International Standard 1213/1

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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

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1213/1 was developed by Technical Committee ISO/TC 27, *Solid mineral fuels*, and was circulated to the member bodies in September 1981.

It has been approved by the member bodies of the following countries :

Australia	Egypt, Arab Rep. of	South Africa, Rep. of
Austria	France	Spain
Belgium	Germany, F. R.	Turkey
Bulgaria	India	United Kingdom
Canada	Japan	USSR
Chile	Poland	Yugoslavia
China	Romania	

No member body expressed disapproval of the document.

This International Standard cancels and replaces ISO Recommendation R 1213/1-1970, of which it constitutes a technical revision.

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Contents

Solid mineral fuels — Vocabulary — Part 1 : Terms relating to coal preparation

0 Introduction

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

The other parts of ISO 1213 are :

Part 2 : Terms relating to coal sampling and analysis[1)]
Part 3 : Terms relating to coke[2)]
Part 4 : Terms relating to the chemistry and technology of brown coal[3)]

For terms relating to petrographic analysis, see ISO 7404/1.

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 includes also 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.

It is intended to prepare two further clauses covering homogenization and automatic control for future publication.

Most of the clauses are subdivided, and in each case the first sub-clause includes general terms and the remaining sub-clauses 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.

The use of the terms indicated by an asterisk is deprecated.

1 Scope and field of application

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

2 Reference

ISO 7404/1, *Methods for the petrographic analysis of bituminous coal and anthracite — Part 1 : Glossary of terms relating to the petrographic analysis of bituminous coal and anthracite.*[3)]

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 which 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 coal to lower the mineral matter content (ash).

1) At present at the stage of draft. (Revision of ISO/R 1213/2-1971.)

2) At present at the stage of draft. (Revision of ISO/R 1213/3-1971.)

3) At present at the stage of draft.

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 which by reason of its ash content is intermediate between coal and discard. 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 : Comparatively high ash particles so nearly homogeneous that their quality cannot readily be improved by crushing and re-cleaning.

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 refuse : Waste material in the raw coal which the cleaning process removes.

See also *discard; dirt; stone* (No. 3.1.12).

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

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

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

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

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

3.1.16 low-grade coal : Combustible material which has only limited uses owing to undesirable characteristics (e.g. ash content or size).

3.1.17 segregation : Partial separation of a previously mixed material into its constituents, occurring as a result of differences in either particle size or relative density.

3.2 Cleaning characteristics

3.2.01 washability : The amenability of a coal to improvement in quality by cleaning.

3.2.02 float-and-sink analysis : The division of a sample into relative density fractions with defined limits, the proportions 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. There are four main types of washability curve :

- the characteristic ash curve;
- the cumulative floats curve;
- the cumulative sinks curve;
- the densimetric (relative 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 probable performance curve : A performance curve showing the expected results of a coal preparation treatment.

3.2.13 M-curve; Mayer curve : A cumulative curve used in the first instance 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 descriptions of a plant, applying to the plant as a whole and to the specific project 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, defined by limits expressing the extent and duration of load variations, at which specific items of plant subject to a performance guarantee 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 which 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 block diagram of the various 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, preferably by symbols, the units of plant 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 flowsheet used in the design of a plant, including statements of the maximum mass flow per hour at principal points in the plant. The total mass flow of products from an operation is usually greater than the mass flow of the feed to that operation.

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 with defined limits, the proportions of the fractions being expressed as percentages of the total sample.

4.1.04 sieve analysis : The process or result of the division of a sample into size fractions 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. Several methods for calculating mean size have been proposed giving results which vary widely for the same size distribution. The method of calculation should always be stated whenever the term is used.

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 (sizing) : Material in a product of size greater than the upper nominal size; 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; may be expressed as a percentage of the product.

4.1.09 dust : Fine material removed dry from coal using air.

See also 6.4.

4.1.10 fines : Coal with a maximum particle size usually less than 4 mm, and with no lower limit. 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 with a maximum particle size usually less than 25 mm, and with no lower limit. 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 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.

4.2.02 amplitude : The maximum displacement from the mean position in an oscillating motion. In the case of a screen with 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* (No. 4.2.03).

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

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

4.2.05 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.

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

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

4.2.08 wet screening : The screening of solid materials of different sizes with the aid of water, normally in the form of a spray.

