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Solid mineral fuels – Vocabulary –

Part 1:
Terms relating to coal preparation

Combustibles minéraux solides – Vocabulaire –

Partie 1: Termes relatifs à la préparation du charbon

Reference number
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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 voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1213-1 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels,* Sub-Committee SC 1, *Coal preparation, terminology and performance.*

This second edition cancels and replaces the first edition (ISO 1213-1:1982), of which it constitutes a technical revision.

ISO 1213 consists of the following parts, under the general title *Solid mineral fuels – Vocabulary*

- *Part 1: Terms relating to coal preparation*
- *Part 2: Terms relating to sampling testing and analysis.*

Annex A of this part of ISO 1213 is for information only.

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Introduction

This part of ISO 1213 is a glossary consisting of a systematic list of terms commonly employed in coal preparation.

For terms relating to petrographic analysis, see ISO 7404-1:1984, *Methods for the petrographic analysis of bituminous coal and anthracite – Part 1: Glossary of terms.*

This part of ISO 1213 takes into account the distinction between processes or operations and the methods or machines for carrying them out.

Clause 3 is devoted primarily to coal properties and the principal operations involved in coal preparation, and also includes general terms such as those relating to capacities and flowsheets.

Clauses 4 to 7 cover the detailed terminology relating to sizing, cleaning, separation of solids from water or air, and size reduction.

Clause 8 deals with the terms involved in interpreting or expressing the results of coal preparation operations.

Clause 9 includes some miscellaneous terms.

Clause 10 covers terms related to blending and homogenization.

Clause 11 covers terms related to automatic control. Of necessity, it covers only a limited selection of terms. A list of other International Standards, which together provide a more comprehensive set of terms, is given in annex A.

Most of the clauses are subdivided, and in each case the first subclause includes general terms and the remaining subclauses cover groups of related terms. As far as possible, this logical principle has been carried through into the arrangement of the terms themselves, which are also numbered for ease of reference. An alphabetical index is also provided, with a numerical cross-reference.

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Solid mineral fuels – Vocabulary –

Part 1:
Terms relating to coal preparation

1 Scope

This part of ISO 1213 defines terms commonly employed in coal preparation

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 1213. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1213 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 10753:–[1], *Coal preparation plant – Assessment of the liability to breakdown in water of materials associated with coal seams.*

3 General

3.1 General coal preparation terms

3.1.01 coal preparation: Collectively, physical and mechanical processes applied to coal to make it suitable for a particular use.

3.1.02 run of mine; r.o.m. coal: Coal produced by mining operations, before screening, crushing or preparation.

3.1.03 raw coal: Coal that has received no preparation other than possibly screening or crushing.

3.1.04 raw coal feed: Raw coal supplied to a plant or machine, in which it undergoes some form of preparation.

3.1.05 coal cleaning: The treatment of raw coal to lower the quantity of undesirable constituents, through the difference in either density or surface properties

3.1.06 cleaned coal; clean coal: Coal produced by a cleaning process (wet or dry).

3.1.07 middlings: A product of coal preparation that, because of its ash percentage, is intermediate between coal and discard.

NOTE 1 It follows therefore that the relative density of middlings is intermediate between those of coal and discard. Middlings may be reprocessed.

3.1.08 true middlings; bone: Middlings so nearly homogeneous that their quality cannot readily be improved by crushing and recleaning.

3.1.09 false middlings; interbanded middlings: Middlings in which the particles consist of bands of coal and shale, and from which the coal may be liberated by crushing.

3.1.10 reject; refuse: The material extracted from the feed during cleaning, for retreatment or discard.

3.1.11 discard; dirt; stone: The material extracted from the raw coal and finally discarded.

3.1.12 recirculation: The operation in which the whole or part of a product from a process is returned to the feed to a process, e.g. the return of the crushed overflow from a screen to the screen feed for rescreening.

3.1.13 "foreign coal": Coal received at a preparation plant from a source other than that to which the plant is attached.

3.1.14 imported coal: Coal coming from a foreign country, or other state within the country.

3.1.15 low-grade coal: Combustible material that has only limited uses owing to undesirable characteristics (e.g. ash percentage or size).

3.1.16 segregation: Partial separation of a material into its constituents, occurring as a result of differences in particle characteristics such as particle size or relative density.

1) To be published.

3.2 Cleaning characteristics

3.2.01 washability: The amenability of a coal to improvement in quality by cleaning, generally through its relative density/ash relationship.

3.2.02 float-and-sink analysis: The division of a sample into relative density fractions having defined limits, the amounts of the fractions being expressed as percentages of the total sample, commonly with an indication of the ash percentage (and other characteristics, if required) of each fraction.

3.2.03 washability curve: Any curve obtained from the results of a float-and-sink analysis permitting the theoretical yield of floats or sinks to be read off.

NOTE 2 The following are the five main types of washability curves:

- the characteristic ash curve;
- the cumulative floats curve;
- the cumulative sinks curve;
- the densimetric (relative density) curve;
- the near-density curve.

3.2.04 characteristic ash curve: The curve obtained from the results of a float-and-sink analysis showing, for any mass percentage of floats (or sinks) the ash percentage of the highest density (or lowest density) fraction passing into these floats (or sinks), the mass percentage being plotted on the ordinate (vertical axis) and the ash percentage on the abscissa (horizontal axis).

3.2.05 cumulative curve: Any curve expressing the results of combining successive relative density fractions or size fractions.

3.2.06 cumulative floats curve: The curve obtained from the results of a float-and-sink analysis by plotting the cumulative mass percentage of floats at each relative density against the cumulative ash of the total floats at that density.

3.2.07 cumulative sinks curve: The curve obtained from the results of a float-and-sink analysis by plotting the cumulative mass percentage of sinks at each relative density against the cumulative ash of the total sinks at that density.

3.2.08 densimetric curve; relative density curve: The curve obtained from the results of a float-and-sink analysis by plotting the cumulative mass percentage of floats or sinks against the relative density.

3.2.09 near-density curve; difficulty curve: The curve obtained from the results of a float-and-sink analysis, or from the densimetric curve, by plotting the mass percentage within the limits ± 0,1 of a given relative density against that relative density.

3.2.10 performance curve: Any curve used to show the relationship between properties of coal and results of a specific treatment.

3.2.11 actual performance curve: A performance curve showing the results actually obtained from a coal preparation treatment.

3.2.12 expected performance curve: A performance curve showing the expected results of a coal preparation treatment.

3.2.13 M-curve; Mayer curve: A vectorial curve, obtained by plotting the cumulative ash percentages against their cumulative yields, used to express the washability of a coal, plotted on a vectorial diagram in which the projection of the vector on the ordinate (vertical axis) represents the percentage of the product (coal) and the direction of the vector represents the percentage of a particular constituent of the product.

3.2.14 ash/relative density curve: The curve obtained from the float-and-sink analysis by plotting the ash percentages of successive fractions against the mean relative density of the fraction.

3.3 Capacity and throughput

3.3.01 nominal capacity: A notional figure, expressed in mass per hour, used in the title of a flowsheet and in the general description of a plant, applying to the plant as a whole and to the specific product under consideration.

3.3.02 operational capacities: Figures given on a flowsheet to indicate quantities per unit time passing various points in the plant, taking account of fluctuations in the rate of supply and composition (as to size and impurity content).

3.3.03 design capacity: The rate of feed at which specific items of plant must operate continuously and give the guaranteed results on a particular quality of feed.

