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Coal and coke — Vocabulary —

Part 1: Terms relating to coal preparation

Charbon et coke — Vocabulaire —

Partie 1: Termes relatifs à la préparation du charbon

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 27, *Coal and coke*, Subcommittee SC 1, *Coal preparation: Terminology and performance*.

This third edition cancels and replaces the second edition (ISO 1213-1:1993), which has been technically revised.

A list of all parts in the ISO 1213 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document 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 Bibliography.

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.

Coal and coke — Vocabulary —

Part 1:
Terms relating to coal preparation

1 Scope

This document defines terms commonly employed in coal preparation.

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

2 Normative reference

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 General coal preparation terms

3.1.1
coal preparation
collectively, physical and mechanical processes applied to coal to make it suitable for a particular use

3.1.2
run of mine
r.o.m.
r.o.m. coal
coal produced by mining operations, before screening, *crushing* (7.1.2) or preparation

3.1.3
raw coal
coal that has received no preparation other than possibly *screening* (4.2.1) or *crushing* (7.1.2)

3.1.4
raw coal feed
raw coal (3.1.3) supplied to a plant or machine, in which it undergoes some form of preparation

3.1.5
coal cleaning
treatment of *raw coal* (3.1.3) to lower the quantity of undesirable constituents, through the difference in either density or surface properties

3.1.6
cleaned coal
clean coal
coal produced by a cleaning process (wet or dry)

3.1.7
middlings
product of *coal preparation* (3.1.1) that, because of its ash percentage, is intermediate between coal and *discard* (3.1.11)

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

3.1.8
true middlings
bone
middlings (3.1.7) so nearly homogeneous that their quality cannot readily be improved by *crushing* (7.1.2) and recleaning

3.1.9
false middlings
interbanded middlings
middlings (3.1.7) in which the particles consist of bands of coal and shale, and from which the coal may be liberated by *crushing* (7.1.2)

3.1.10
reject
refuse
material extracted from the *feed* (3.3.6) during cleaning, for retreatment or *discard* (3.1.11)

3.1.11
discard
dirt
stone
material extracted from the *raw coal* (3.1.3) and finally discarded

3.1.12
recirculation
operation in which the whole or part of a product from a process is returned to the *feed* (3.3.6) to a process

Note 1 to entry: For example, 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
part-cleaned coal
mixed product of cleaned and uncleaned fractions of coal

3.1.17
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

3.1.18
beneficiate
to increase the commercial value of a coal by appropriate treatment

3.1.19
coal preparation plant
plant in which a *coal preparation* (3.1.1) process is carried out

3.1.20
compressor air
compressor, either rotary or reciprocating, used to produce air at a pressure suitable for specific operations in the *coal preparation plant* (3.1.19)

3.1.21
concentrate clean coal
cleaned product from a beneficiation process e.g. *froth flotation* (5.1.22)

3.1.22
demagnetise
to promote *dispersion* (6.1.12), by means of a suitable magnetic field, in a *dense medium* (5.4.2) of solids that have been flocculated magnetically

3.1.23
Durham cone
laboratory apparatus used for evaluation of the flow or handling characteristics of coal

3.1.24
flowsheet
diagram indicating the method of treating the *raw coal* (3.1.3) in a preparation plant, by showing in correct sequence the chief units of plant, the principal operations and (normally) the quantities of each stage

3.1.25
haematite
iron oxide mineral, typically forming the non-magnetic component of *industrial magnetite* (3.1.30)

3.1.26
idlers
<conveyor> rollers for supporting a conveyor belt

3.1.27
impact box
container interposed at impact points in the flow of material to resist wear

3.1.28
tramp iron
pieces of magnetic metal, metallic equipment of machine parts, used welding rods that have become accidently mixed with the run-of-mine coal

3.1.29
magnetite
strongly magnetic iron oxide mineral, making up the magnetic component of *industrial magnetite* (3.1.30)

3.1.30
industrial magnetite
commercially available magnetic material used for preparation of *dense medium* (5.4.2) for use in *coal preparation* (3.1.1), commonly referred to as *magnetite* (3.1.29)

3.1.31
metering box
container, having single or multiple compartments, and a *weir* (3.1.44) or weirs to provide the controlled addition of one or more *reagents* (3.1.36)

3.1.32
percentage recovery
amount of a certain constituent in the product, expressed as a percentage of that constituent in the *feed* (3.3.6)

3.1.33
finger planimeter
flow rate indicator for determining the volumetric rate of flow of a solid particulate material, in which a series of flexible steel fingers mounted on a common frame are situated above a conveyor belt with the fingers resting on the belt surface

3.1.34
pilot plant
coal preparation plant (3.1.19) of limited capacity but duplicating the operations of a proposed plant or a part of the proposed plant, so that the effectiveness of the designed process may be determined

3.1.35
metering pump
variable, positive-displacement pump to control the addition of *reagents* (3.1.36) to a *coal preparation plant* (3.1.19) circuit

3.1.36
reagent
chemical substance added to the preparation plant circuit for some specific purpose

3.1.37
residence time
mean time for which a unit of material is within a vessel or process

3.1.38
solids concentration

a) <by mass> mass of solids in a solids/liquid mixture or *suspension* (5.1.11), expressed as a percentage of the total *pulp* (5.6.6) or *slurry* (5.1.21) mass

b) <by volume> volume of solids in a solids/liquid mixture or *suspension* (5.1.11), expressed as a percentage of the total pulp or *slurry* (5.1.21) volume

c) <by other means> mass or volume of solids in a solids/liquid mixture or *suspension* (5.1.11), expressed as a mass per unit volume, or volume per unit mass, of the total *pulp* (5.6.6) or *slurry* (5.1.21) respectively

3.1.39
spigot
orifice of a device [e.g. the apex of a *cyclone* (5.5.8)] through which the underflow discharges

3.1.40
splitter box
receiver fitted with an adjustable device to divert or apportion flow

3.1.41
spoil bank
stockpile of *reject* (3.1.10) material; may also refer to waste material (e.g. overburden) from mining operations

3.1.42
trash
extraneous material associated with the run-of-mine coal, e.g. wood, metal, and plastic materials

3.1.43
belt weigher
apparatus used to quantify the mass flow of a material on a belt conveyor

3.1.44
weir
plate or dam (over which the liquid must flow) to control the level of the liquid

3.2 Cleaning characteristics

3.2.1
washability
amenability of a coal to improvement in quality by cleaning, generally through its relative density/ash relationship

3.2.2
float-and-sink analysis
division of a sample into relative density fractions having defined limits, the amounts of the fractions being expressed as weight percentages of the total sample, commonly with an indication of the ash percentage (and other characteristics, if required) of each fraction

3.2.3
washability curve
curve obtained from the results of a *float-and-sink analysis* (3.2.2) permitting the *theoretical yield* (8.3.2) of *floats* (8.3.11) or *sinks* (8.3.12) to be read off

Note 1 to entry: The following are examples of washability curves:

a) characteristic ash curve; see 3.2.4;

b) cumulative floats curve; see 3.2.6;

c) cumulative sinks curve; see 3.2.7;

d) densimetric (relative density) curve; see 3.2.8;

e) near-density curve; see 3.2.9;

f) instantaneous ash curve; see 3.2.15;

g) ash/relative density curve. See 3.2.14.

3.2.4
characteristic ash curve
curve obtained from the results of a *float-and-sink analysis* (3.2.2) showing, for any mass percentage of *floats* (8.3.11) [or *sinks* (8.3.12)] the ash percentage of the highest density (or lowest density) fraction passing into these *floats* (8.3.11) [or *sinks* (8.3.12)], the mass percentage being plotted on the ordinate (vertical axis) and the ash percentage on the abscissa (horizontal axis)

3.2.5
cumulative curve
curve expressing the results of combining successive relative density fractions or size fractions

3.2.6
cumulative floats curve
curve obtained from the results of a *float-and-sink analysis* (3.2.2) by plotting the cumulative mass percentage of *floats* (8.3.11) at each relative density against the cumulative ash of the total *floats* (8.3.11) at that density

3.2.7
cumulative sinks curve
curve obtained from the results of a *float-and-sink analysis* (3.2.2) by plotting the cumulative mass percentage of *sinks* (8.3.12) at each relative density against the cumulative ash of the total *sinks* (8.3.12) at that density

3.2.8
densimetric curve
<relative density curve> curve obtained from the results of a *float-and-sink analysis* (3.2.2) by plotting the cumulative mass percentage of *floats* (8.3.11) or *sinks* (8.3.12) against the relative density

3.2.9
near-density curve
difficulty curve
curve obtained from the results of a *float-and-sink analysis* (3.2.2), or from the *densimetric curve* (3.2.8), by plotting the mass percentage within the limits ± 0,1 of a given relative density against that relative density

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

3.2.11
actual performance curve
performance curve (3.2.10) showing the results actually obtained from a *coal preparation* (3.1.1) treatment

