodity received regularly at a given point.

2-06 **continuous sampling**

The taking of a gross sample from every unit of a commodity.

2-07 **intermittent sampling**

The taking of gross samples only from certain definite units of the commodity, for example, from one shift's production each week.

2-08 **replicate sampling**

The taking of increments from the consignment (batch, unit) at equal intervals of time, mass or space. The increments are combined in rotation to give several replicate samples of approximately equal mass.

By the procedure of replicate sampling it is possible to estimate the precision of sampling, for example, for isolated consignments.

2-09 **duplicate sampling**

A particular case of replicate sampling (with only two replicate samples), for the purpose of estimating the average precision of sampling from a number of consignments (units).

2-10 **frequency of sampling**

No definition.

2-11 **sample** (noun)

A part of a population collected with the object of estimating some characteristic. It is a portion extracted from a consignment, batch or unit as being representative of it with regard to the characteristic to be investigated.

2-12 random sample

A sample selected in such a way that all possible samples of the same size have the same chance of being chosen.

2-13 systematic sample

A sample in which the increments are taken at equal intervals of time, space or mass over the whole consignment, batch or unit; the first increment being taken at random within the first such interval.

2-14 stratified random sample

To obtain a "stratified random sample", the commodity to be investigated is considered as consisting of a number of sections (strata). The strata may be selected before sampling by any convenient method of subdivision such as time, quantity or space. One or several increments are extracted from each section, the position of the increments within the section being taken at random. The precision of sampling may be increased by planned distribution of the number of increments between the strata.

2-15 gross sample

A sample formed when all the increments collected from a consignment (batch or unit) are combined for reduction to a laboratory sample; where two or more samples are formed from interleaved increments, these samples are designated **duplicate samples** or **replicate samples** as the case may be.

2-16 increment

The quantity taken by a single sampling operation.

2-17 laboratory sample

The sample delivered to the laboratory for analysis or testing.

2-18 analysis sample

The sample crushed to pass a sieve of 0.2 mm, used for general analysis.

2-19 moisture sample

A sample used exclusively for the purpose of determining moisture.

2-20 mass of sample

No definition.

2-21 sample preparation

The process of bringing the sample to the condition prescribed for the investigations. It covers mixing, sample division, size reduction and sometimes drying of samples and may be performed in several stages.

2-22 stage (of sample preparation)

The group of operations comprising reduction in particle size, mixing, and decrease in mass of the sample.

2-23 particle size reduction

The process of milling the sample to reduce the particle size.

2-24 **to mill**

To reduce the particle size of the sample by crushing, grinding or pulverizing.

2-25 **to crush**

To reduce the size of the sample into coarse particles.

2-26 **to grind**

To reduce the size of the sample into fine particles.

2-27 **screen**

A device for carrying out the operation of screening.

2-28 **sample division**

The process in the course of preparing the sample whereby part of the sample is retained whilst the remainder may be rejected.

2-29 **pass** (in sample division)

The passage of all the retained sample once through a sample divider.

2-30 **to reject** (in sample preparation)

No definition.

3. ANALYSIS AND TESTING

3-01 **inerts**

Constituents of coal which decrease its efficiency in use, for example, mineral matter (ash) and moisture in fuel for combustion, or fusain in coal for carbonization.

3-02 **total ash**

Residue of the mineral matter obtained by incinerating coal under defined conditions.

3-03 **inherent ash**

Ash derived from mineral matter which is not removable from coal by physical processes.

3-04 **ash** (other than inherent)

No definition.

3-05 **mineral matter**

No definition.

3-06 **total moisture**

The moisture in the coal as sampled, and removable under standardized conditions which are defined in ISO Recommendation R 589, *Determination of total moisture in hard coal.*

3-07 **free moisture**
surface moisture

The moisture which is lost by the coal sample in attaining approximate equilibrium with the air to which it is exposed (see ISO Recommendation R 1988*, *Sampling of hard coal.*)

* At present at the stage of Draft ISO Recommendation.

3-08 **moisture in air-dried coal**

The moisture in the coal sample after it has attained approximate equilibrium with the air to which it is exposed (see ISO Recommendation R 1988*, *Sampling of hard coal* and ISO Recommendation R 589, *Determination of total moisture in hard coal.*)

3-09 **water of constitution**

Water chemically bound to the mineral matter and remaining after the determination of total moisture.

3-10 **dry matter**

The material in the dry state after the removal of total moisture.