3.3.04 peak design capacity: A rate of feed in excess of the design capacity that specific items of plant will accept for short periods without necessarily fulfilling the performance guarantees given in respect of them.

3.3.05 mechanical maximum capacity: The highest rate of feed at which specific items of equipment, not subject to performance guarantees, will function on the type and quality of feed for which they are supplied.

3.3.06 feed: Material for treatment supplied to an appliance or plant.

3.3.07 basic flowsheet: A schematic diagram representing the various preparation process stages in the treatment of the raw coal.

3.3.08 process flowsheet: A basic flowsheet indicating the main operational steps within the plant, the movement of the various materials between the steps and the final products obtained, and often also the average mass flow at various points in the plant.

3.3.09 equipment flowsheet: A diagram indicating, by standard symbols, the units of equipment used in the various operational steps carried out within a coal preparation plant.

3.3.10 materials flowsheet: A flowsheet principally concerned with solid materials.

3.3.11 liquids flowsheet: A flowsheet to indicate the flow of liquids throughout a series of operations.

3.3.12 weighted flowsheet; capacity flowsheet: A materials flowheet used in the design of a plant, including statements of the mass flow per hour at principal points in the plant.

4 Sizing

4.1 General

4.1.01 sizing: Division of a material into products between nominal size limits.

4.1.02 classification: The separation of particles according to their size, density and shape by control of their settling rate through a fluid medium.

4.1.03 size analysis: The process or the result of the division of a sample into size fractions, each within defined limits, the mass or number of particles in each fraction being expressed as percentages of the total sample.

4.1.04 sieve analysis: Size analysis in which the division is carried out by the use of test sieves.

4.1.05 mean size: The weighted average particle size of any sample, batch or consignment of particulate material.

NOTE 3 Several bases for calculating mean size have been proposed, giving results that vary widely for the same size distribution. The method of calculation should, therefore, always be stated whenever results are reported.

4.1.06 nominal size; limiting size: The limit or limits of particle size used to describe a product of a sizing operation.

4.1.07 oversize: Material in a product of size greater than the upper nominal size limit; may be expressed as a percentage of the product.

4.1.08 undersize: Material in a product of size smaller than the lower nominal size limit; may be expressed as a percentage of the product.

4.1.09 dust: Particles of solid material sufficiently fine to allow suspension in air. (See also 6.4.)

4.1.10 fines: Coal having a maximum particle size usually less than 4 mm, and having no lower limit.

NOTE 4 The upper limit may vary widely. To avoid confusion, the term should always be qualified by stating the nominal size.

4.1.11 smalls: Coal having a maximum particle size usually less than 25 mm, and having no lower limit.

NOTE 5 The upper limit may vary widely. To avoid confusion, the term should always be qualified by stating the nominal size.

4.2 Screening

4.2.01 screening: The separation of solid materials of different sizes, by causing part to remain on a surface provided with apertures through which the remainder passes.

4.2.02 screen:

(1) A device for carrying out the operation of screening.

(2) A commonly used abbreviation for screen deck or screening surface, e.g. woven-wire screen.

4.2.03 amplitude: The maximum displacement from the mean position in an oscillating motion.

NOTE 6 In the case of a screen having a straight line motion or elliptical motion, it is half of the total movement or half of the major axis of the ellipse. In the case of a circular motion, it is the radius of the circle.

See also *stroke* (4.2.04).

4.2.04 stroke; throw: The distance between the extreme positions of an oscillating or vibrating motion, i.e. the stroke is equal to twice the amplitude.

4.2.05 aperture size: The dimension or dimensions defining the opening in the screening surface, qualified as to the shape of aperture, e.g. "round-hole", "square-mesh", "long-slot".

4.2.06 dry screening: The screening of solid materials of different sizes without the aid of water.

4.2.07 wet screening: : The screening of solid materials of different sizes with the aid of water.

4.2.08 probability screening: A method of screening that, by making extended use of the probability of a particle passing through an aperture, allows sizing at fine sizes to be performed with relatively large apertures.

4.2.09 desliming: The removal of slimes from coal or a mixture of coal and water, however accomplished.

4.2.10 fines removal: The removal of fine particles from a feed material, by either wet or dry methods, to facilitate treatment or utilization of the remainder.

4.2.11 dedusting: Fines removal by dry methods.

4.2.12 screen overflow: That portion of the feed material discharged from the screen deck without having passed through the apertures.

4.2.13 misplaced undersize: Particles in a screen overflow that are smaller than a reference size.

4.2.14 screen underflow: That portion of the feed material that has passed through the apertures in a screen deck.

4.2.15 misplaced oversize: Particles in a screen underflow that are larger than a reference size.

4.2.16 misplaced material (screening): Undersize contained in the overflow, or oversize contained in the underflow.

4.2.17 near-mesh material; near-size material: Material approximating in size to a reference size, usually within ± 25 % of that reference.

4.2.18 nominal area (screen): The total area of the screen deck exposed to the flow of the material feed.

4.2.19 effective area (screen); working area (deprecated): The nominal area less any area occupied by fixings or supports that obstruct the passage of material over or through the screen deck.

4.2.20 open area: The ratio of the total area of the apertures to the total area of the wire cloth, perforated plate or wedge-wire panel, expressed as a percentage.

4.2.21 sieve

(1) Generally, a screen of relatively small area.

(2) Particularly, a screen used for size analysis.

4.3 Parts of screens

4.3.01 screen deck; screening surface: A surface provided with apertures of specified size for carrying out the operation of screening.

4.3.02 screen plate: A plate provided with apertures of specified size and range for use as a screen deck.

4.3.03 screen cloth; screen mesh: A mesh of wires woven in a consistent manner to form the apertures.

4.3.04 wedge-wire deck; wedge-wire sieve: A screen deck, comprising wires of wedge-shaped cross-section spaced from each other at a fixed dimension, in which the underflow passes through an aperture of increasing cross-section.

4.3.05 loose-rod deck: A screening surface consisting of loosely held parallel rods positioned at right angles to the flow of material over the screen.

NOTE 7 Normally, a loose-rod deck is used only on high-speed vibrating screens.

4.3.06 relieving deck: A screen plate having large apertures mounted over the screening deck to reduce the load and wear thereon.

4.4 Screens according to purpose

4.4.01 run-of-mine screen: A screen used for dividing run-of-mine coal into two or more sizes for further treatment or disposal.

NOTE 8 A run-of-mine screen is usually employed to remove the largest pieces for crushing and re-addition to the run-of-mine coal.

4.4.02 primary screen; raw coal screen: A screen used to divide coal (usually raw coal) into sizes more suitable for the subsequent cleaning of some or all of them.

4.4.03 dewatering screen: A screen used for the separation of water from solids.

4.4.04 desliming screen: A screen used for the removal of slimes from larger particles, usually with the aid of water sprays.

4.4.05 slurry screen: A screen used to recover and dewater granular products from circulating water in a coal preparation plant.

4.4.06 rinsing screen; spray screen: A screen used for the removal of fine solids by spraying, especially dense medium solids present among or adhering to larger particles.

4.4.07 sizing screen(s); grading screen(s), classifying screen(s) (deprecated): A screen or set of screens normally used for dividing a product (e.g. clean coal) into a range of sizes.

4.4.08 guard screen; oversize control screen: A screen used to prevent the entry into a machine of coarse particles which can interfere with its operation.

4.4.09 undersize control screen; breakage screen (deprecated): A screen used for the removal or undersize from a product.

4.5 Screens according to principle of construction

4.5.01 single-deck screen: A screen having one screening surface, not necessarily limited to one size or shape of aperture.