3.2.12
expected performance curve
performance curve (3.2.10) showing the expected results of a *coal preparation* (3.1.1) treatment

3.2.13
M-curve
Mayer curve
vectorial curve, obtained by plotting the cumulative ash percentages against their cumulative *yields* (8.1.3), used to express the *washability* (3.2.1) 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
curve obtained from the *float-and-sink analysis* (3.2.2) by plotting the ash percentages of successive fractions against the mean relative density of the fraction

3.2.15
ash/instantaneous
maximum ash percentage of any particle in any given relative density fraction mass

3.2.16
ash curve instantaneous
standard *washability curve* (3.2.3) that relates the maximum ash percentage of any particle (contained in a cumulative-floats mass) to the cumulative-floats mass of a known ash percentage

3.2.17
ash adventitious
ash arising from mineral matter that was not associated with the original plant material from which the coal was formed; this form of mineral can be removed readily by physical means

3.2.18
ash extraneous
ash arising from that part of the mineral matter associated with but not inherent in coal

3.2.19
ash inherent
ash arising from finely dispersed mineral matter present in the original plant material or from which the coal was formed, or from mineral matter incorporated intimately in the coal during the coalification process

3.2.20
Rosin-Rammler curve
particular form of particle size distribution curve graphed on specific ordinate and abscissa scales that results in any individual material's size distribution, due to natural *breakage* (7.1.6), being represented by a straight line

3.3 Capacity and throughput

3.3.1
nominal capacity
notional figure, expressed in mass per hour, used in the title of a *flowsheet* (3.1.24) and in the general description of a plant, applying to the plant and to the specific product under consideration

3.3.2
operational capacities
figures given on a *flowsheet* (3.1.24) 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)

3.3.3
design capacity
rate of *feed* (3.3.6) at which specific items of plant must operate continuously and give the guaranteed results on a particular quality of *feed* (3.3.6)

3.3.4
peak design capacity
rate of *feed* (3.3.6) in excess of the *design capacity* (3.3.3) that specific items of plant equipment will accept for short periods without necessarily fulfilling the performance guarantees given in respect of them

3.3.5
mechanical maximum capacity
highest rate of *feed* (3.3.6) at which specific items of equipment, not subject to performance guarantees, will function on the type and quality of *feed* (3.3.6) for which they are supplied

3.3.6
feed
material for treatment supplied to an appliance or plant

3.3.7
basic flowsheet
schematic diagram representing the various preparation process stages in the treatment of the *raw coal* (3.1.3)

3.3.8
process flowsheet
basic flowsheet (3.3.7) 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

3.3.9
equipment flowsheet
diagram indicating, by standard symbols, the units of equipment used in the various operational steps carried out within a *coal preparation plant* (3.1.19)

3.3.10
materials flowsheet
flowsheet (3.1.24) principally concerned with solid materials

3.3.11
liquids flowsheet
flowsheet (3.1.24) to indicate the flow of liquids throughout a series of operations

3.3.12
weighted flowsheet
capacity flowsheet
materials flowsheet (3.3.10) used in the design of a plant, including statements of the mass flow per hour at principal points in the plant

3.3.13
capacity design
rate of *feed* (3.3.6), defined by limits expressing the extent and duration of load variations, at which specific items of plant equipment, subject to a performance guarantee, operate continuously and give the guaranteed results on a quality of *feed* (3.3.6)

3.3.14
capacity peak design
rate of *feed* (3.3.6), in excess of the *design capacity* (3.3.3) that specific items of plant equipment will accept for short periods without fulfilling the performance guarantees given in respect of them

3.3.15
capacity mechanical maximum
highest rate of *feed* (3.3.6) at which specific items of equipment, not subject to performance guarantees, will function on the type and quality of *feed* (3.3.6) for which they are supplied

4 Terms related to sizing

4.1 General

4.1.1
sizing
division of a material into products between *nominal size* (4.1.6) limits

4.1.2
classification
separation of particles according to their size, density and shape by control of their settling rate through a fluid medium

4.1.3
size analysis
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

4.1.4
sieve analysis
size analysis (4.1.3) in which the division is carried out using test sieves

4.1.5
mean size
weighted average particle size of any sample, batch or consignment of particulate material

Note 1 to entry: Several bases for calculating mean size have been proposed which give results that vary widely for the same size distribution. The method of calculation should, therefore, always be stated whenever results are reported.

4.1.6
nominal size
limiting size
limit or limits of particle size used to describe a product of a *sizing* (4.1.1) operation

4.1.7
oversize
product of *coal preparation* (3.1.1) that, because of its ash percentage, is intermediate between coal and *discard* (3.1.11)

4.1.8
undersize
material in a product of size smaller than the lower *nominal size* (4.1.6) limit; may be expressed as a percentage of the product

4.1.9
dust
particles of solid material sufficiently fine to allow *suspension* (5.1.11) in air

Note 1 to entry: 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 1 to entry: upper limit may vary widely. To avoid confusion, the term should always be qualified by stating the *nominal size* (4.1.6).

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

4.1.12
oversize in undersize stream
<undersize stream>, particles that are larger than the nominal dimension of the size of the separation

4.1.13
undersize in oversize stream
particles in a screen *oversize* (4.1.7) stream that are smaller than the nominal dimensions of the screen apertures

4.1.14
nominal top size
size of aperture of the finest *sieve* (4.2.21) through which a minimum of 95 % of the mass of the material *passes* (11.3.29)

4.2 Screening

4.2.1
screening
separation of solid materials of different sizes, by causing part to remain on a surface provided with apertures through which the remainder *passes* (11.3.29)

4.2.2
screen
device for carrying out the operation of *screening* (4.2.1)

Note 1 to entry: Commonly used abbreviation for *screen deck* (4.3.1) or *screening surface* (4.3.1), e.g. woven-wire screen.

Examples are as follows:

a) bar screen, see 4.5.9;

b) multi-slope or banana screen, see 4.5.2;

c) desliming screen, see 4.4.4;

d) dewatering screen, see 4.4.3;

e) fixed screen, see 6.2.2;

f) jigging screen, see 4.5.3;

g) loose rod; loose-rod deck, see 4.3.5;

h) medium draining screen; drain and rinse screen, see 5.4.18;

i) medium recovery screen, see 5.4.20;

j) multi deck screen, see 4.5.2;

k) oversize control screen (guard screen), see 4.4.8;

l) primary screen (raw coal screen), see 4.4.2;

m) resonance screen, see 4.5.4;

n) rinsing screen, see 4.4.6;

o) roll screen, see 4.5.8;

p) rotating probability screen, see 4.5.6;

q) run of mine screen, see 4.4.1;

r) single deck screen, see 4.5.1;

s) sizing screen (grading screen), see 4.4.7;

t) slurry screen, see 4.4.5;

u) trommel screen, see 4.5.7;

v) vibrating screen, see 4.5.5.

4.2.3
amplitude
maximum displacement from the mean position in an oscillating motion

Note 1 to entry: In the case of a *screen* (4.2.2) 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.

Note 2 to entry: See also stroke (4.2.4).

4.2.4
stroke
throw
distance between the extreme positions of an oscillating or vibrating motion, i.e. the stroke is equal to twice the *amplitude* (4.2.3)

4.2.5
aperture size
dimension or dimensions defining the opening in the *screening surface* (4.3.1), qualified as to the shape of aperture, e.g. "round-hole", "square-mesh", "long-slot"

4.2.6
dry screening
screening (4.2.1) of solid materials of different sizes without the aid of water

4.2.7
wet screening
screening (4.2.1) of solid materials of different sizes with the aid of water

4.2.8
probability screening
method of *screening* (4.2.1) that, by making extended use of the probability of a particle passing through an aperture, allows *sizing* (4.1.1) at fine sizes to be performed with relatively large apertures

4.2.9
desliming
removal of *slimes* (5.1.20) from coal or a mixture of coal and water, however accomplished

4.2.10
fines removal
removal of fine particles from a *feed* (3.3.6) material, by either wet or dry methods, to facilitate treatment or utilization of the remainder

4.2.11
dedusting
fines removal (4.2.10) by dry methods

4.2.12
screen overflow
that portion of the *feed* (3.3.6) material discharged from the *screen* (4.2.2) deck without having passed through the apertures

4.2.13
misplaced undersize
particles in a *screen* (4.2.2) overflow that are smaller than a *reference size* (8.2.6)

4.2.14
screen underflow
that portion of the *feed* (3.3.6) material that has passed through the apertures in a *screen* (4.2.2) deck

4.2.15
misplaced oversize
particles in a *screen* (4.2.2) that are larger than a *reference size* (8.2.6)

4.2.16
misplaced material
<screening> *undersize* (4.1.8) contained in the overflow, or *oversize* (4.1.7) contained in the underflow

