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Coalbed methane exploration and development — Terms and definitions

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National foreword

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**Coalbed methane exploration and
development — Terms and definitions**

*Exploration et développement du méthane de houille — Termes et
définitions*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The committee responsible for this document is ISO/TC 263, *Coalbed methane (CBM)*.

Coalbed methane exploration and development — Terms and definitions

1 Scope

This International Standard provides terminology on geology and exploration, engineering construction, field development and production in coalbed methane industry. This International Standard does not contain surface gathering.

2 Terms relating to geology and exploration

2.1

coalbed methane CBM

methane-rich gas naturally occurring in coal seams (and surrounding rock) typically comprising of 80 % to 95 % methane with lower proportions of ethane, propane, nitrogen and carbon dioxide

Note 1 to entry: In common international use, this term refers to methane recovered from un-mined coal seams using surface boreholes.

2.2

adsorption

enrichment of the absorptive gas at the external and accessible internal surfaces of a solid material (coal matrix)

[SOURCE: ISO 15901-2:2006, 3.2]

2.3

desorption

opposite of *adsorption* (2.2), in which adsorbed gases leave the surface of a solid material (coal matrix)

Note 1 to entry: The liberation can be spontaneous but can be accelerated by physical actions.

[SOURCE: ISO 3529-1:1981, 1.13.2]

2.4

gas content

volume of gas per unit mass of coal, usually expressed in cubic meter of gas per ton of coal under standard temperature and pressure (STP) conditions

Note 1 to entry: Unit is m³/t or cm³/g. STP conditions are 100 000 Pa and 0 °C (273,15 K).

2.5

CBM content

volume of hydrocarbon gas per unit mass of coal, usually expressed in cubic meter of gas per ton of coal under standard temperature and pressure (STP) conditions

Note 1 to entry: Unit is m³/t or cm³/g. STP conditions are 100 000 Pa and 0 °C (273,15 K).

2.6

CBM reservoir

coal seams and surrounding rock with hydrocarbon resources that can potentially be extracted for commercial purposes

2.7

initial reservoir pressure

P_i

initial gas pressure measured in a reservoir, prior to the start of production

[SOURCE: WWW.GLOSSARY.OILFIELD.SLB.COM]

2.8

pressure gradient

pressure change with distance ratio of fluid pressure in the middle of the coal seam and reservoir depth
rate of pressure change with respect to depth of coalbed methane reservoir in unit depth, MPa/m,
increasing pressure value of coalbed methane reservoir in unit depth, MPa/m

2.9

abandonment pressure

lowest pressure at which commercial production can be maintained under present economic and technical conditions expressed by flowing bottom hole pressure (FBHP)

2.10

adsorption isotherm

relationship between the amount of gas adsorbed and the equilibrium pressure of the gas at constant temperature

Note 1 to entry: Normally described by the Langmuir equation $V_{ads}=V_L \cdot (p/(P_L+p))$.

[SOURCE: ISO 15901-2:2006, 3.5]

2.11

Langmuir volume

V_L

maximum adsorbed gas content per unit mass of coal at infinite pressure under particular temperature conditions

2.12

Langmuir pressure

P_L

pressure at which half of the Langmuir volume exists within the coal under particular temperature conditions

2.13

adsorption time

time in hour or day taken for 63,2% of the total absorbed gas to desorb from the matrix

2.14

adsorption saturation

ratio of measured gas content to the maximum adsorbed gas content in theory per unit mass of coal under particular CBM reservoir pressure and temperature conditions

2.15

critical desorption pressure

pressure in which the gas begins to desorb from the coal matrix as the CBM reservoir pressure declines

2.16

shrinkage

contraction coefficient

decrease in volume of coal matrix after gas desorption expressed as a percentage of the initial volume

[SOURCE: ISO 14616:1997, 2.2 — modified]

2.17

diffusion coefficient

rate of gas diffusion through a material

Note 1 to entry: Expressed in m²/s.

Note 2 to entry: Express flow ability of coalbed methane depending on concentration.

[SOURCE: ISO 9346:2007,3.34]

2.18

dual porosity system

rock characterized by primary porosity from original deposition and secondary porosity from some other mechanism [*cleat* (2.20) or *fracture* (2.19)] and in which all flow to the well effectively occurs in one porosity system, and most of the fluid is stored in the other

[SOURCE: WWW.GLOSSARY.OILFIELD.SLB.COM — modified]

2.19

fracture

natural fractures in a formation resulting from external stress, usually being associated with a displacement

2.20

cleat

natural *fractures* (2.19) in a coal seam usually being associated with *coalification* (2.21)

Note 1 to entry: Normally in a form as two groups of parallel fractures orthogonal with each other the group with better fracture continuity is called surface cleat (face cleat), the other group limited by surface cleat is called end cleat (butt cleat).

2.21

coalification

process by which deposited and compacted plant remains are transformed into coal

Note 1 to entry: Includes diagenesis and metamorphism.