4.5.02 multi-deck screen: A screen having two or more superimposed screening surfaces mounted rigidly within a common frame.

4.5.03 jigging screen; reciprocating screen; shaking screen (deprecated): A screen to which a combined horizontal and vertical motion is imparted, normally by a crankshaft and connecting rod, the screen deck being horizontal or inclined at a small angle.

4.5.04 resonance screen: A screen having a period of oscillation at or very close to the natural period of oscillation of the resilient mounting.

4.5.05 vibrating screen: A screen oscillated at high speed by either mechanical or electrical means.

NOTE 9 The amplitude of movement of the vibrating screen is smaller than that of the jigging screen, and its frequency of oscillation is higher.

4.5.06 rotating probability screen: A device for probability screening, consisting of a rotating horizontal deck having radial spokes, the separation point being obtained by varying the rotational speed.

4.5.07 trommel screen; revolving screen: A screen in which the screening surface is formed into a cylinder or frustum of a cone, mounted upon a horizontal or near-horizontal rotating shaft, or on revolving rollers.

4.5.08 roll screen: A screen consisting of a number of horizontal rotating shafts, fitted with elements arranged to provide screening apertures.

4.5.09 bar screen: A stationary inclined screen, comprising longitudinal bars, spaced at intervals, onto which the material is fed at the upper end.

4.5.10 grizzly: A rugged screen for rough sizing at comparatively large size (e.g. 150 mm).

NOTE 10 A grizzly can comprise fixed or moving bars, discs, or shaped tumblers or rollers.

4.5.11 sieve bend: A device for the sizing of fine particles suspended in water by means of a stationary curved panel, usually of wedge-wire, the aperture of which is at right angles to the flow of feed, whereby the finer particles are removed with the bulk of the water in the underflow. [See also *fixed screen* (6.2.02).]

4.6 Sizing in a current of air or water

4.6.01 air classification: The process of sizing in a current of air.

4.6.02 classifier: A device that separates particles, according to their size, shape and density, by physical means other than screening.

4.6.03 cyclone classifier: A device for classification by centrifugal means of fine particles suspended in a fluid, whereby the coarser particles are discharged from the apex of the vessel, and the finer particles are removed with the bulk of the fluid at the overflow orifice.

5 Cleaning

5.1 General

5.1.01 dry cleaning: The separation of impurities from coal by manual or mechanical methods that avoid the use of a liquid.

5.1.02 wet cleaning: The mechanical separation of impurities from coal by methods involving the use of a liquid.

5.1.03 washery: A coal preparation plant in which a wet cleaning process is carried out.

5.1.04 reclean; rewash: To re-treat a product in the same or in another plant.

5.1.05 washery products: The final products from a washery.

5.1.06 reject elevator; refuse elevator (deprecated): An elevator for removing and draining the reject from a washing appliance.

5.1.07 middlings elevator: An elevator that removes middlings for further treatment or for disposal as an inferior product.

5.1.08 head tank: A tank or vessel in the water circuit that is used to maintain the delivery pressure of the water by constant level to the washing units.

5.1.09 launder: A trough or channel along which liquids, or a mixture of liquids and solids, flow.

5.1.10 pump sump: A tank into which the process water gravitates and from which it is recirculated by means of a pump.

5.1.11 suspension: A mixture of solid particles and water or air in which the solid particles are completely and individually supported.

5.1.12 teeter (in); **fluidized suspension** (in): The condition of a suspension of solids in an upward-moving current of water or air, whereby the support given to the particles reduces the internal friction between them to such an extent that the suspension acquires fluid or partially fluid properties.

5.1.13 water circuit: The complete system of pipelines, pumps, sumps, tanks, launders and accessories used for the circulation of water in a washery.

5.1.14 closed water circuit: A water circuit designed so that the only water added is that necessary to replace the loss on the washery products and that due to atmospheric evaporation.

5.1.15 circulating water: The water in the water circuit.

5.1.16 make-up water: Water supplied to a plant to replace that lost from the circuit.

5.1.17 rinsing water; spray water: Water used to remove fine particles from larger sizes.

5.1.18 waste water; surplus water, bleed water (deprecated): Excess water allowed to run to waste from the water circuit. [See also *effluent* (6.1.09 and 6.1.10)].

5.1.19 pit water; mine water: Water from underground workings or an open-cut mine.

5.1.20 slimes: Extremely fine particles in suspension or adhering to larger particles.

5.1.21 slurry (coal preparation): Fine particles concentrated in a portion of the circulating water and water-borne for treatment or disposal.

5.1.22 froth flotation: A process for cleaning fine coal in which the coal, with the aid of a reagent or reagents, becomes attached to air bubbles in a liquid medium and floats as a froth.

5.2 Dry cleaning

5.2.01 hand cleaning: The removal by hand of impurities from coal, or coal from impurities.

5.2.02 hand selection: The selection by hand of pieces of coal having certain specific qualities according to surface appearance.

5.2.03 picking belt; picking table: A continuous conveyor (e.g. in the form of a rubber belt or of a steel apron, steel plate or link construction) on which raw coal is spread for hand cleaning and/or hand selection.

5.2.04 picking table, circular: An apparatus used for the same purpose as a picking belt and consisting of a flat horizontal rotating annular plate.

5.2.05 pneumatic cleaning: Cleaning by means of an air current.

5.2.06 dry cleaning table: An apparatus in which dry cleaning is achieved by the application of air currents and agitation to a layer of feed of controlled depth moved along the surface of the table, usually by a reciprocating action.

5.2.07 air jig: A machine in which the feed is stratified by means of pulsating currents of air and from which the statified products are separately removed.

5.3 Jigging

5.3.01 jig; washbox (deprecated): A machine in which the feed is stratified in water by means of a vertical pulsating motion and from which the stratified products are separately removed.

5.3.02 primary jig: In a series of jigs, the first jig, which receives the feed and from which one product at least is given further treatment.

5.3.03 re-wash jig: A jig to which the product (or a portion thereof) of a previous cleaning operation is fed for additional treatment.

5.3.04 air pulsating jig: A jig in which the pulsating motion is produced by the intermittent admission of compressed air to the water, either alongside the jig bed, e.g. Baum, or under the jig bed, e.g. Batac, Tacub.

5.3.05 feldspar jig: A jig used to clean coal usually smaller than 12,5 mm in size, in which the pulsating water is made to pass through a bed of graded feldspar, retained on a compartmented jig screenplate.

5.3.06 moving sieve jig: A jig in which the jig screen plate supporting the bed of material under treatment is moved up and down in water.

5.3.07 plunger jig; piston jig: A jig in which the pulsating motion is produced by the reciprocating movement of a plunger or piston.

5.3.08 diaphragm jig: A jig in which the pulsating motion is produced by the reciprocating movement of a diaphragm.

5.3.09 jig screen plate; bed plate; grid plate, sieve plate (deprecated): A perforated plate or grid that supports the bed of material being treated.

5.3.10 jig bed: The whole of the material on the jig screen plate.

5.3.11 jig cell: One of the individual sections into which the jig below the jig screen plate is divided by transverse division plates, each being capable of separate control.

5.3.12 jig compartments: The sections into which a jig is divided by transverse division plates that extend above the jig screen plate to form a weir.

NOTE 11 Each compartment usually comprises two or more cells.

5.3.13 hutch: The part of a jig situated below the jig screen plate in which the controlled pulsating movement of the water takes place.

5.3.14 jig feed sill: That part of the jig over which the feed passes when it enters the box.