3-11 **volatile matter**

The loss in mass, corrected for moisture, when coal is heated out of contact with air under standardized conditions, which are defined in ISO Recommendation R 562, *Determination of the volatile matter of hard coal and of coke.*

3-12 **gross calorific value**

The number of heat units measured as being liberated when unit mass of coal is burned in oxygen saturated with water vapour in a bomb under standardized conditions (as defined in ISO Recommendation R 1928, *Solid mineral fuels – Determination of gross calorific value by the calorimetric bomb method, and calculation of net calorific value*), the residual materials being taken as gaseous oxygen, carbon dioxide, sulphur dioxide and nitrogen, liquid water in equilibrium with its vapour and saturated with carbon dioxide, and ash.

3-13 **net calorific value**

The gross calorific value (3-12) less the latent heat of evaporation of the water originally contained in the fuel and that formed during its combustion.

3-14 **particle size**

No definition.

3-15 **mesh size**

No definition.

3-16 **size distribution**
size consist

The proportion of various sizes in a product.

3-17 **size fraction**

The part of the sample belonging to a specified size class limited by either one or two sieve sizes.

3-18 **size range**

The interval expressed by the sieves used to denote the upper and lower sizes of the coal.

3-19 **test**

An experiment made in order to measure a characteristic.

3-20 **general analysis**

This term, frequently used in English publications, means the determination of the chemical and physical characteristics of coal, other than the determination of moisture.

* At present at the stage of Draft ISO Recommendation.

3-21 **ultimate analysis**

The analysis of coal expressed in terms of its carbon, hydrogen, nitrogen, sulphur and oxygen contents.

3-22 **proximate analysis**

The analysis of coal expressed in terms of moisture, volatile matter, ash and fixed carbon.

3-23 **duplicate determination**

No definition.

3-24 **content**

No definition.

3-25 **percentage by mass**

No definition.

3-26 **to check**

No definition.

3-27 **to ash**
to incinerate

No definition.

3-28 **to dry**

To remove moisture from coal by evaporation.

3-29 **mass of material to be ashed or dried**

No definition.

3-30 **mass of residue after ashing or drying**

No definition.

3-31 **moisture in the analysis sample**

The moisture in the analysis sample of coal after it has attained approximate equilibrium with the air in the laboratory and removable under standardized conditions, which are defined in ISO Recommendation R 331, *Determination of moisture in the analysis sample of coal by the direct gravimetric method*, and ISO Recommendation R 348, *Determination of moisture in the analysis sample of coal by the direct volumetric method.*

3-32 **dry**

No definition.

3-33 **dry, ash free**
daf

No definition.

3-34 **dry, mineral matter free**
dmmf

No definition.

3-35 **size analysis**

The process of dividing a sample into size fractions with defined limits.

3-36 **to screen**

To separate solid particles of different sizes by causing one component to remain on a surface provided with apertures through which the other component passes.

3-37 **to screen out**

No definition.

3-38 **to sieve**

Sieving is the term usually applied to describe the operation of screening when using a screen (sieve) of relatively small area, particularly a screen used in the laboratory for test purposes.

3-39 **sieve test**

No definition.

4. EQUIPMENT

4-01 **sampler** (device)

No definition.

4-02 **scoop**

A small shovel with built-up back and sides.

4-03 **probe**

A sampling device designed to extract a pillar of coal from a consignment.

4-04 **auger**

A device for obtaining a sample of coal from a wagon or stock pile. It consists for example of two fixed curved blades mounted on a cross piece attached to a steel or aluminium stem. The two blades, which together form part of a cone, fork and interlace at the far end.

4-05 **ladle**

No definition.

4-06 **sampling frame**

No definition.

4-07 **breeches chute**

No definition.

4-08 **slotted vessel**

No definition.

4-09 **swinging arm**

No definition.

4-10 **box car drawer**

No definition.

4-11 **bucket sampler**

No definition.

4-12 **sample container**

No definition.

4-13* **rotary crusher**

No definition.

4-14* **jaw crusher**

No definition.

4-15 **mechanical sample divider**

No definition.

4-16 **rotary sample divider**

No definition.

4-17 **riffle**

No definition.

4-18 **double cone sample divider**

No definition.

4-19 **double cone mixer**

No definition.

4-20 **coning and quartering**

No definition.

4-21 **air-drying cabinet**

No definition.

4-22 **muffle**

No definition.

4-23 **laboratory sieve**

No definition.