4.2.17
near-mesh material
near-size material
material approximating in size to a *reference size* (8.2.6), usually within ± 25 % of that reference

4.2.18
nominal area
<screen> total area of the *screen* (4.2.2) deck exposed to the flow of the material *feed* (3.3.6)

4.2.19
effective area
working area (deprecated)
<screen> *nominal area* (4.2.18) less any area occupied by fixings or supports that obstruct the passage of material over or through the *screen* (4.2.2) deck

4.2.20
open area
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
generally, a *screen* (4.2.2) of relatively small area. Particularly, a *screen* (4.2.2) used for *size analysis* (4.1.3)

4.3 Parts of screens

4.3.1
screen deck
screening surface
surface provided with apertures of specified size for carrying out the operation of *screening* (4.2.1)

4.3.2
screen plate
plate provided with apertures of specified size and range for use as a *screen deck* (4.3.1)

4.3.3
screen cloth
screen mesh
mesh of wires woven in a consistent manner to form the apertures

4.3.4
wedge-wire deck
wedge-wire sieve
screen deck (4.3.1), comprising wires of wedge-shaped cross-section spaced from each other at a fixed dimension, in which the underflow *passes* (11.3.29) through an aperture of increasing cross-section

4.3.5
loose-rod deck
screening surface (4.3.1) consisting of loosely held parallel rods positioned at right angles to the flow of material over the *screen* (4.2.2)

Note 1 to entry: Normally, a loose-rod deck is used only on high-speed *vibrating screens* (4.5.5).

4.3.6
relieving deck
screen (4.2.2) plate having large apertures mounted over the *screening* (4.2.1) deck to reduce the load and wear thereon

4.3.7
rod deck
screening (4.2.1) surface consisting of loosely held parallel rods positioned at right angles to the flow of material over the *screen* (4.2.2)

Note 1 to entry: Normally only used on high-speed screens.

4.4 Screens according to purpose

4.4.1
run-of-mine screen
screen (4.2.2) used for dividing run-of-mine coal into two or more sizes for further treatment or disposal

Note 1 to entry: A run-of-mine screen is usually employed to remove the largest pieces for *crushing* (7.1.2) and re-addition to the run-of-mine coal.

4.4.2
primary screen
raw coal screen
screen (4.2.2) used to divide coal [usually *raw coal* (3.1.3)] into sizes more suitable for the subsequent cleaning of some or all of them

4.4.3
dewatering screen
screen (4.2.2) used for the separation of water from solids

4.4.4
desliming screen
screen (4.2.2) used for the removal of *slimes* (5.1.20) from larger particles, usually with the aid of water sprays

4.4.5
slurry screen
screen (4.2.2) used to recover and dewater granular products from *circulating water* (5.1.15) in a *coal preparation plant* (3.1.19)

4.4.6
rinsing screen
spray screen
screen (4.2.2) used for the removal of fine solids by spraying, especially *dense medium* (5.4.2) solids present among or adhering to larger particles

4.4.7
sizing screen(s)
grading screen(s)
classifying screen(s) (deprecated)
screen (4.2.2) or set of screens normally used for dividing a product (e.g. clean coal) into a range of sizes

4.4.8
guard screen
oversize control screen
screen (4.2.2) used to prevent the entry into a machine of coarse particles which can interfere with its operation

4.4.9
undersize control screen
breakage screen (deprecated)
screen (4.2.2) used for the removal of *undersize* (4.1.8) from a product

4.5 Screens according to principle of construction

4.5.1
single-deck screen
screen (4.2.2) having one *screening surface* (4.3.1), not necessarily limited to one size or shape of aperture

4.5.2
multi-deck screen
screen (4.2.2) having two or more superimposed *screening surfaces* (4.3.1) mounted rigidly within a common frame

4.5.3
jigging screen
reciprocating screen
shaking screen (deprecated)
screen (4.2.2) to which a combined horizontal and vertical motion is imparted, normally by a crankshaft and connecting rod, the *screen deck* (4.3.1) being horizontal or inclined at a small angle

4.5.4
resonance screen
screen (4.2.2) having a period of oscillation at or very close to the natural period of oscillation of the resilient mounting

4.5.5
vibrating screen
screen (4.2.2) oscillated at high speed by either mechanical or electrical means

Note 1 to entry: The *amplitude* (4.2.3) of movement of the vibrating screen is smaller than that of the *jigging screen* (4.5.3), and its frequency of oscillation is higher.

4.5.6
rotating probability screen
device for *probability screening* (4.2.8), consisting of a rotating horizontal deck having radial spokes, the separation point being obtained by varying the rotational speed

4.5.7
trommel screen
revolving screen
screen (4.2.2) in which the *screening surface* (4.3.1) is formed into a cylinder or frustum of a cone, mounted upon a horizontal or near horizontal rotating shaft, or on revolving rollers

4.5.8
roll screen
screen (4.2.2) consisting of several horizontal rotating shafts, fitted with elements arranged to provide *screening* (4.2.1) apertures

4.5.9
bar screen
stationary inclined *screen* (4.2.2), comprising longitudinal bars, spaced at intervals, onto which the material is fed at the upper end

4.5.10
grizzly
rugged *screen* (4.2.2) for rough *sizing* (4.1.1) at comparatively large size (e.g. 150 mm)

Note 1 to entry: A grizzly can comprise fixed or moving bars, discs, or shaped tumblers or ratters.

4.5.11
sieve bend
device for the *sizing* (4.1.1) 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* (3.3.6), whereby the finer particles are removed with the bulk of the water in the underflow

Note 1 to entry: Note 1to entry: See also fixed screen (6.2.2).

4.5.12
banana screen
multi-slope screen
multi-slope screen that processes larger volumes of material using a smaller footprint

4.6 Sizing in a current of air or water

4.6.1
air classification
process of *sizing* (4.1.1) in a current of air

4.6.2
classifier
device that separates particles, according to their size, shape and density, by physical means other than *screening* (4.2.1)

4.6.3
cyclone classifier
device for *classification* (4.1.2) 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 Terms related to cleaning

5.1 General

5.1.1
dry cleaning
separation of impurities from coal by manual or mechanical methods that avoid the use of a liquid

5.1.2
wet cleaning
mechanical separation of impurities from coal by methods involving the use of a liquid

5.1.3
washery
coal preparation plant (3.1.19) in which a *wet cleaning* (5.1.2) process is carried out

5.1.4
reclean
rewash
to re-treat a product in the same or in another plant

5.1.5
washery products
final products from a *washery* (5.1.3)

5.1.6
reject elevator
refuse elevator (deprecated)
elevator for removing and *draining* (6.1.3) the *reject* (3.1.10) from a washing appliance

5.1.7
middlings elevator
elevator that removes *middlings* (3.1.7) for further treatment or for disposal as an inferior product

5.1.8
head tank
tank or vessel in the *water circuit* (5.1.13) that is used to maintain the delivery pressure of the water by constant level to the washing units

5.1.9
launder
trough or channel along which liquids, or a mixture of liquids and solids, flow

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

5.1.11
suspension
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)
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
complete system of pipelines, pumps, sumps, tanks, *launders* (5.1.9) and accessories used for the circulation of water in a *washery* (5.1.3)

5.1.14
closed water circuit
water circuit (5.1.13) designed so that the only water added is that necessary to replace the loss on the *washery products* (5.1.5) and that due to atmospheric evaporation

5.1.15
circulating water
water in the *water circuit* (5.1.13)

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* (5.1.13)

Note 1 to entry: See also effluent (6.1.9) 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* (5.1.15) and water-borne for treatment or disposal

5.1.22
froth flotation
process for cleaning fine coal in which the coal, with the aid of a *reagent* (3.1.36) or reagents, becomes attached to air bubbles in a liquid medium and a froth

5.1.23
vacuum flotation
process in which the *pulp* (5.6.6) is subjected to a reduced pressure, causing dissolved air to form the bubbles necessary for *froth flotation* (5.1.22)

5.2 Dry cleaning

5.2.1
hand cleaning
removal by hand of impurities from coal, or coal from impurities

5.2.2
hand selection
selection by hand of pieces of coal having certain specific qualities according to surface appearance

5.2.3
picking belt
picking table
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* (3.1.3) is spread for *hand cleaning* (5.2.1) and/or *hand selection* (5.2.2)

5.2.4
picking table, circular
apparatus used for the same purpose as a *picking belt* (5.2.3) and consisting of a flat horizontal rotating annular plate

5.2.5
pneumatic cleaning
cleaning by means of an air current

5.2.6
dry cleaning table
apparatus in which *dry cleaning* (5.1.1) is achieved by the application of air currents and agitation to a layer of *feed* (3.3.6) of controlled depth moved along the surface of the table, usually by a reciprocating action

5.2.7
air jig
machine in which the *feed* (3.3.6) is stratified by means of pulsating currents of air and from which the stratified products are separately removed