5.3.15 jig centre weir: An adjustable plate situated between the feed end and the discharge end of a jig and serving to regulate the forward movement of material through the box.

5.3.16 jig discharge sill: That part of the jig over which the cleaned coal passes out of the box.

NOTE 12 Usually the discharge sill is part of the discharge-end refuse extraction chamber.

5.3.17 air valve: A valve that controls the alternate admission and release of compressed air to each cell of a jig.

5.3.18 jig slide valve; jig piston valve (deprecated): A jig air valve operated by means of a reciprocating motion.

5.3.19 rotary air valve: A jig air valve that rotates on a central axis.

5.3.20 jig air cycle: The value-timing cycle determining the periods of air admission and exhaust.

5.3.21 reject extractor: A device used in a jig to remove the reject from the compartments of a jig, operated manually or automatically.

5.3.22 float: On certain types of automatic reject extractors, the part that detects variations in thickness of the layer of heavy material on the jig screen plate.

5.3.23 bed depth transducer: A device that measures variations in the thickness of heavy material on the jig screen plate without the use of a float.

5.3.24 reject extraction chamber: That part of the jig into which the reject extractor discharges.

5.3.25 reject gate; discharge shutter (deprecated): The mechanism of the reject extractor that may be manually or automatically operated to control the rate of removal of reject from the jig.

5.3.26 reject rotor; star wheel extractor (deprecated): A reject gate in the form of a rotary (or star) valve.

5.3.27 reject worm: A screw conveyor fitted at the bottom of some jigs to collect the fine reject which has passed through the apertures in the jig screen plate.

5.3.28 reject discharge pipes: Pipes used on some jigs instead of a reject worm.

5.3.29 primary reject elevator: An elevator that extracts the first or more dense reject; usually situated at the feed end of the jig.

5.3.30 secondary reject elevator: An elevator that extracts the second or less dense reject; usually situated at the discharge end of the jig.

5.3.31 top water; transport water (deprecated): Water introduced with the raw coal feed to assist the transport of material through the jig.

5.3.32 flushing water: Water used to assist the flow of materials in a chute or launder.

5.3.33 underscreen water; back water (deprecated): Water that is fed into the cells of a jig below the level of the jig screen plate.

5.4 Dense medium cleaning

5.4.01 dense liquid: A liquid or solution, of density greater than that of water, that can be used in industry or in the laboratory to divide coal into two fractions of different relative densities.

5.4.02 dense medium; heavy medium: A fluid, formed by the suspension in water of particles of relatively high density (e.g. magnetite, barytes, shale), that can be used in industry or in the laboratory to divide coal into fractions of different relative densities.

5.4.03 dense medium process: A process for the cleaning of coal, in which the desired separation is effected in a dense medium.

5.4.04 dense medium separator: A device, employing gravity or centrifugal force to effect separation, for the cleaning of coal using a dense medium.

5.4.05 medium solids: The solid component of a dense medium.

5.4.06 separating medium; correct medium: Dense medium of the density required to achieve a given separation.

5.4.07 circulating medium: Medium in circulation in or outside the dense medium separator, at or about the density of that in the separator.

5.4.08 make-up medium; make-up medium solids: Medium or medium solids added to the circuit to replace losses.

5.4.09 dense medium recovery; medium solids recovery: The collection, for reuse, of medium solids from dilute medium, usually understood to include the removal, in whole or in part, of contaminating fine coal and clay.

5.4.10 magnetic separator: A device for the recovery and concentration of medium solids that are magnetic.

5.4.11 magnetics: The portion of the dense medium solids that has a high magnetic susceptibility and is therefore readily recovered by magnetic means.

5.4.12 non-magnetics: The portion of the dense medium solids that has a low magnetic susceptibility.

NOTE 13 These solids are usually of lower relative density than the magnetics and are therefore classed as contaminants.

5.4.13 regenerated dense medium; recovered dense medium: Medium obtained from the medium recovery system and separated (wholly or partly) from contaminants.

5.4.14 dilute medium: Medium of density less than that in the dense medium separator, usually occurring as a result of spraying the products with water for the removal of adhering medium solids.

5.4.15 over-dense medium: Medium of density greater than that in the dense medium separator, usually produced in the medium recovery system and used to maintain the desired density in the separator.

5.4.16 dense medium plant: A dense medium process including all the equipment associated with the recovery, regeneration and circulation of the medium.

5.4.17 density control device: An automatic device to control the density of the medium in, or entering, the dense medium separator.

5.4.18 medium draining screen; depulping screen (deprecated): A screen for draining the separating medium from dense medium separator products.

5.4.19 suspended matter: Particles from the feed, of density equal or close to that of a separating medium, that are therefore relatively difficult to remove from the separator, because they are not readily recovered in either the float or the sink product.

5.4.20 medium recovery screen: A screen for draining and spraying the product from a dense medium separator to remove adhering medium solids.

5.4.21 shower box: A device that produces a continuous curtain of water droplets in a band over the full width of a screen; usually used on medium recovery screens.

5.4.22 medium solids preparation: Any grinding or treatment of the raw dense medium solids to make them suitable for use.

5.5 Cleaning equipment (miscellaneous)

5.5.01 trough washer; launder washer: A cleaning device applying the principle of alluviation in troughs.

5.5.02 concentrating table; shaking table: A device consisting of a riffled deck, usually inclined in two directions to the horizontal, to which a differential reciprocating motion in a substantially horizontal direction is imparted; the material to be separated is fed in a stream of water; the heavy particles collect between the riffles and are there conveyed in the direction of the reciprocating motion, whereas the lighter particles are borne by the current of water over the riffles to be discharged laterally from the table.

5.5.03 riffles: Longitudinal strips of varying heights mounted on the deck of a concentrating table to separate the more dense particles.

5.5.04 dressing water; cross water: Secondary water used on concentrating tables.

5.5.05 upward current washer: A washer in which separation takes place under the influence of an upward current of water or dense medium.

5.5.06 plate cleaner: A device, for cleaning closely-sized raw coal, that uses the difference in the coefficient of resilience of friction between clean coal and an inclined plate, commonly of steel, and that between refuse and the plate, to allow the clean coal to jump over a gap while the refuse falls through.

5.5.07 barrel washer; drum washer: A device for cleaning raw coal, comprising a cylinder rotating slowly about an axis slightly inclined to the horizontal, into which the raw coal, with a current of water or in suspension, is fed near its upper end; the clean coal is carried by the water or suspension to the lower end of the cylinder over a scroll that conveys the reject to the upper end of the cylinder.

5.5.08 cyclone: A device in which the principle of centrifugal force is applied to effect a separation in water or in a dense medium.

5.5.09 hindered settling cleaner: A wet cleaning device for fine coal, using a teeter bed combined with an upward current of water to effect separation.

5.6 Froth flotation

5.6.01 activating agent; activator: A substance that, when added to a pulp, promotes flotation in the presence of a collecting agent.

5.6.02 collecting agent; collector: A reagent added to a pulp to promote adhesion between coal particles and air bubbles.

5.6.03 frothing agent; frother: A reagent used to control the size of the air bubbles and the stability of the froth in the flotation process.

5.6.04 wetting agent: A reagent used to reduce the interfacial tension between a solid and a liquid and therefore facilitate the spreading of the liquid over the solid surface.

5.6.05 depressant: A substance that, when added to a pulp, prevents a particular mineral or minerals from floating.

5.6.06 pulp: A mixture of solid particles and water. [See also *slurry* (5.1.21).]