4-24 **sieving test machine**

No definition.

4-25 **filter bag**
breather bag

An apparatus for removing dust from dust-laden air, employing cylinders of closely woven material which permit passage of air but retain solid particles. Also used to reduce the flow of air through a crushing mill.

* See section 5.2 of ISO/R 1213, Part I.

5. STATISTICAL TERMS

5-01 true value

No definition.

5-02 observed value (x)

The value obtained as the result of an experiment.

5-03 average ($\bar{x}$)
arithmetical mean

The sum of the individual values divided by the number of values.

5-04 median

The middle value or the average of the two middle values when the observed values are arranged in ascending or descending order of magnitude.

5-05 range

The difference between the greatest and least of a number of results.

5-06 deviation

The difference between an experimental result and a specified value taken for comparison.

5-07 mean deviation (from an origin)

The mean of the deviations from the origin, when all deviations are given a positive sign.

NOTE. – If not otherwise specified, the origin is the arithmetic mean.

5-08 population

A collection of items or elements possessing one or more characteristics under consideration.

5-09 population mean (μ)

The arithmetic mean of all values of a population (or sample). It can be estimated by calculating the arithmetic mean of the absolute values.

5-10 variance (σ^2) (of a population or sample)

The mean square deviation of all values from the mean. It is calculated from the sum of squares of the deviations of the values from their mean divided by the number of values less one.

5-11 standard deviation (σ) (of a population or sample)

The square root of the variance of the population or sample.

5-12 estimate

No definition.

5-13 frequency curve

No definition.

5-14 distribution

No definition.

5-15 frequency distribution

Correspondence between the values of a characteristic and their frequencies. The distribution is generally presented as a table with special groupings for continuous variates.

5-16 normal distribution

A frequency distribution for which the probability density is defined by the function :

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp - \frac{\frac{1}{2}(x-\mu)^2}{\sigma^2}$$

5-17 degree of freedom

No definition.

5-18 total variance

The total variance of experimental results is made up of the individual variances arising from the procedures of sampling, sample preparation and analysis.

5-19 variance of sampling

The variance arising from the procedure of sampling.

5-20 variance of sample preparation

The variance arising from the procedure of sample preparation, usually including the variance of sample division.

5-21 variance of sample division

The variance arising from the procedure of sample division.

5-22 variance of analysis

The variance arising from the procedure of analysis.

5-23 error

The procedures of sampling, sample preparation and analysis are necessarily imperfect and the experimental results will be dispersed about the true figures. The differences between the experimental results and the true figures are described as errors which can be of two kinds, **systematic (bias)** or **random**.

5-24 sampling error

The error arising from the procedure of sampling.

5-25 error of sample division

The error arising from the procedure of sample division.

5-26 error of sample preparation

The error arising from the procedure of sample preparation, usually including the error of sample division.

5-27 analytical error

The error arising from the procedure of analysis.

5-28 **random error**

Errors which arise from the experimental procedure leading to results which are sometimes higher and sometimes lower than the true figures. The average of a number of experimental results subject only to random errors will approach the true figure as the number of results increases.

5-29 **bias**

A systematic error (bias) is one which leads to results which are consistently higher or consistently lower than the true figure.

5-30 **precision**

A measure of the way in which a set of observations agree with each other, so that a method will be precise if the random errors are small.

The method may, however, be subject to bias. A larger number of measurements will tend to reduce the effect of random errors and thus improve the precision. The precision is twice the root mean square deviation from the mean of a set of observations.

5-31 **accuracy**

The closeness of agreement between an experimental result and the true value. The accuracy of a method is a measure of the ability of the method to provide accurate results. The accuracy of a result must not be confused with its **precision**. A determination may be made with great precision and the standard deviation of a number of determinations on the same consignment of coal may therefore be low, but the results will only be accurate if they are free from **bias**.

5-32 **tolerance**

The maximum acceptable difference between two values obtained under stated experimental conditions.

5-33 **tolerance between duplicates (repeatability)**

No definition.

5-34 **tolerance between laboratories (reproducibility)**

No definition.

5-35 **to plot** (on a graph, etc.)

No definition.

5-36 **to plot** (*A* as a function of *B*)

No definition.

5-37 **origin** (of a curve, etc.)

No definition.

5-38 **gradient** (of a curve)

No definition.

5-39 **point of inflexion** (of a graph)

No definition.

5-40 **to scatter**

No definition.

5-41 **scatter** (noun)

No definition.

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