5.2.8
bath
vessel containing a medium used to separate coal by the *float* (5.3.22) and sink method

5.2.9
bath
<dense medium> dense-medium separator for beneficiating coarse coal, consisting of a large stationary or rotating tank through which coal and medium are passed. Various mechanical devices are used for removal of product, *middlings* (3.1.7) and *reject* (3.1.10)

5.3 Jigging

5.3.1
jig
wash box (deprecated)
machine in which the *feed* (3.3.6) is stratified in water by means of a vertical pulsating motion and from which the stratified products are separately removed

5.3.2
primary jig
in a series of *jigs* (5.3.1), the first jig, which receives the *feed* (3.3.6) and from which one product at least is given further treatment

5.3.3
re-wash jig
jig (5.3.1) to which the product (or a portion thereof) of a previous cleaning operation is fed for additional treatment

5.3.4
air pulsating jig
jig (5.3.1) in which the pulsating motion is produced by the intermittent admission of compressed air to the water, either alongside the *jig* (5.3.1) bed, e.g. Baum, or under the *jig bed* (5.3.10), e.g. Batac, Tacub

5.3.5
feldspar jig
jig (5.3.1) 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 screen plate* (5.3.9)

5.3.6
moving sieve jig
jig (5.3.1) in which the *jig screen plate* (5.3.9) supporting the bed of material under treatment is moved up and down in water

5.3.7
plunger jig
piston jig
jig (5.3.1) in which the pulsating motion is produced by the reciprocating movement of a plunger or piston

5.3.8
diaphragm jig
jig (5.3.1) in which the pulsating motion is produced by the reciprocating movement of a diaphragm

5.3.9
jig screen plate
bed plate
grid plate
sieve plate (deprecated)
perforated plate or grid that supports the bed of material being treated

5.3.10
jig bed
all of the material on the *jig screen plate* (5.3.9)

5.3.11
jig cell
one of the individual sections into which the *jig* (5.3.1) below the *jig screen plate* (5.3.9) is divided by transverse division plates, each being capable of separate control

5.3.12
jig compartments
sections into which a *jig* (5.3.1) is divided by transverse division plates that extend above the *jig screen plate* (5.3.9) to form a *weir* (3.1.44)

Note 1 to entry: Each compartment usually comprises two or more cells.

5.3.13
hutch
part of a *jig* (5.3.1) situated below the *jig screen plate* (5.3.9) in which the controlled pulsating movement of the water takes place

5.3.14
jig feed sill
that part of the *jig* (5.3.1) over which the *feed* (3.3.6) passes when it enters the box

5.3.15
jig centre weir
adjustable plate situated between the *feed* (3.3.6) end and the discharge end of a *jig* (5.3.1) and serving to regulate the forward movement of material through the box

5.3.16
jig discharge sill
that part of the *jig* (5.3.1) over which the *cleaned coal* (3.1.6) passes out of the box

Note 1 to entry: Usually the discharge sill is part of the discharge-end refuse extraction chamber.

5.3.17
jig air valve
valve that controls the alternate admission and release of compressed air to each cell of a *jig* (5.3.1)

5.3.18
jig slide valve
jig piston valve (deprecated)
jig (5.3.1) air valve operated by means of a reciprocating motion

5.3.19
rotary air valve
jig (5.3.1) air valve that rotates on a central axis

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

5.3.21
reject extractor
device used in a *jig* (5.3.1) to remove the *reject* (3.1.10) from the compartments of a *jig* (5.3.1), operated manually or automatically

5.3.22
float
on certain types of automatic *reject* (3.1.10) extractors, the part that detects variations in thickness of the layer of heavy material on the *jig screen plate* (5.3.9)

5.3.23
bed depth transducer
device that measures variations in the thickness of heavy material on the *jig screen plate* (5.3.9) without the use of a *float* (5.3.22)

5.3.24
reject extraction chamber
that part of the *jig* (5.3.1) into which the extractor discharges

5.3.25
reject gate
discharge shutter (deprecated)
mechanism of the *reject* (3.1.10) extractor that may be manually or automatically operated to control the rate of removal of *reject* (3.1.10) from the *jig* (5.3.1)

5.3.26
reject rotor
star wheel extractor (deprecated)
reject (3.1.10) gate in the form of a rotary (or star) valve

5.3.27
reject worm
screw conveyor fitted at the bottom of some *jigs* (5.3.1) to collect the fine *reject* (3.1.10) which has passed through the apertures in the *jig screen plate* (5.3.9)

5.3.28
reject discharge pipes
pipes used on some *jigs* (5.3.1) instead of a *reject* (3.1.10) worm

5.3.29
primary reject elevator
elevator that extracts the first or more dense *reject* (3.1.10)

Note 1 to entry: Usually situated at the *feed* (3.3.6) end of the *jig* (5.3.1).

5.3.30
secondary reject elevator
elevator that extracts the second or less dense *reject* (3.1.10)

Note 1 to entry: Usually situated at the discharge end of the *jig* (5.3.1).

5.3.31
top water
transport water (deprecated)
water introduced with the *raw coal* (3.1.3) *feed* (3.3.6) to assist the transport of material through the *jig* (5.3.1)

5.3.32
flushing water
water used to assist the flow of materials in a chute or *launder* (5.1.9)

5.3.33
underscreen water
back water (deprecated)
water that is fed into the cells of a *jig* (5.3.1) below the level of the *jig screen plate* (5.3.9)

5.3.34
effective area of a jig
total area of a *jig bed* (5.3.10) exposed to the flow of the material *feed* (3.3.6), less any area occupied by fixings or supports that obstruct the passage of material over or through the *jig bed* (5.3.10)

5.3.35
nominal area of a jig
total area of a *jig* (5.3.1) exposed to the flow of material *feed* (3.3.6)

5.3.36
stratification
action of the pulsations of a *jig* (5.3.1) that result in the lower-density, lower-ash coal particles reporting to the upper layers of the bed, whereas the higher-density, higher-ash *reject* (3.1.10) and shale particles report to the lower layers of the bed

5.3.37
hutch water
water introduced into the *hutches* (5.3.13) of a *jig* (5.3.1) to assist the *stratification* (5.3.36) of material in the *jig* (5.3.1)

5.4 Dense medium cleaning

5.4.1
dense liquid
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

5.4.2
dense medium
heavy medium
fluid, formed by the suspension in water of particles of relatively high density [e.g. *magnetite* (3.1.29), barytes, shale], that can be used in industry or in the laboratory to divide coal into fractions of different relative densities

Note 1 to entry: Examples of this are as follows:

a) dilute medium, a medium of density less than that of dense medium occurring as a result of rinsing the products to remove adhering medium solids, see 5.4.14;

b) over-dense medium, see 5.4.15;

c) regenerated dense medium, see 5.4.13;

d) make-up medium, see 5.4.8.

5.4.3
dense medium process
process for the cleaning of coal, in which the desired separation is achieved in a *dense medium* (5.4.2)

5.4.4
dense medium separator
separator for beneficiating coarse coal, consisting of a large stationary or rotating tank through which coal and medium are passed

Note 1 to entry: various mechanical devices are used for removal of product, *middlings* (3.1.7) and *reject* (3.1.10).

5.4.5
medium solids
solid component of a *dense medium* (5.4.2)

5.4.6
separating medium
correct medium
dense medium (5.4.2) of the density required to achieve a given separation

5.4.7
circulating medium
medium in circulation in or outside the *dense medium separator* (5.4.4), at or about the density of that in the separator

5.4.8
make-up medium
make-up medium solids
medium or *medium solids* (5.4.5) added to the circuit to replace losses

5.4.9
dense medium recovery
medium solids recovery
collection, for reuse, of *medium solids* (5.4.5) from *dilute medium* (5.4.14), usually understood to include the removal, in whole or in part, of contaminating fine coal and clay

5.4.10
magnetic separator
device for the recovery and concentration of *medium solids* (5.4.5) that are magnetic

5.4.11
magnetics
portion of the *dense medium* (5.4.2) solids that has a high magnetic susceptibility and is therefore readily recovered by magnetic means

5.4.12
non-magnetics
portion of the *dense medium* (5.4.2) solids that has a low magnetic susceptibility

Note 1 to entry: These solids are usually of lower relative density than the *magnetics* (5.4.11) 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* (5.4.4), usually occurring as a result of spraying the products with water for the removal of adhering *medium solids* (5.4.5)

5.4.15
over-dense medium
medium of density greater than that in the *dense medium separator* (5.4.4), usually produced in the medium recovery system and used to maintain the desired density in the separator

5.4.16
dense medium plant
dense medium process (5.4.3) including all the equipment associated with the recovery, regeneration and circulation of the medium

5.4.17
density control device
automatic device to control the density of the medium in, or entering, the *dense medium separator* (5.4.4)

5.4.18
medium draining screen
depulping screen (deprecated)
screen (4.2.2) for *draining* (6.1.3) the *separating medium* (5.4.6) from *dense medium separator* (5.4.4) products

5.4.19
suspended matter
particles from the *feed* (3.3.6), of density equal or close to that of a *separating medium* (5.4.6), that are therefore relatively difficult to remove from the separator, because they are not readily recovered in either the *float* (5.3.22) or the sink product

5.4.20
medium recovery screen
screen (4.2.2) for *draining* (6.1.3) and spraying the product from a *dense medium separator* (5.4.4) to remove adhering *medium solids* (5.4.5)

5.4.21
shower box
device that produces a continuous curtain of water droplets in a band over the full width of a *screen* (4.2.2)

Note 1 to entry: Usually used on medium recovery screens.