5.6.07 selective flotation: A process for the preferential recovery of a particular ingredient of the coal, e.g. a petrological constituent, by froth flotation.

5.6.08 aeration: The introduction of air into the pulp in a flotation cell to form air bubbles.

5.6.09 conditioning: The preparatory stage in the flotation process in which the reagents are brought into intimate contact with the solids of the pulp.

5.6.10 conditioner: An apparatus in which conditioning takes place.

5.6.11 reagent feeder: An apparatus for the feeding and proportioning of one or more reagents.

5.6.12 flotation cell: A vessel in which a pulp is subjected to froth flotation.

5.6.13 agitator: A device used to bring about a continuous vigorous disturbance in a pulp, usually used to assist bubble formation.

NOTE 14 In the latter case, the agitator is usually in two parts: a rotating part, the impeller, and a stationary part, the diffuser or hood.

5.6.14 primary cells: A group of flotation cells in which the raw feed is given a preliminary treatment, either or both of the products being subsequently re-treated.

5.6.15 rougher cells: Primary cells in which the majority of the tailings are removed and discarded.

5.6.16 secondary cells: A group of flotation cells in which a product from the primary cells is re-treated.

5.6.17 cleaner cells; recleaner cells: Secondary cells for the re-treatment of the flotation concentrates from primary or rougher cells.

5.6.18 scavenger cells: Secondary cells for the re-treatment of tailings.

5.6.19 flotation concentrate: The clean product recovered in froth flotation.

5.6.20 flotation tailings: The reject from froth flotation cells.

5.6.21 flotation middlings: Flotation products that may be re-treated.

5.6.22 contact angle: The angle between the tangent to the fluid-fluid interface and the tangent to the solid surface at any point along the line of contact of the interface between two fluids and a solid.

NOTES

15 Where water is involved, the contact angle is usually measured inside the water phase.

16 Maximum and minimum values measured under static conditions, termed advancing and receding contact angles respectively, are usually qualified by stating the phase in which the angle is measured, e.g. oil-advancing contact angle.

5.6.23 froth breaker: A device used to reduce the volume of froth flotation concentrates by de-aeration.

5.6.24 release analysis: A procedure, employing staged addition of collector, to determine the best results possible in cleaning a coal by froth flotation.

6 Separation of solids from water or air

6.1 General

6.1.01 dewatering: The removal of water by means other than evaporation.

6.1.02 drying: The removal of moisture, mainly by evaporation.

6.1.03 draining: The removal of water or medium from a product, mainly by gravity.

6.1.04 filtration: A process for separating solids from liquids by allowing the liquid to pass through a finely woven cloth or gauze that retains the solids, using vacuum or pressure to accelerate the separation.

6.1.05 centrifuging: Dewatering with the aid of centrifugal force.

6.1.06 flocculation: The formation of aggregates from particles dispersed in a liquid by the use of a flocculating agent.

6.1.07 clarification: The removal of solids from circulating water to reduce the suspended solids to a minimum.

6.1.08 thickening: The concentration of the solids in a suspension, with a view to recovering a product having a higher concentration of solids than that of the original suspension.

6.1.09 effluent: Water discharged from any item of equipment after fulfilment of its function or after having itself been treated (e.g. for clarification).

6.1.10 plant effluent: Water, sometimes containing solids, discharged from a coal preparation plant, usually to waste.

6.1.11 slurry pond: A natural or artificial pond or lagoon for settling and draining the solids from washery slurry.

6.1.12 dispersion

(1) A suspension of discrete particles in a fluid

(2) The creation of a dispersion (1) by destroying the aggregates of particles.

6.2 Dewatering

6.2.01 dryer: Equipment for the drying of coal with the aid of heat.

6.2.02 fixed screen: A stationary inclined flat or curved panel, commonly of wedge-wire, that is used to remove a large proportion of water and fines from a suspension.

6.2.03 basket centrifuge: A device for dewatering in which wet solids are held by centrifugal force against a perforated containing surface that permits the outward passage of water (centrate) and retains the solids that are discharged mechanically.

6.2.04 solid-bowl centrifuge: A device for dewatering in which the retaining surface is imperforate, the retained solid particles are collected by a scroll and discharged from one end of the machine, and the water (centrate) overflows from the opposite end.

6.2.05 screen-bowl centrifuge: A dewatering device combining in one machine a bowl and a basket centrifuge.

6.2.06 centrate: The liquid product from a centrifugal dewatering device.

6.2.07 filter bowl; filter tank: A tank, containing the pulp to be filtered and generally fitted with an agitator to maintain the solids in the pulp in suspension, in which the drum or disc of a rotary vacuum filter is partially immersed.

6.2.08 filter cloth: A woven or felted fabric used as a medium for filtration.

6.2.09 filter cake: The solid product from the filtration process.

6.2.10 filtrate: The liquid product from the filtration process

6.2.11 pressure filter: A filter in which filtration is carried out as a result of the application of pressure to one side of a filter medium.

6.2.12 filter press: A form of pressure filter, non-continuous in operation, used for the removal of water from slurries, tailings and similar products.

6.2.13 vacuum filter: A filter in which filtration is carried out as a result of the application of a vacuum on one side of a filter medium.

6.2.14 dredging conveyor: A scraper partially immersed in a vessel containing liquid and used for removing any solids that may settle therein.

6.2.15 dredging sump; drag tank; smudge tank (deprecated): A tank, forming part of the water circuit, in which slurry or small coal settles and is removed continuously by means of a scraper chain or scraper buckets.

6.3 Clarification and thickening

6.3.01 flocculating agent; flocculant: A reagent added to a dispersion of solids in a liquid to bring together the fine particles to form flocs.

6.3.02 flocs: Aggregates resulting from flocculation.

6.3.03 settling cone; conical settling tank: A conical tank used to settle coarse solids from the circulating water.

6.3.04 settling pond: A pond, natural or artificial, for collecting solids from plant effluent, the supernatant water being either recovered for re-use or discarded.

6.3.05 rake thickener: Equipment for thickening in which the concentrated suspension settles in a container of circular section and is delivered mechanically to one or more discharge points by a series of arms revolving slowly around a central shaft.

6.3.06 cyclone thickener: A device for thickening by centrifugal means, in which the concentrated suspension is discharged from the apex of the vessel, and the bulk of the water is removed at the overflow orifice.

6.3.07 headbox; feed box: A device for distributing a suspension of solids in water to a machine, or for retarding the rate of flow, as to a top-feed filter.

6.4 Separation of solids from air

6.4.01 dust extraction: The removal of solid particles suspended in gas or ambient air.

6.4.02 dust recovery: The accumulation, in a convenient form for handling, of solid particles suspended in air or gas.

6.4.03 dust collector: An apparatus for separating solid particles from air or gas and accumulating them in a form convenient for handling.

6.4.04 cyclone dust collector: An apparatus for the separation, by centrifugal means, of fine particles suspended in gas or air.

6.4.05 bag filter; fabric filter: An apparatus for removing dust from dust-laden air, employing a container made from woven material that permits the passage of air but retains solid particles.

6.4.06 electrostatic precipitator: An apparatus for removing dust from dust-laden air, employing principle of electrostatic precipitation.

7 Size reduction

7.1 General

7.1.01 breaking; cracking (deprecated): Size reduction of large particles.

7.1.02 crushing: Size reduction into relatively coarse particles.

7.1.03 grinding; pulverizing: Size reduction into relatively fine particles.

7.1.04 reduction ratio: The ratio of the size of the feed to the size of product in a crushing operation.