4.2.09 probability screening : A method of screening which 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.

4.2.10 de-sliming : The removal of slimes from coal or a mixture of coal and water, however accomplished.

4.2.11 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.

4.2.12 de-dusting : Fines removal by dry methods.

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

4.2.14 undersize (overflow) : Particles in a screen overflow which are smaller than the nominal dimensions of the screen apertures.

4.2.15 underflow (screen) : That portion of the feed material which has passed through the apertures in a screen deck.

4.2.16 oversize (underflow) : Particles in a screen underflow which are larger than the nominal dimensions of the screen apertures.

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

4.2.18 near-mesh material; near-sized material : Material approximating in size to the aperture in the screening surface, usually within ± 25 % of that aperture size.

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

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

4.2.21 percentage 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. In the case of perforated plate the area of the unperforated margins is excluded.

4.2.22 sieve :

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

(2) Particularly, a screen used in the laboratory for test purposes.

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 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; the underflow thus passes through an aperture of increasing cross-section.

* Deprecated term.

4.3.05 rod deck : A screening surface consisting of loosely held parallel rods positioned at right angles to the flow of material over the screen. Normally used only on high speed vibrating screens.

4.3.06 relieving deck : A screen plate with large apertures mounted over the screening deck in order 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; 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 de-watering screen : A screen used for the separation of water from solids.

4.4.04 de-sliming 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 to recover a granular product from circulating water in a coal preparation plant, usually after a preliminary concentration of the solids and with or without the use of water sprays.

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

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

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

4.4.09 undersize control screen; breakage screen* : A screen used for the removal of 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 with two or more superimposed screening surfaces mounted rigidly within a common frame.

4.5.03 jigging screen; shaking screen; reciprocating screen : 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 with 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 either by mechanical or electrical means. The amplitude of movement of the vibrating screen is smaller than that of the jigging screen and its speed of oscillation is higher.

4.5.06 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.

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

4.5.08 bar screen : A stationary inclined screen, comprising longitudinal bars, spaced at intervals, on to which the material to be screened is fed at the upper end.

4.5.09 grizzly : A rugged screen for rough sizing at comparatively large size (e.g. 150 mm); it can comprise fixed or moving bars, discs, or shaped tumblers or rollers.

4.5.10 sieve bend : A device for the sizing of fine particles suspended in water by means of a stationary curved panel, commonly of wedge-wire, whereby the finer particles are removed with the bulk of the water in the underflow.

See also *fixed screen* (No. 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 which 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 grains are discharged from the apex of the vessel, while the finer particles are removed with the bulk of the fluid at the overflow orifice.

* Deprecated term.

5 Cleaning

5.1 General

5.1.01 upgrade : To increase the commercial value of a coal by appropriate treatment.

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

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

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

5.1.05 re-clean; re-wash : To retreat a product in the same or in another plant.

5.1.06 washery products : The final products from a washery.

5.1.07 reject elevator; refuse elevator* : An elevator for removing and draining the reject from a washing appliance.

5.1.08 middlings elevator : An elevator which removes material for further treatment or for disposal as an inferior product.

5.1.09 head tank : Any tank or vessel in the water circuit which is used to control the delivery pressure of the water to the washing units.

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

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

5.1.12 suspension : A mixture of solid particles and water or air in which the solid particles are completely and individually supported, normally by means of an upwardly moving current or with the assistance of mechanical agitation.

5.1.13 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.

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

5.1.15 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.

5.1.16 circulating water : The water in the water circuit.

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

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

5.1.19 waste water; surplus water*; bleed water* : Excess water allowed to run to waste from the water circuit.

See also *effluent* (No. 6.1.09).

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

5.1.21 slimes : Extremely fine particles in suspension or present with larger particles.

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

5.1.23 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 with 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 so that selected ingredients may be removed manually.

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 hand picker : A person employed either for hand cleaning or for hand selection.

5.2.06 pneumatic cleaning : Cleaning in an air current.

* Deprecated term.

5.2.07 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 on the table surface.

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

5.3 Jigging

5.3.01 jig; washbox* : A machine in which the feed is stratified in water by means of a pulsating motion and from which the stratified products are separately removed, the pulsating motion usually being obtained by alternate upward and downward currents of water.