5.4.22
medium solids preparation
grinding (7.1.3) or treatment of the raw *dense medium* (5.4.2) solids to make them suitable for use

5.5 Cleaning equipment (miscellaneous)

5.5.1
trough washer
launder washer
cleaning device applying the principle of alluviation in troughs

5.5.2
concentrating table
shaking table
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* (5.5.3) and are then conveyed in the direction of the reciprocating motion, whereas the lighter particles are borne by the current of water over the *riffles* (5.5.3) to be discharged laterally from the table

5.5.3
riffles
longitudinal strips of varying heights mounted on the deck of a *concentrating table* (5.5.2) to separate the denser particles

5.5.4
dressing water
cross water
secondary water used on *concentrating tables* (5.5.2)

5.5.5
upward current washer
washer in which separation takes place under the influence of an upward current of water or *dense medium* (5.4.2)

5.5.6
plate cleaner
device, for cleaning closely-sized *raw coal* (3.1.3), 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

5.5.7
barrel washer
drum washer
device for cleaning *raw coal* (3.1.3), comprising a cylinder rotating slowly about an axis slightly inclined to the horizontal, into which the *raw coal* (3.1.3), 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* (3.1.10) to the upper end of the cylinder

5.5.8
cyclone
vessel consisting of cylindrical or conical sections for separating particles suspended in liquid or gas, by means of centrifugal force imparted by tangential injection of *feed* (3.3.6)

Note 1 to entry: Examples of cyclones as follows:

a) hydrocyclone cyclone for separating materials suspended in water;

b) *dense medium* (5.4.2) cyclone (heavy medium cyclone), cyclone for separating materials suspended in a *dense medium* (5.4.2), whereby the particles of higher relative density collect at, and are discharged from, the apex of the vessel, while those at lower relative density are discharged with the bulk of the *dense medium* (5.4.2) at the overflow orifice;

c) classifying cyclone [*cyclone classifier* (4.6.3), desliming cyclone], hydrocyclone for the treatment of *fines* (4.1.10), whereby the coarser particles collect at, and are discharged from, the apex of the vessel, while the finer particles are discharged with the bulk of the water at the overflow orifice;

d) thickening cyclone (dewatering cyclone) classifying cyclone adjusted so that a thickened suspension of the *feed* (3.3.6) solids is discharged at the apex, while the bulk of the water is discharged at the overflow orifice;

e) water-washing cyclone (water-only cyclone) hydrocyclone whereby the particles of higher relative density collect at, and are discharged from, the apex of the vessel, while those of a lower relative density are discharged with the bulk of the water at the overflow orifice.

5.5.9
hindered settling cleaner
wet cleaning (5.1.2) device for fine coal, using a teeter bed combined with an upward current of water to effect separation

5.5.10
baffle
device such as a steel plate, used to check, retard or divert the flow of materials

5.5.11
sump pump
tank into which the *circulating water* (5.1.15) or *pulp* (5.6.6) gravitates and from which it is discharged by means of a pump

5.5.12
vortex finder
open cylinder arranged axially inside a *cyclone* (5.5.8) to control separation

5.5.13
spiral separator
fine coal separator consisting of a helical trough, having a specific cross section mounted around a vertical post, down which the coal flows with water or other fluid

Note 1 to entry: Up to three spiral troughs (referred to as starts) and up to eight stands can be grouped together, resulting in a cluster or module.

5.6 Froth flotation

5.6.1
activating agent
activator
substance that, when added to a *pulp* (5.6.6), promotes flotation in the presence of a *collecting agent* (5.6.2)

5.6.2
collecting agent
collector
reagent (3.1.36) added to a *pulp* (5.6.6) to promote adhesion between coal particles and air bubbles

5.6.3
frothing agent
frother
reagent (3.1.36) used to control the size of the air bubbles and the *stability* (11.3.18) of the froth in the flotation process

5.6.4
wetting agent
reagent (3.1.36) used to reduce the interfacial tension between a solid and a liquid and therefore facilitate the spreading of the liquid over the solid surface

5.6.5
depressant
substance that, when added to a *pulp* (5.6.6), prevents a particular mineral or minerals from floating

5.6.6
pulp
mixture of solid particles and water

Note 1 to entry: See also slurry (5.1.21).

5.6.7
selective flotation
process for the preferential recovery of an ingredient of the coal, e.g. a petrological constituent, by *froth flotation* (5.1.22)

5.6.8
aeration
introduction of air into the *pulp* (5.6.6) in a *flotation cell* (5.6.12) to form air bubbles

5.6.9
conditioning
preparatory stage in the flotation process in which the *reagents* (3.1.36) are brought into intimate contact with the solids of the *pulp* (5.6.6)

5.6.10
conditioner
apparatus in which *conditioning* (5.6.9) takes place

5.6.11
reagent feeder
apparatus for the feeding and proportioning of one or more *reagents* (3.1.36)

5.6.12
flotation cell
vessel in which a *pulp* (5.6.6) is subjected to *froth flotation* (5.1.22)

Note 1 to entry: Examples are as follows:

a) conventional mechanical or agitated cell, e.g. Wemco or Denver;

b) conventional column cell;

c) non-conventional column cell, e.g. Jameson, Microcel or sparged cell.

5.6.13
agitator
device used to bring about a continuous vigorous disturbance in a *pulp* (5.6.6), usually used to assist bubble formation

Note 1 to entry: 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
group of *flotation cells* (5.6.12) in which the raw *feed* (3.3.6) is given a preliminary treatment, either or both of the products being subsequently re-treated

5.6.15
rougher cells
primary cells (5.6.14) in which the majority of the tailings are removed and discarded

5.6.16
secondary cells
group of *flotation cells* (5.6.12) in which a product from the *primary cells* (5.6.14) is re-treated

5.6.17
cleaner cells
recleaner cells
secondary cells (5.6.16) for the re-treatment of the *flotation concentrates* (5.6.19) from *primary cells* (5.6.14) or *rougher cells* (5.6.15)

5.6.18
scavenger cells
secondary cells (5.6.16) for the re-treatment of tailings

5.6.19
flotation concentrate
clean product recovered in *froth flotation* (5.1.22)

5.6.20
flotation tailings
reject (3.1.10) from *froth flotation* (5.1.22) cells

5.6.21
flotation middlings
flotation products that may be re-treated

5.6.22
contact angle
angle between the tangent to the fluid-fluid *interface* (11.3.22) and the tangent to the solid surface at any point along the line of contact of the *interface* (11.3.22) between two fluids and a solid

Note 1 to entry: Where water is involved, the contact angle is usually measured inside the water phase.

Note 2 to entry: 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
device used to reduce the volume of *froth flotation* (5.1.22) concentrates by de-aeration

5.6.24
release analysis
procedure, employing staged addition of collector, to determine the best results possible in cleaning a coal by *froth flotation* (5.1.22)

5.6.25
pulp density
mass of one cubic metre of a *pulp* (5.6.6) [i.e. a solids-liquid *slurry* (5.1.21)], expressed in relative density units, after comparing the *pulp* (5.6.6) mass to the mass of an equal volume of water

5.6.26
inversion phase
replacement of the film of water covering a coal particle by a film of oil

5.6.27
froth paddle
moving blade to remove froth from the lip of a *flotation cell* (5.6.12)

5.6.28
percent mass solids
proportion of the solids mass in the total *pulp* (5.6.6) or *slurry* (5.1.21) mass, expressed as a percentage

5.6.29
percentage volume solids
proportion of the solids volume in the total *pulp* (5.6.6) or *slurry* (5.1.21) volume, expressed as a percentage

5.6.30
sequential-tree flotation
variations on the normal procedure of laboratory flotation tests on a single coal sample involving the re-floating of concentrates and tailings a few times to realise the optimum *yield* (8.1.3) of both

Note 1 to entry: The masses and ash percentages of the various products are used to construct a *yield-ash curve* (8.2.15) showing flotation response.

Note 2 to entry: See also ISO 8858-2 for more details on flotation tests.