NOTE 17 There are several methods of calculating the ratio, e.g. limiting reduction ratio, 80 % reduction ratio, mean-size reduction ratio.

7.1.05 liberation (of intergrown constituents): Crushing of intergrown material to free the constituent materials.

7.1.06 breakage

(1) Voluntary or involuntary size reduction of a solid.

(2) Small material produced by involuntary breakage during mechanical handling or processing.

7.1.07 degradation: Involuntary breakage resulting from handling, processing and storage.

7.1.08 disintegration, dissociation (deprecated): The physical breakdown of material, usually shale, as a result of immersion in water or weathering. (See ISO 10753-1.)

7.1.09 crushability: The relative ease of crushing a sample under standard conditions.

7.1.10 grindability: The relative ease of grinding a sample under standard conditions

7.1.11 selective crushing: Crushing in such a manner as to cause one ingredient of the feed to be crushed preferentially to others.

7.1.12 selective grinding: Grinding in such a manner as to cause one ingredient of the feed to be ground preferentially to others.

7.1.13 crushing circuit: A system involving the use of a crusher followed by a screen to size the crushed product.

NOTE 18 If the coarse fraction is returned to the crusher, the circuit is termed "closed", otherwise the circuit is termed "open".

7.1.14 grinding circuit: A system involving the use of a grinding mill followed by classification of the mill discharge.

NOTE 19 If the coarse fraction is returned to the mill, the circuit is termed "closed", otherwise the circuit is termed "open".

7.2 Size reduction machines

7.2.01 pick breaker: A machine for breaking coal by the splitting action of mechanically operated picks.

7.2.02 rotary breaker; Bradford breaker: A rotating, steel, perforated drum through which material of the desired size falls; the oversize material is lifted by flights inside the drum and falls back so that the weaker component (coal) breaks and passes through the perforations, whereas the hardest material (rock) remains unbroken and is rejected.

7.2.03 jaw crusher: A machine for reducing the size of materials by compression between a fixed plate and an oscillating plate, or between two oscillating plates, forming a tapered jaw.

7.2.04 roll crusher; toothed roll crusher: A machine in which size reduction is effected by causing the material to pass between a rotating roller, generally toothed, and a fixed or oscillating plate, or between two or more rollers.

7.2.05 rigid-hammer crusher: A machine in which size reduction is effected by elements rigidly fixed to a rotating horizontal shaft mounted in a surrounding casing.

7.2.06 swing-hammer crusher; swing-hammer mill; swing-hammer pulverizer: A machine in which size reduction is effected by elements loosely pivoted to discs fitted on a rotating horizontal shaft mounted in a surrounding casing.

7.2.07 ball mill; rod mill: A cylinder, rotating on a horizontal axis, partly filled with balls or rods (generally of steel) that, by their tumbling motion, reduce a coarse material into a fine material by impact and abrasion.

7.2.08 gyratory crusher; cone crusher: A machine in which the feed is delivered to a conical chamber in which a solid cone rotates eccentrically on a vertical axis.

8 Expression of results

8.1 General terms

8.1.01 efficiency: Any measure of the effectiveness of a separation.

8.1.02 statement of performance: A statement describing the scope and duty of a plant in terms, for example, of the tonnage of coal treated per hour, the processes used, the separations effected and the sizes produced.

NOTE 20 A statement of performance can also be used to express the results of plant operation.

8.1.03 yield; recovery (deprecated)**:** The amount of a product obtained from any operation, expressed as a percentage of the feed material.

8.1.04 calculated feed; reconstituted feed: The composition (e.g. relating to size or density) of the feed to a preparation plant (or to a component part) calculated by combining the properties of the products obtained in the appropriate mass proportions in contrast to the analysis of the actual feed.

8.1.05 partition curve; distribution curve: A curve indicating the percentage of each density (or size) fraction contained in one of the products of the separation.

8.1.06 partition coefficients; distribution coefficients: The percentage of a particular density (or size) fraction recovered in one of the products of the separation.

8.1.07 cut-point: The exact level (e.g. density or size) at which a separation into two fractions is desired or achieved.

8.1.08 misplaced material: Material wrongly included in the products of a sizing or density separation, i.e. material that has been included in the lower size or relative density product but that itself has a size or relative density above that of the cut-point, or vice versa.

NOTE 21 The mass of misplaced material may be expressed as a percentage of the product or the feed.

8.1.09 total misplaced material: The sum of the masses of the misplaced material in the products of a sizing or density separation, expressed as a percentage of the mass of the feed.

NOTE 22 If three products are made in a single separator, the total misplaced material will be the sum of the mass of material wrongly placed in each of the three products, expressed as a percentage of the feed to the separator.

8.1.10 correctly placed material: Material correctly included in the products of a sizing or density separation.

8.1.11 total correctly placed material: The sum of the masses of material correctly included in the products of a sizing or density separation, expressed as a percentage of the mass of the feed to the separator (and equal to 100 minus the total misplaced material).

8.2 Sizing operations

8.2.01 designated size: The particle size at which it is desired to separate a feed by a sizing operation.

NOTE 23 The designated size is commonly expressed as either the partition size or the equal errors size.

8.2.02 separation size: A general term indicating the effective size at which separation has taken place, calculated from a size analysis of the product.

NOTE 24 The separation size is commonly expressed as either the partition size or the equal errors size.

8.2.03 partition size: The separation size corresponding to 50 % recovery as read from a size partition curve.

8.2.04 equal errors size: The separation size at which equal portions of the feed material are wrongly placed in each of two products of a sizing operation.

8.2.05 control size; checking size, testing size (deprecated)**:** A single size chosen to test the accuracy of a sizing operation.

NOTE 25 The control size may be the same as the designated size.

8.2.06 reference size: The separation size, the designated size or the control size used to define the size limit of the products of a sizing operation.

8.2.07 nominal screening size: A notional size at which it is intended to divide a feed by a screening operation.

8.2.08 misplaced material (sizing): Undersize contained in the overflow, or oversize contained in the underflow, of a sizing operation.

8.2.09 correctly placed material (sizing): Material finer than the separation size contained in the underflow, or material coarser than the separation size contained in the overflow, of a sizing operation.

8.2.10 effective screen aperture: The cut-point (e.g. equal errors or partition size) at which a sizing operation separates the material tested into two size fractions.

8.2.11 nominal screen aperture: A nominal mesh aperture used to designate the result of a sizing operation.

8.2.12 efficiency of sizing; yield of sizing: The mass of material correctly placed relative to the reference size, expressed as a percentage of the mass of corresponding material in the reconstituted feed.

8.2.13 efficiency of screening: The mass of underflow (excluding oversize) expressed as a percentage of the total mass of material finer than the reference size of the reconstituted feed.

8.2.14 size-distribution curve: A graphical representation of the size analysis of a mixture of particles of various sizes, using an ordinary, logarithmic or other scale.

8.3 Cleaning operations

8.3.01 organic efficiency: The ratio (normally expressed as a percentage) between the actual yield of a desired product and the theoretically possible yield (based on the reconstituted feed), both actual and theoretical products having the same percentage of ash.

8.3.02 theoretical yield: The maximum yield (as shown by the washability curve) of a product having a specified percentage of ash.

8.3.03 error curve; Tromp error curve: A partition curve drawn to defined conventional scales with the portion showing recoveries over 50 % reversed to enclose an error area.

8.3.04 separation density: The effective density at which a separation has taken place, calculated from a relative density analysis of the products.

NOTE 26 The separation density is commonly expressed as either the partition density or the equal errors density.