5.3.02 primary jig : The first of a series of jigs 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 to clean coal usually smaller than 12,5 mm in size, in which the pulsating water is made to pass through a layer of graded material, e.g. feldspar, situated on top of the screen plate.

5.3.06 moving sieve jig : A jig in which the 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 screenplate; grid plate*; sieve plate*; bed plate* : A perforated plate or grid which supports the bed of material being treated.

5.3.10 jig bed : The whole of the material on the jig screenplate.

5.3.11 jig cell : One of the individual portions into which the part of a jig below the 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 which extend above the screen plate to form a weir; each compartment usually comprises two or more cells.

5.3.13 hutch : The part of a jig situated below the 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. Usually the discharge sill is part of the discharge-end refuse extraction chamber.

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

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

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

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

5.3.21 refuse 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 refuse extractor, that part which detects variations in thickness of the layer of heavy material on the jig screenplate.

5.3.23 refuse extraction chamber : That part of the jig into which the refuse extractor discharges.

5.3.24 reject gate; discharge shutter* : The mechanism of the refuse extractor which may be manually or automatically operated to control the rate of removal of reject from the jig.

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

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

5.3.27 refuse discharge pipes : Pipes used on some jigs instead of a refuse worm.

* Deprecated term.

5.3.28 primary reject elevator : A refuse elevator which extracts the first or heavier reject; often situated at the feed end of the jig.

5.3.29 secondary reject elevator : A refuse elevator which extracts the second or lighter reject; usually situated at the discharge end of the jig.

5.3.30 top water; transport water* : Water introduced with the raw coal feed to assist the transport of material through the jig.

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

5.3.32 underscreen water; back water* : Water which is fed into the cells of a jig below the level of the screen plate.

5.4 Dense medium cleaning

5.4.01 dense liquid : A liquid or solution of density greater than that of water, which 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), which 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 for the cleaning of coal on a commercial scale using a dense medium. The separation may be made by gravity or by the use of centrifugal force.

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

5.4.06 separating 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 loss during the separation.

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 medium solids recovery plant : The equipment used to remove adhering medium solids from a product from a dense medium separator (after drainage of surplus medium), usually by spraying, and to remove contaminating coal and clay from these medium solids.

5.4.11 magnetic separator : A device for the recovery of medium solids which are magnetic.

5.4.12 magnetics : That portion of the dense medium solids which has a high magnetic susceptibility and is therefore readily recovered by magnetic means.

5.4.13 non-magnetics : That portion of the dense medium solids which has a low magnetic susceptibility. These solids are usually of lower relative density than the magnetics and are therefore classed as contaminants.

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

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

5.4.16 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.

5.4.17 dense medium plant : The operation of a dense medium process including all the equipment associated with the recovery, regeneration and circulation of the medium.

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

5.4.19 medium draining screen; de-pulping screen* : A screen for draining the separating medium from dense medium separator products.

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

* Deprecated term.

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

5.4.22 shower box : A device which produces a continuous curtain of water droplets in a band over the full width of a screen. Usually used on medium recovery screens.

5.4.23 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 while the lighter particles are borne by the current of water over the riffles to be discharged laterally from the table.

5.5.03 riffle : A raised portion of the deck of a concentrating table, which serves to trap the heaviest 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 raw coal which uses the difference in the coefficient of resilience or 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 which comprises a cylinder rotating slowly about an axis which is slightly inclined to the horizontal and into which the raw coal, with a current of water or of a 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 which 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.

5.6 Froth flotation

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

5.6.02 collecting agent; collector : A reagent added to a pulp to bring about adhesion between solid particles and air bubbles.

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

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

5.6.05 depressant : A substance which 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* (No. 5.1.22).

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 in order 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, frequently used to assist bubble formation. 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; re-cleaner cells : Secondary cells for the retreatment of the concentrate 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 which 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; usually measured inside the water phase where water is involved. 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 to reduce the volume of froth flotation concentrates by de-aeration.

6 Separation of solids from water or air

6.1 General

6.1.01 de-watering : 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 which retains the solids, using vacuum or pressure to accelerate the separation.

6.1.05 centrifuging : De-watering 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 in order 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 with a higher concentration of solids than in 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 : Surplus 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 deflocculation.

6.2 De-watering

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, which is used to remove a large proportion of water and fines from a suspension of coal in water.