6 Terms related to separation of solids from water or air

6.1 General

6.1.1
dewatering
removal of water by means other than evaporation

6.1.2
drying
removal of moisture, mainly by evaporation

6.1.3
draining
removal of water or medium from a product, mainly by gravity

6.1.4
filtration
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

6.1.5
centrifuging
dewatering (6.1.1) with the aid of centrifugal force

6.1.6
flocculation
formation of aggregates from particles dispersed in a liquid by the use of a *flocculating agent* (6.3.1)

6.1.7
clarification
removal of solids from *circulating water* (5.1.15) to reduce the suspended solids to a minimum

6.1.8
thickening
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

6.1.9
effluent
water discharged from an item of equipment after fulfilment of its function or after having itself been treated [e.g. for *clarification* (6.1.7)]

6.1.10
plant effluent
water, sometimes containing solids, discharged from a *coal preparation plant* (3.1.19), usually to waste

6.1.11
slurry pond
natural or artificial pond or dam for settling and *draining* (6.1.3) the solids from *washery* (5.1.3) tailings *slurry* (5.1.21)

6.1.12
dispersion

a) suspension of discrete particles in a fluid

b) creation of a dispersion by destroying the aggregates of particles

6.1.13
pre-coat
permeable layer, generally consisting of a coarser size fraction, covering the medium in a filtering machine to improve *filtration* (6.1.4)

6.1.14
slurry tower
tank (usually of concrete) used for the storage and *thickening* (6.1.8) of preparation plant slurries; located high enough to permit the flow by gravity of the water and *slurry* (5.1.21) to the appropriate units in the *coal preparation plant* (3.1.19)

6.2 Dewatering

6.2.1
dryer
equipment for the *drying* (6.1.2) of coal with the aid of heat

6.2.2
fixed screen
stationary inclined flat or curved panel, commonly of wedge-wire, that is used to remove a large proportion of water and *fines* (4.1.10) from a suspension

6.2.3
basket centrifuge
device for *dewatering* (6.1.1) in which wet solids are held by centrifugal force against a perforated containing surface that permits the outward passage of water [*centrate* (6.2.6)] and retains the solids that are discharged mechanically

6.2.4
solid-bowl centrifuge
decanter
device for *dewatering* (6.1.1) 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* (6.2.6)] overflows from the opposite end

6.2.5
screen-bowl centrifuge
dewatering (6.1.1) device combining in one machine a bowl and a *basket centrifuge* (6.2.3)

6.2.6
centrate
liquid product from a centrifugal *dewatering* (6.1.1) device

6.2.7
filter bowl
filter tank
tank, containing the *pulp* (5.6.6) to be filtered and generally fitted with an *agitator* (5.6.13) to maintain the solids in the *pulp* (5.6.6) in suspension, in which the drum or disc of a rotary *vacuum filter* (6.2.13) is partially immersed

6.2.8
filter cloth
woven or felted fabric used as a medium for *filtration* (6.1.4)

6.2.9
filter cake
solid product from the *filtration* (6.1.4) process

6.2.10
filtrate
liquid product from the *filtration* (6.1.4) process

6.2.11
pressure filter
filter in which *filtration* (6.1.4) is carried out because of the application of pressure to one side of a filter medium

6.2.12
filter press
band press filter
form of *pressure filter* (6.2.11), non-continuous in operation, used for the removal of water from slurries, tailings and related products

Note 1 to entry: Other examples are as follows:

a) belt press filter, form of continuous *pressure filter* (6.2.11) in which the material being de-watered is supported on a porous belt and pressure is induced to aid water removal from the *filter cake* (6.2.9);

b) disc filter, a vacuum filter in which the filtering medium is supported on discs that rotate in a vertical plane through the *pulp* (5.6.6) to be dewatered;

c) drum filter, a vacuum filter in which the filtering medium is supported on drums caused to rotate on a horizontal axis through the *pulp* (5.6.6) to be de-watered;

d) horizontal belt filter, a vacuum filter in which the filtering medium is a large horizontal belt that moves horizontally and upon which the *pulp* (5.6.6) to be dewatered is placed;

e) hyperbaric filter, an enclosed vacuum disc filter inside a pressure vessel.

6.2.13
vacuum filter
filter in which *filtration* (6.1.4) is carried out as a result of the application of a vacuum on one side of a filter medium

6.2.14
dredging conveyor
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)
tank, forming part of the *water circuit* (5.1.13), in which *slurry* (5.1.21) or small coal settles and is removed continuously by means of a scraper chain or scraper buckets

6.3 Clarification and thickening

6.3.1
flocculating agent
flocculant
reagent (3.1.36) added to a *dispersion* (6.1.12) of solids in a liquid to bring together the fine particles to form *floccs* (6.3.2)

6.3.2
floccs
aggregates resulting from *flocculation* (6.1.6)

6.3.3
settling cone
conical settling tank
conical tank used to settle coarse solids from the *circulating water* (5.1.15)

6.3.4
settling pond
pond, natural or artificial, for collecting solids from *plant effluent* (6.1.10), the supernatant water being either recovered for re-use or discarded

6.3.5
rake thickener
equipment for *thickening* (6.1.8) 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

6.3.6
cyclone thickener
device for *thickening* (6.1.8) 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

6.3.7
headbox
feed box
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

6.3.8
clarified water
within a *coal preparation plant* (3.1.19), recycled water that has had suspended solids removed by a thickener

6.3.9
thickener

a) circular tank for *slurry* (5.1.21) *thickening* (6.1.8) assisted by *flocculating agents* (6.3.1) to form a dense underflow and clear overflow

b) alternative settling tank capable of delivering a denser underflow by feeding flocculated solids into the settling bed.

6.4 Separation of solids from air

6.4.1
dust extraction
removal of solid particles suspended in gas or ambient air

6.4.2
dust recovery
accumulation, in a convenient form for handling, of solid particles suspended in air or gas

6.4.3
dust collector
apparatus for separating solid particles from air or gas and accumulating them in a form convenient for handling

6.4.4
cyclone dust collector
apparatus for the separation, by centrifugal means, of fine particles suspended in gas or air

6.4.5
bag filter
fabric filter
apparatus for removing *dust* (4.1.9) from dust-laden air, employing a container made from woven material that permits the passage of air but retains solid particles

6.4.6
electrostatic precipitator
apparatus for removing *dust* (4.1.9) from dust-laden air, employing principle of the electrostatic precipitation

7 Terms related to size reduction

7.1 General

7.1.1
breaking
cracking (deprecated)
size reduction of large particles

7.1.2
crushing
size reduction into relatively coarse particles

7.1.3
grinding
pulverizing
size reduction into relatively fine particles

7.1.4
reduction ratio
ratio of the size of the *feed* (3.3.6) to the size of product in a *crushing* (7.1.2) operation

Note 1 to entry: There are several methods of calculating the ratio, e.g. limiting reduction ratio, 80 % reduction ratio, mean-size reduction ratio.

7.1.5
liberation (of intergrown constituents)
crushing (7.1.2) of intergrown material to free the constituent materials

7.1.6
breakage

a) voluntary or involuntary size reduction of a solid

b) small material produced by involuntary breakage during mechanical handling or processing

7.1.7
degradation
involuntary *breakage* (7.1.6) resulting from handling, processing and storage

7.1.8
disintegration
dissociation (deprecated)
physical breakdown of material, usually shale, as a result of immersion in water or weathering

Note 1 to entry: See ISO 10753.

7.1.9
crushability
relative ease of *crushing* (7.1.2) a sample under standard conditions

7.1.10
grindability
relative ease of *grinding* (7.1.3) a sample under standard conditions

7.1.11
selective crushing
crushing (7.1.2) in such a manner as to cause one ingredient of the *feed* (3.3.6) to be crushed preferentially to others

7.1.12
selective grinding
grinding (7.1.3) in such a manner as to cause one ingredient of the *feed* (3.3.6) to be ground preferentially to others

7.1.13
crushing circuit
system involving the use of a crusher followed by a *screen* (4.2.2) to size the crushed product

Note 1 to entry: 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
system involving the use of a *grinding* (7.1.3) mill followed by *classification* (4.1.2) of the mill discharge

Note 1 to entry: 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

7.2.1
pick breaker
machine for *breaking* (7.1.1) coal by the splitting action of mechanically operated picks

7.2.2
rotary breaker
Bradford breaker
rotating, steel, perforated drum through which material of the desired size falls; the *oversize* (4.1.7) material is lifted by flights inside the drum and falls back so that the weaker component (coal) breaks and *passes* (11.3.29) through the perforations, whereas the hardest material (rock) remains unbroken and is rejected

7.2.3
jaw crusher
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

7.2.4
roll crusher
toothed roll crusher
machine in which size reduction is affected by causing the material to pass between a rotating roller, generally toothed, and a fixed or oscillating plate, or between two or more rollers

7.2.5
rigid-hammer crusher
machine in which size reduction is affected by elements rigidly fixed to a rotating horizontal shaft mounted in a surrounding casing

7.2.6
swing-hammer crusher
swing-hammer mill
swing-hammer pulverizer
machine in which size reduction is affected by elements loosely pivoted to discs fitted on a rotating horizontal shaft mounted in a surrounding casing

7.2.7
ball mill
rod mill
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

7.2.8
gyratory crusher
cone crusher
machine in which the *feed* (3.3.6) is delivered to a conical chamber in which a solid cone rotates eccentrically on a vertical axis

7.2.9
comminution
processes of particle size reduction in crushers and *grinding* (7.1.3) mills

8 Terms related to the expression of results

8.1 General terms

8.1.1
efficiency
measure of the effectiveness of a separation

8.1.2
statement of performance
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 1 to entry: A statement of performance can also be used to express the results of plant operation.