8.3.05 partition density (d_p, d_{50}); **Tromp cut-point:** The density corresponding to 50 % recovery as read from a partition curve.

8.3.06 equal errors cut-point (density); Wolf cut-point (deprecated): The density at which equal portions of the feed material are wrongly placed in each of two products of a relative density separation.

8.3.07 écart probable moyen; Epm (literally: mean probable error): One half of the difference between the densities corresponding to the 75 % and 25 % ordinates as shown in the partition curve.

8.3.08 imperfection; I: The ratio

$$\frac{\text{écart probable moyen}}{\text{partition density} - 1} \quad \text{or} \quad \frac{\text{Epm}}{d_{50} - 1}$$

NOTE 27 This ratio is applicable only if the separating medium is water.

8.3.09 ash error: The difference between the actual percentage ash of a product of a separation and that shown by the washability curve (based on the reconstituted feed) corresponding to the actual yield obtained.

8.3.10 yield loss; washing loss (deprecated): The difference between the actual yield of a product and the yield theoretically possible (based on the reconstituted feed) of a product having the same properties (usually percentage of ash).

8.3.11 floats: Fractions having a defined upper limit of relative density and so described, e.g. floats at relative density 1,40.

8.3.12 sinks: Fractions having a defined lower limit of relative density and so described, e.g. sinks at relative density 1,60.

8.3.13 near-density material: Material having a relative density lying between limits, usually 0,1, on either side of the cut-point.

8.3.14 misplaced material (cleaning): Material of relative density lower than the separation density that has been included in the high density product, or material of relative density higher than the separation density that has been included in the low density product.

8.3.15 correctly placed material (cleaning): Material of relative density lower than the separation density that has been included in the low density product, or material of relative density higher than the separation density that has been included in the high density product.

9 Miscellaneous

9.1.01 dust-proofing: A surface treatment, e.g. with oil, calcium chloride solution or other surface active agent, to prevent or reduce the dustiness of coal in handling.

9.1.02 freeze-proofing: A surface treatment, with reagents, to prevent or reduce cohesion of coal particles by ice formation during freezing weather.

9.1.03 angle of repose: The angle between the surface of a heap of loosely piled material and the horizontal.

9.1.04 dust supression: The prevention or reduction of the dispersion of dust into the air, e.g. by using water sprays.

9.1.05 blending: Mixing in predetermined and controlled quantities to give a uniform product of desired properties.

9.1.06 bunker; bin: A vessel for the storage of materials, with the main section having vertical walls and the lowermost portion usually constructed in the form of a hopper.

9.1.07 hopper: A vessel into which materials are fed, usually constructed in the form of an inverted pyramid or cone terminating in an opening through which the materials are discharged (not primarily intended for storage).

9.1.08 surge hopper; surge bunker: : A hopper (bunker) designed to receive a feed at fluctuating rate and from which it is discharged at some predetermined rate.

9.1.09 agglomeration: A process in which fine particles are caused to adhere together to form balls or clusters, usually with the addition of a suitable reagent to promote adhesion.

9.1.10 bulk density: The mass in air of unit volume of bulk material, including the voids within and between particles.

9.1.11 paddle mixer: A horizontal screw conveyor having two non-continuous spirals which form paddles to propel and blend the constituents of the feed.

10 Blending and homogenization terms

10.1.01 bunker blending; bin blending: A method of blending whereby the components are stored separately in bunkers or bins that are discharged simultaneously in predetermined and controlled quantities.

10.1.02 feeder: A mechanical device for delivering material at a controlled rate.

10.1.03 heterogeneity: The state of a material when particles having certain characteristics are distributed unevenly throughout it.

10.1.04 homogeneity: The state of a material when particles having certain characteristics are distributed evenly throughout it.

10.1.05 homogenization: The thorough mixing of a material to obtain a product of relatively constant characteristics.

10.1.06 mixing: The combination of two or more materials of different characteristics in proportions that need not be predetermined or controlled.

10.1.07 mixer: A device or process that achieves mixing.

10.1.08 uniformity: The state of a material relative to a certain characteristic if all the particles have identical values for that characteristic.

10.1.09 non-uniformity: The state of a material relative to a certain characteristic if the particles have different values for that characteristic.

10.1.10 reclaimer: A mechanical device that recovers material from a stockpile.

10.1.11 stacker: A mechanical device used to form a stockpile.

10.1.12 stockpile: A formed mass of material maintained in storage on the ground.

NOTE 28 A stockpile may have the following parts:

a) active or live: The portion of a stockpile that can be reclaimed using installed equipment.

b) dead or inactive: The portion of a stockpile that cannot be reclaimed using installed equipment.

10.1.13 stockpiling: The action of forming a stockpile.

NOTE 29 There are several methods of stockpiling, for example

a) chevron: The method of forming a longitudinal stockpile of triangular cross-section whereby successive components are evenly stacked along the central axis of the stockpile.

b) cone-ply: The method of forming a longitudinal stockpile of triangular cross-section whereby an initial conical stockpile is extended linearly by adding successive components to one conical face.

c) layered: The method of forming a stockpile whereby successive components are added in a layer form. If the stockpile is formed for blending, the successive layers are distributed over the area of the stockpile.

d) windrow: The method of forming a longitudinal stockpile whereby successive components are stacked in adjoining parallel longitudinal stockpiles that progessively form the overall stockpile.

10.1.14 mass flow (in bunkers): Flow in which all the contents of a bunker are in motion, so that there is substantially uniform velocity of flow across the whole cross-section of the material.

10.1.15 core flow; funnel flow: Material flow that is confined to a column immediately surrounding the vertical axis through the outlet and in which the material on the surface slides in towards the downward-moving column.

11 Automatic control terms

11.1 General

11.1.01 control system: An arrangement of elements (e.g. amplifiers, converters, human operators) interconnected and interacting in such a way as to maintain or to affect in a prescribed manner some condition of a body, process or machine that forms part of the system.

11.1.02 automatic control

(1) The provision of equipment to enable plant and machinery to perform some or all of its operations without the intervention of an operator or attendant.

NOTE 30 Automatic control is not to be confused with *remote control* (11.1.07) which itself may or may not include provision for automatic control.

(2) The process of comparing measured values with a reference value (set point) and correcting deviations from the reference value by automatic means.

11.1.03 manual control: The operation of a plant in response to command actions taken by an operator as opposed to those taken automatically.

11.1.04 central control: The operation of a number of control functions on a plant from one central point.

11.1.05 local control: Operator control of a plant from a position adjacent to the motive power.

11.1.06 remote indications: The receiving and display of data at a point remote from the process or machine.

11.1.07 remote control: The initiation of control operations for a process or machine at a point remote from the motive power.

11.1.08 process control system: A control system, whose purpose is to control some physical quantity or condition of a process.

11.1.09 adaptive control system: A system in which automatic means are used to change the system parameters in a way intended to achieve the best possible performance of the system at all times.

11.1.10 management information system; MIS: A computer system designed to acquire and retain information about the performance of operations and equipment, with facilities for retrieving that information on demand.

11.1.11 monitor (to): To measure or record continuously or regularly.

11.1.12 data: Representation of facts, concepts or instructions in a formalized manner suitable for communication, interpretation or processing by human or automatic means.

11.1.13 sequence control: The starting or stopping of a series of related events in a prescribed order.

11.1.14 alarm: A visual or audible signal to attract human attention to a condition or state.

11.1.15 fail safe: A system concept in which the failure of any component or sub-system will not cause a hazard.