6.2.03 basket centrifuge : A device for de-watering in which wet coal is held by centrifugal force against a perforated containing surface which permits the outward passage of water and retains the coal, which is discharged mechanically.

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

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

6.2.06 centrate : The liquid product from a centrifugal de-watering device.

6.2.07 filter bowl; filter tank : A tank containing the pulp to be filtered, generally fitted with an agitator to maintain the solids in the pulp in suspension and 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 which may settle therein.

6.2.15 dredging sump; drag tank; smudge tank* : 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 water may either be recovered for reuse 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, while 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, or for eliminating by overflow some of the finest particles.

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 air or gas.

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

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

7 Size reduction

7.1 General

7.1.01 breaking; cracking* : 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 : Broadly the ratio of the size of the feed to the size of product in a crushing operation. There are several methods of calculating the ratio, e.g. limiting reduction ratio, 80 % reduction ratio, mean 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 incidental to handling, processing and storage.

7.1.08 disintegration; dissociation : The physical breakdown of material, usually shale, as a result of immersion in water or weathering.

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.

* Deprecated term.

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 : The use of a crusher followed by a screen to size the crushed product.

7.1.14 grinding circuit : The use of a grinding mill followed by classification of the mill discharge. 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 : A rotating steel drum perforated with holes through which material of the desired size falls, e.g. Bradford, trommel. The oversize material is lifted by flights inside the drum and allowed to fall back so that the weaker component, e.g. coal, may break by impact and fall through the holes. The stronger component, e.g. rock, may not break and so may pass along the drum to be discharged.

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 : A cylinder, rotating on a horizontal axis, partly filled with balls (e.g. of steel) which, by their tumbling motion, reduce by impact and abrasion a coarse material into a fine material.

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 sizes produced; sometimes also used to express the results of plant operation.

8.1.03 yield; recovery* : 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 weight proportions in contrast to the analysis of the actual feed.

8.1.05 partition curve; distribution curve : A curve indicating, for each density (or size) fraction, the percentage of it which is contained in one of the products of the separation (e.g. the reject).

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

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 which has been included in the lower size or relative density product but which itself has a size or relative density above that of the cut-point, or vice versa. Its mass may be expressed as a percentage of the product or of the feed.

8.1.09 total of 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. When three products are made in a single separator the total of 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 of 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 of 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.

* Deprecated term.

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; commonly expressed as either partition size or 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* : A single size chosen to test the accuracy of a sizing operation; may be the same as the designated size.

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

See also *cut-point* (No. 8.1.07).

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

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

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

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

8.2.11 efficiency of sizing; yield of sizing : The mass of material correctly placed above or below the reference size, expressed as a percentage of the mass of corresponding material in the feed.

8.2.12 efficiency of screening : The mass of underflow (excluding oversize) expressed as a percentage of the total mass of material below the reference size in the feed.

8.2.13 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; recovery 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 with 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; commonly expressed as either partition density or equal errors cut-point (density).

8.3.05 partition density; 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* : 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; E : 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

$$\frac{\text{écart probable moyen}}{\text{partition density} - 1}$$

NOTE — This ratio is applicable only when 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* : The difference between the actual yield of a product and the yield theoretically possible (based on the reconstituted feed) of a product with the same properties (usually percentage of ash).

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

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

8.3.13 release analysis : A procedure employed to determine the best results possible in cleaning a coal by froth flotation.

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

* Deprecated term.

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

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

9 Miscellaneous

9.1.01 dust-proofing : A surface treatment, as 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, as with calcium chloride solution or other surface active agent 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 banking level; pit bank* : The level at which the full cages or skips come to rest and are discharged after being wound up the shaft.

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

9.1.06 blending : Mixing in predetermined and controlled quantities to give a uniform product.

9.1.07 bunker; bin : A vessel for the storage of materials; the lowermost portion is usually constructed in the form of a hopper.

9.1.08 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).

9.1.09 surge hopper; surge bunker : A hopper (bunker) designed to receive a feed at fluctuating rate and to deliver it at some predetermined rate.

9.1.10 agglomeration : A process in which fine particles are caused to adhere together to form balls or clusters. A suitable reagent may be added to promote the adhesion.

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

9.1.12 paddle mixer : A horizontal screw conveyor usually having two non-continuous spirals which form paddles. The shafts are contra-rotating and spirals opposite hand.

* Deprecated term.

Alphabetical index

* Deprecated term.