8.1.3
yield
recovery (deprecated)
amount of a product obtained from any operation, expressed as a percentage of the *feed* (3.3.6) material

8.1.4
calculated feed
reconstituted feed
composition (e.g. relating to size or density) of the *feed* (3.3.6) 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* (3.3.6)

8.1.5
partition curve
distribution curve
curve indicating the percentage of each density (or size) fraction contained in one of the products of the separation

8.1.6
partition coefficients
distribution coefficients
percentage of a particular density (or size) fraction recovered in one of the products of the separation

8.1.7
cut-point
exact level (e.g. density or size) at which a separation into two fractions is desired or achieved

8.1.8
misplaced material
<general> material wrongly included in the products of a *sizing* (4.1.1) 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* (8.1.7), or vice versa

Note 1 to entry: The mass of misplaced material may be expressed as a percentage of the product or the *feed* (3.3.6).

8.1.9
total misplaced material
sum of the masses of the *misplaced material* (8.1.8) in the products of a *sizing* (4.1.1) or density separation, expressed as a percentage of the mass of the *feed* (3.3.6)

Note 1 to entry: 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
<general> material correctly included in the products of a *sizing* (4.1.1) or density separation

8.1.11
total correctly placed material
sum of the masses of material correctly included in the products of a *sizing* (4.1.1) or density separation, expressed as a percentage of the mass of the *feed* (3.3.6) to the separator [and equal to 100 minus the *total misplaced materia*l (8.1.9)]

8.2 Sizing operations

8.2.1
designated size
particle size at which it is desired to separate a *feed* (3.3.6) by a *sizing* (4.1.1) operation

Note 1 to entry: The designated size is commonly expressed as either the *partition size* (8.2.3) or the *equal errors size* (8.2.4).

8.2.2
separation size
general term indicating the effective size at which separation has taken place, calculated from a *size analysis* (4.1.3) of the product

Note 1 to entry: The separation size is commonly expressed as either the *partition size* (8.2.3) or the *equal errors size* (8.2.4).

8.2.3
partition size
separation size (8.2.2) corresponding to 50 % recovery as read from a size *partition curve* (8.1.5)

8.2.4
equal errors size
separation size (8.2.2) at which equal portions of the *feed* (3.3.6) material are wrongly placed in each of two products of a *sizing* (4.1.1) operation

8.2.5
control size
checking size
testing size (deprecated)
single size chosen to test the accuracy of a *sizing* (4.1.1) operation

Note 1 to entry: The control size may be the same as the *designated size* (8.2.1).

8.2.6
reference size
separation size (8.2.2), the *designated size* (8.2.1) or the *control size* (8.2.5) used to define the size limit of the products of a *sizing* (4.1.1) operation

8.2.7
nominal screening size
notional size at which it is intended to divide a *feed* (3.3.6) by a *screening* (4.2.1) operation

8.2.8
misplaced material
<sizing> *undersize* (4.1.8) contained in the overflow, or *oversize* (4.1.7) contained in the underflow, of a *sizing* (4.1.1) operation

8.2.9
correctly placed material
<sizing> material finer than the *separation size* (8.2.2) contained in the underflow, or material coarser than the *separation size* (8.2.2) contained in the overflow, of a *sizing* (4.1.1) operation

8.2.10
effective screen aperture
cut-point (8.1.7)]e.g. equal errors or *partition size* (8.2.3)] at which a *sizing* (4.1.1) operation separates the material tested into two size fractions

8.2.11
nominal screen aperture
nominal mesh aperture used to designate the result of a *sizing* (4.1.1) operation

8.2.12
efficiency of sizing
yield of sizing
mass of material correctly placed relative to the *reference size* (8.2.6), expressed as a percentage of the mass of corresponding material in the reconstituted *feed* (3.3.6)

8.2.13
efficiency of screening
mass of underflow [excluding *oversize* (4.1.7)] expressed as a percentage of the total mass of material finer than the *reference size* (8.2.6) of the reconstituted *feed* (3.3.6)

8.2.14
size-distribution curve
graphical representation of the *size analysis* (4.1.3) of a mixture of particles of numerous sizes, using an ordinary, logarithmic or other scale

8.2.15
yield-ash curve
graphical means of displaying plant performance; can be used in conjunction with *float* (5.3.22) and sink *data* (11.1.12), to compare plant performance with optimal separation condition

8.2.16
particle size range
interval used to denote the upper and lower particle sizes of the coal

8.3 Cleaning operations

8.3.1
organic efficiency
ratio (normally expressed as a percentage) between the actual *yield* (8.1.3) of a desired product and the theoretically possible *yield* (8.1.3) [based on the reconstituted *feed* (3.3.6)], both actual and theoretical products having the same percentage of ash

8.3.2
theoretical yield
maximum *yield* (8.1.3) [as shown by the *washability curve* (3.2.3)] of a product having a specified percentage of ash

8.3.3
error curve
tromp error curve
partition curve (8.1.5) drawn to defined conventional scales with the portion showing recoveries over 50 % reversed to enclose an *error area* (8.3.16)

8.3.4
separation density
effective density at which a separation has taken place, calculated from a relative density analysis of the products

Note 1 to entry: The separation density is commonly expressed as either the partition density or the equal errors density

8.3.5
partition density
tromp cut-point
d_p, d_{50}
density corresponding to 50 % recovery as read from a *partition curve* (8.1.5)

8.3.6
equal errors cut-point (density)
wolf cut-point (deprecated)
density at which equal portions of the *feed* (3.3.6) material are wrongly placed in each of two products of a relative density separation

8.3.7
mean probable error
epm
one half of the difference between the densities corresponding to the 75 % and 25 % ordinates as shown in the *partition curve* (8.1.5)

8.3.8
imperfection
I

$$\frac{\text{mean probable error}}{\text{partition density} - 1} \text{ or } \frac{\text{epm}}{d_{50} - 1}$$

Note 1 to entry: This ratio is applicable only if the *separating medium* (5.4.6) is water.

8.3.9
ash error
difference between the actual percentage ash of a product of a separation and that shown by the *washability curve* (3.2.3) [based on the reconstituted *feed* (3.3.6)] corresponding to the actual *yield* (8.1.3) obtained

8.3.10
yield loss
washing loss (deprecated)
difference between the actual *yield* (8.1.3) of a product and the *yield* (8.1.3) theoretically possible [based on the reconstituted *feed* (3.3.6)] 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* (8.1.7)

8.3.14
misplaced material
<cleaning> material of relative density lower than the *separation density* (8.3.4) that has been included in the high-density product, or material of relative density higher than the *separation density* (8.3.4) 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* (8.3.4) that has been included in the low-density product, or material of relative density higher than the *separation density* (8.3.4) that has been included in the high-density product

8.3.16
error area
partition curve (8.1.5) drawn to defined conventional scales, with the portion showing recoveries over 50 % reversed to enclose an error area

9 Terms related to miscellaneous

9.1.1
dust-proofing
surface treatment, e.g. with oil, calcium chloride solution or other surface-active agent, to prevent or reduce the dustiness of coal in handling

9.1.2
freeze-proofing
surface treatment, with *reagents* (3.1.36), to prevent or reduce cohesion of coal particles by ice formation during freezing weather

9.1.3
angle of repose
angle between the surface of a heap of loosely piled material and the horizontal

9.1.4
dust suppression
prevention or reduction of the *dispersion* (6.1.12) of *dust* (4.1.9) into the air, e.g. by using water sprays

9.1.5
blending
mixing (10.1.6) in predetermined and controlled quantities to give a uniform product of desired properties

9.1.6
bunker
bin
vessel for the storage of materials, with the main section having vertical walls and the lower most portion usually constructed in the form of a *hopper* (9.1.7)

9.1.7
hopper
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)

9.1.8
surge hopper
surge bunker
hopper (9.1.7) [*bunker* (9.1.6)] designed to receive a *feed* (3.3.6) at a fluctuating rate and from which it is discharged at some predetermined rate

9.1.9
agglomeration
process in which fine particles are caused to adhere together to form balls or clusters, usually with the addition of a suitable *reagent* (3.1.36) to promote adhesion