11.2 Control equipment

11.2.01 sensor: A detector or transducer normally used for measuring quantities or detecting occurrences.

NOTE 31 Analogue transducers are sometimes called sensors.

11.2.02 detector: A device to indicate a specific occurrence.

11.2.03 transducer: A device that detects and measures some quantity in a system (e.g. pressure, current, voltage) and converts it into a signal of related or proportional units.

11.2.04 flowmeter: A device used to measure the rate of flow (volume per unit time), or the total volume during a given period.

11.2.05 controller: A piece of equipment that combines the function of at least the input elements, the comparing elements and he amplifying and signal processing elements, for a process control system.

11.2.06 actuator: A motor having limited rotary or rectilinear motion.

11.2.07 servo-mechanism: A system using feedback in which one or more of the signals in the system represents mechanical motion.

11.2.08 amplifier: A device for controlling power from a source so that more is available at the output than is supplied at the input.

NOTE 32 Examples of the source or power are electrical, mechanical, hydraulic and pneumatic.

11.2.09 converter: A device that receives analogue signals in one form, e.g. pneumatic, and produces an equivalent output in another form, e.g. electronic.

NOTE 33 A converter is usually qualified by naming the types of signals received and produced.

11.2.10 ash monitor: A device that analyses coal quality in terms of ash percentage and produces a signal representing ash percentage.

11.2.11 bulk density meter: A device for monitoring the bulk density of a mineral to provide an indication of quality.

11.2.12 moisture meter: A device that analyses coal quality in terms of moisture percentage and produces a signal representing moisture percentage.

11.2.13 density meter: A device for monitoring the relative density of a suspension.

11.2.14 proximity switch: A device for detecting the presence of another body without physical contact.

11.2.15 pre-start warning: An audible alarm that is caused to sound before machinery (e.g. a conveyor) is started.

11.2.16 mimic diagram: A visual presentation of the state of a plant or part of a plant.

11.2.17 printer: A device for producing printouts of text and/or graphics.

11.2.18 printout: The document or set of messages produced by a printer.

11.2.19 visual display unit; VDU: A device for visual presentation of data (e.g. from a computer), generally employing a cathode ray tube or liquid crystal display.

11.2.20 status display: A presentation or report by visual means of the state of operation at a particular time.

11.2.21 static display: A presentation or report by visual means in which the values or information display remain steady and are not updated to represent the current information.

11.2.22 dynamic display: A display by visual means that is effectively continuously updated so as to present up-to-date information at all times.

11.2.23 microcomputer; microprocessor: A small computer based on either a single chip of semi-conductor or a small number of chips.

11.2.24 digital computer: A machine that carries out arithmetic and logical operations on data represented in a binary digital format.

11.2.25 analogue computer: A computer that uses physical quantities to represent numbers, e.g. a pneumatic analogue computer uses pressure and flow rate, an electronic analogue computer uses current and voltage.

11.2.26 hybrid computer: A computer formed from a combination of an analogue and a digital computer.

11.2.27 front end processor: A small computer used to organize input/output functions for a larger machine.

11.2.28 programmed controller: A controller incorporating a sequence of predetermined commands to a control system as a function either of time or of some other variable.

NOTE 34 Programmable Logic Controller (PLC) is a device for performing this task.

11.2.29 programmable controller: A controller, whose function is determined by codes or instructions programmed into it by the user, the application programme(s) being stored in an accessible memory.

11.2.30 dedicated controller: A controller that is responsible for the control of a specific section of a plant.

11.2.31 limit switch: A switch that is operated by movement of a machine or apparatus beyond a set limit and that is frequently used to cut off power to the machine or to reverse its motion.

11.2.32 limit transducer: A transducer that is used, with a control system, to apply a preset limit to any operation or movement.

11.2.33 lock-out circuit: A facility to allow a machine to be rendered inoperative by local or remote switches or contacts, e.g. during maintenance work.

11.3 Control terminology

11.3.01 open loop control (system): A system of control using feedback but not using any automatic means of determining deviations from the target value.

NOTE 35 The feedback signal or signals are normally displayed visually, deviations being corrected manually.

11.3.02 closed loop control (system): A system of automatic control in which the operation being performed is measured and compared with the desired performance.

NOTE 36 The deviation is used to activate the control element in such a manner as to tend to reduce the deviation to zero. An important feature of such systems is the way in which the deviation is modified before being fed back to the control element. Closed loop controllers may have proportional, integral or derivative action or a combination of these.

11.3.03 ratio control (system): A control system that maintains two or more physical quantities or conditions at a predetermined ratio.

11.3.04 controlled device: A body, process or machine, a particular condition of which is controlled by a system.

11.3.05 controlled condition: The physical quantity or condition of the controlled body, process or machine that it is the purpose of the system to control.

11.3.06 desired value: The independently set reference in a control system.

11.3.07 input signal: A received signal that initiates action.

11.3.08 command signal: The quantity or signal that is set or varied by some device or human agent external to and independent of the control system and that is intended to determine the value of the controlled condition.

11.3.09 set point: The desired value at which the process or machine is to be controlled.

11.3.10 deviation: The difference between the measured value of the controlled condition and the command signal.

11.3.11 error signal: In an automatic control system, a signal that represents the discrepancy between the desired and the actual performance and that is used to apply the necessary corrections.

11.3.12 control signal: A signal passed to the equipment governed by a control system to apply a change or correction.

11.3.13 control action: A term describing the relationship between the input signal and the output signal of a control element.

11.3.14 proportional action: The action of a control element whose output signal is proportional to its input signal.

11.3.15 derivative action: The change of output signal proportional to the rate of change of the deviation.

11.3.16 integral action: The action of a control element whose output signal changes at a rate that is proportional to the change of input with respect to time.

11.3.17 feedback: The transmission of a signal from one stage of the system to a preceding stage to effect correction and/or control.

11.3.18 stability: The ability of a control system (or any mechanical or electrical system) to return to a state of equilibrium after a disturbance.

11.3.19 damping: The progressive reduction or suppression of the oscillation of a system.

11.3.20 hunting: A sustained oscillation of the output quantity about the required value.

11.3.21 calibration: The graduation, correction or adjustment of the scale of a measuring instrument to a standard.

11.3.22 interface: The connection between two distinct parts of a system.

NOTE 37 An interface may be physical, as between a transducer and transmission system, or imaginary, as between one computer programme and the data area.

11.3.23 man-machine interface: The operator's control panel and all that is associated with communication between the operator and a device that either monitors or controls a process.

11.3.24 hardware: The mechanical, magnetic, electrical and electronic devices or components that comprise a computer system.

11.3.25 software: The collection of programmes or routines associated with a computer.

11.3.26 hardwire (to): To connect solely by relays, switches and wires.

11.3.27 machine language: The binary code representation of the instructions executed by a computer.

11.3.28 programme: A sequential set of instructions that specifies, in a manner capable of interpretation by a computer, the set of actions to be taken or not taken.

11.3.29 pass: The complete process of reading a set of information; usually relevant when the same set of information is to be read more than once in the same sequence.

11.3.30 diagnostic: A programme run to determine (hardware) faults in a computer system.

11.3.31 word: A complete element of computer memory normally treated as a unit.

11.3.32 memory: Any device associated with a computer that is used to store information such as programmes or data, in digital form.

11.3.33 configuration: The specific set of equipment supplied as part of the system and usually applied to the size and number of storage and input/output devices.

Annex A

(informative)

Bibliography of International Standards defining terms for automatic control

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Alphabetical index