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

9.1.11
paddle mixer
horizontal screw conveyor having two non-continuous spirals which form paddles to propel and blend the constituents of the *feed* (3.3.6)

10 Terms related to blending and homogenization terms

10.1.1
bunker blending
bin blending
method of *blending* (9.1.5) whereby the components are stored separately in *bunkers* (9.1.6) or *bins* (9.1.6) that are discharged simultaneously in predetermined and controlled quantities

10.1.2
feeder

a) belt feeder, conveyor for withdrawing solid materials from a *hopper* (9.1.7) or *bin* (9.1.6), and usually supplied with a variable-speed drive to enable variable-rate discharge

b) plough feeder, feeder consisting of a series or rotating arms arranged to sweep material off a narrow shelf beneath a bulk storage

c) reciprocating feeder, feeder in which the material is carried on a plate subjected to a reciprocating motion and so constructed that when the plate moves in the reverse direction, the material remains stationary. The rate of feed is normally varied by adjusting the *stroke* (4.2.4) of the reciprocating plate

d) screw feeder, feeder consisting of a helical- shaped rotating unit either partly or totally enclosed

e) star feeder, rotating feeder consisting of a horizontal shaft with radial blades running within a close-fitting cylindrical chamber provider with an inlet and an outlet

f) vibratory feeder; pan feeder, feeder consisting of an open-ended tray actuated by a vibration unit, the rate of feed being controlled by varying the *amplitude* (4.2.3) or frequency of the vibrations

g) grizzly feeder, vibratory feeder with a *grizzly* (4.5.10) *screen* (4.2.2), used to *feed* (3.3.6) oversized material to a crusher and allow *undersize* (4.1.8) material to by-pass the crusher

10.1.3
heterogeneity
state of a material when particles having certain characteristics are distributed unevenly throughout it

10.1.4
homogeneity
state of a material when particles having certain characteristics are distributed evenly throughout it

10.1.5
homogenization
thorough *mixing* (10.1.6) of a material to obtain a product of relatively constant characteristics

10.1.6
mixing
combination of two or more materials of different characteristics in proportions that need not be predetermined or controlled

10.1.7
mixer
device or process that achieves *mixing* (10.1.6)

10.1.8
uniformity
state of a material relative to a certain characteristic if all the particles have identical values for that characteristic

10.1.9
non-uniformity
state of a material relative to a certain characteristic if the particles have different values for that characteristic

10.1.10
reclaimer
mechanical device that recovers material from a stockpile

10.1.11
stacker
mechanical device used to form a stockpile

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

Note 1 to entry: A stockpile may have the following parts:

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

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

10.1.13
stockpiling
action of forming a stockpile

Note 1 to entry: 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* (9.1.5), 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 progressively form the overall stockpile.

10.1.14
mass flow (in bunkers)
flow in which all the contents of a *bunker* (9.1.6) 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 Terms related to automatic control terms

11.1 General

11.1.1
control system
arrangement of elements [e.g. *amplifiers* (11.2.8), *converters* (11.2.9), 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

11.1.2
automatic control
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 1 to entry: Automatic control is not to be confused with *remote control* (11.1.7) which itself may or may not include provision for automatic control.

Note 2 to entry: Process of comparing measured values with a reference value [*set point* (11.3.9)] and correcting *deviations* (11.3.10) from the reference value by automatic means.

11.1.3
manual control
operation of a plant in response to command actions taken by an operator as opposed to those taken automatically

11.1.4
central control
operation of several control functions on a plant from one central point

11.1.5
local control
operator control of a plant from a position adjacent to the motive power

11.1.6
remote indications
receiving and display of *data* (11.1.12) at a point remote from the process or machine

11.1.7
remote control
initiation of control operations for a process or machine at a point remote from the motive power

11.1.8
process control system
control system (11.1.1), whose purpose is to control some physical quantity or condition of a process

11.1.9
adaptive control system
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
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
starting or stopping of a series of related events in a prescribed order

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

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

11.2 Control equipment

11.2.1
sensor
detector (11.2.2) or *transducer* (11.2.3) normally used for measuring quantities or detecting occurrences

Note 1 to entry: Analogue transducers are sometimes called sensors.

11.2.2
detector
device to indicate a specific occurrence

11.2.3
transducer
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

Note 1 to entry: Transducer limit, is a transducer that is used, with a *control system* (11.1.1), to apply a pre-set limit to any operation or movement.

11.2.4
flowmeter
device used to measure the rate of flow (volume per unit time), or the total volume during a given period

11.2.5
controller
piece of equipment that combines the function of at least the input elements, the comparing elements and the amplifying and signal processing elements, for a *process control system* (11.1.8)

11.2.6
actuator
<control system> final item which adjusts the setting of the controlled variable in accordance with instructions received from the *controller* (11.2.5)

11.2.7
servo-mechanism
system using *feedback* (11.3.17) in which one or more of the signals in the system represents mechanical motion

11.2.8
amplifier
device for controlling power from a source so that more is available at the output than is supplied at the input

Note 1 to entry: Examples of the source or power are electrical, mechanical, hydraulic and pneumatic

11.2.9
converter
device that receives analogue signals in one form, e.g. pneumatic, and produces an equivalent output in another form, e.g. electronic

Note 1 to entry: A converter is usually qualified by naming the types of signals received and produced

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

11.2.11
bulk density meter
device for monitoring the *bulk density* (9.1.10) of a mineral to provide an indication of quality

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

11.2.13
density meter
device for monitoring the relative density of a suspension

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

11.2.15
pre-start warning
audible *alarm* (11.1.14) that is caused to sound before machinery (e.g. a conveyor) is started

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

11.2.17
printer
device for producing *printouts* (11.2.18) of text and/or graphics

11.2.18
printout
document or set of messages produced by a *printer* (11.2.17)

11.2.19
visual display unit
VDU
device for visual presentation of *data* (11.1.12) (e.g. from a computer), generally employing a cathode ray tube or liquid crystal display

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

11.2.21
static display
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
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
small computer based on either a single chip of semi-conductor or a small number of chips

11.2.24
digital computer
machine that carries out arithmetic and logical operations on *data* (11.1.12) represented in a binary digital format

11.2.25
analogue computer
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
computer formed from a combination of an analogue and a *digital computer* (11.2.24)

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

11.2.28
programmed controller
controller (11.2.4) incorporating a sequence of predetermined commands to a *control system* (11.1.1) as a function either of time or of some other variable

Note 1 to entry: Programmable Logic Controller (PLC) is a device for performing this task.

11.2.29
programmable controller
programmable logic controller
PLC
controller (11.2.4), whose function is determined by codes or instructions programmed into it by the user, the application *programme(s)* (11.3.28) being stored in an accessible *memory* (11.3.32)

11.2.30
dedicated controller
controller (11.2.4) that is responsible for the control of a specific section of a plant

11.2.31
limit switch
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
transducer (11.2.3) that is used, with a *control system* (11.1.1), to apply a preset limit to any operation or movement

11.2.33
lock-out circuit
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

11.3.1
open loop control (system)
system of control using *feedback* (11.3.17) but not using any automatic means of determining *deviations* (11.3.10) from the target value

Note 1 to entry: The feedback signal or signals are normally displayed visually, deviations being corrected manually.

11.3.2
closed loop control (system)
system of *automatic control* (11.1.2) in which the operation being performed is measured and compared with the desired performance

Note 1 to entry: The *deviation* (11.3.10) 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* (11.2.4) may have proportional, integral or *derivative action* (11.3.15) or a combination of these.

11.3.3
ratio control (system)
control system (11.1.1) that maintains two or more physical quantities or conditions at a predetermined ratio

11.3.4
controlled device
body, process or machine, a particular condition of which is controlled by a system

11.3.5
controlled condition
physical quantity or condition of the controlled body, process or machine that it is the purpose of the system to control

11.3.6
desired value
independently set reference in a *control system* (11.1.1)

11.3.7
input signal
received signal that initiates action

11.3.8
command signal
quantity or signal that is set or varied by some device or human agent external to and independent of the *control system* (11.1.1) and that is intended to determine the value of the *controlled condition* (11.3.5)

11.3.9
set point
desired value (11.3.6) at which the process or machine is to be controlled

11.3.10
deviation
difference between the measured the *controlled condition* (11.3.5) and the *command signal* (11.3.8)

11.3.11
error signal
in an automatic *control system* (11.1.1), 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
signal passed to the equipment governed by a *control system* (11.1.1) to apply a change or correction

11.3.13
control action
term describing the relationship between the *input signal* (11.3.7) and the output signal of a control element

11.3.14
proportional action
action of a control element whose output signal is proportional to its *input signal* (11.3.7)

11.3.15
derivative action
change of output signal proportional to the rate of change of the *deviation* (11.3.10)

11.3.16
integral action
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
transmission of a signal from one stage of the system to a preceding stage to effect correction and/or control