[SOURCE: ISO 1213-2:1992, 3.29]

2.22

coal rank

position of a coal in the coalification series from lignite coal (low rank) to anthracite (high rank), indicating maturity in terms of chemical and physical properties

[SOURCE: ISO 7404-1:1994, 2.1.3]

2.23

CBM exploration

initial phase in coalbed methane operations that includes generation of a prospect or play or both, and drilling of an exploration well

[SOURCE: WWW.GLOSSARY.OILFIELD.SLB.COM]

2.24

CBM resources

naturally occurring concentrations or reservoirs of coalbed methane in coal seams and surrounding rock in such forms and amounts that economic extraction is currently or potentially feasible

[SOURCE: WWW.EIA.GOV/TOOLS/GLOSSARY]

2.25

original CBM in place

volume of coalbed methane in a reservoir prior to production

2.26

recovery factor

ratio of recoverable amount of hydrocarbon initially in place

[SOURCE: WWW.GLOSSARY.OILFIELD.SLB.COM]

2.27

reserve

portion of the demonstrated reserve base that is estimated to be recoverable at the time of determination

Note 1 to entry: Derived by applying a recovery factor to that component of the identified resource designated as the demonstrated reserve base.

2.28

CBM resource abundance

amount of hydrocarbons in unit area

2.29

zone evaluation

screening of various zones to decide on one or more favorable zone through comprehensive geological research

2.30

prospecting well

wildcat well

well drilled for the purpose of discovering a new field or reservoir in the new frontier

[SOURCE: <http://www.mpgpetroleum.com/glossary.html>]

2.31

appraisal well

wells drilled after gas has been discovered, in order to establish the limits of the accumulation in terms of both the area extent and thickness of the reservoir and the volume of hydrocarbons it contains, and in order to obtain fluid samples to investigate the distribution of fluid properties in the reservoir

2.32

dirt band

parting

layer of mineral matter lying parallel to the bedding plane in a seam of coal

[SOURCE: ISO 1213-2:1992]

2.33

ash

residue obtained by incineration of a solid mineral fuel under specified conditions

[SOURCE: ISO 1213-2:1992]

2.34

volatile matter

loss in mass, corrected for moisture, when a solid mineral fuel is heated out of contact with air under specified conditions

[SOURCE: ISO 1213-2:1992]

2.35

proximate analysis

analysis of a solid mineral fuel reported in terms of moisture, *volatile matter* (2.34), *ash* (2.33) and fixed carbon

[SOURCE: ISO 1213-2:1992, 3.134]

2.36

air dried basis

means of expressing an analytical result based on the condition in which a solid mineral fuel is in equilibrium with atmospheric humidity

[SOURCE: ISO 1213-2:1992, 3.5]

2.37

dry ash-free basis

means of expressing an analytical result based on a hypothetical condition in which the solid mineral fuel is considered to be free from both moisture and ash

[SOURCE: ISO 1213-2:1992, 3.48]

2.38

seismic

exploration technique that can find structures and potential reservoir traps by reflecting sound waves from the rock strata

[SOURCE: <http://www.gekenengineering.com/>]

3 Terms relating to engineering and construction

3.1

casing programme

number of casing layers in one well, depth of setting and diameters of each casing pipe, wellbore diameter of relevant well depth and returning cement depth

3.2

directional well

well drilled at an angle from a surface location to reach a target which is not located directly underneath the wellhead

3.3

cluster wells

group of two or more wells drilled from one drilling pad

3.4

horizontal well

directional well (3.2) whose hole deviation angle is near, equal or larger than 90° with bore hole entering target seam and extending to a length

3.5

multi-lateral horizontal well

horizontal well (3.4) with more horizontal well segments or with more branch horizontal well segments drilled in one horizontal well segment

3.6

U-type well

combination of a *horizontal well* (3.4) and a vertical well with far end of the former connecting to the latter

3.7

V-type well

combination of *horizontal well* (3.4) wells with far ends connecting to the same vertical well

3.8

coalbed following drilling

drilling type following coal seams with dip more than 45°

- 3.9**
inclination
deviation angle
angle of tangent line at one point of borehole axis and plumb line of the point
- 3.10**
dog-leg severity
dog-leg angle with unit length in well unit °/30m
- 3.11**
azimuth
angle of projection line of tangent line from one point of borehole axis following drilling direction and true north traverse line (clockwise rotation start with true north traverse line)
- 3.12**
measured depth
MD
measured length of borehole axis from rig rotary table surface to measure point in the well
- 3.13**
true vertical depth
TVD
vertical distance from measured point to kelly bushing surface
- 3.14**
horizontal displacement
horizontal distance from measured point on well track to wellbore
- 3.15**
wireline coring
operation to obtain rock sample (*core* ([3.16](#))) drilled from stratum by wire line core barrel
- 3.16**
core
cylinder coal rock sample obtained in the well by coring operation
- 3.17**
core cutting
operation to cut core cylinder from drill to bottom when drilling to designed depth in coring
- 3.18**
well cementing
operation to inject cement into annular space between casing string and borehole wall
- 3.19**
injection
fall off test
method of determination of reservoir permeability based on measurement and analysis of pressure data gathered while injection of a fluid
- 3.20**
skin effect
change in permeability near wellbore causing additional flow effect when permeability after drilling, well completion or well stimulation
- 3.21**
CBM well completion
technology to achieve connection between drilled coalbed methane well and target stratum of development

3.22

open hole completion

well completion method when casing pipe reaches target coal seam of development and cementing, exposing production layer

3.23

cased hole completion

well completion method when casing pipe reaches target coal seam of development, cementing and connect wellbore and coal layer through perforation technology to create eyelet on casing pipe

3.24

cavern completion

well completion method to create a cave in target stratum after fall of coal seam into wellbore through pressure inducing,hydraulic chambering, etc. methods

3.25

screen pipe completion

well completion method of using screen liner in target zone

3.26

stimulation

technology to improve initial fracture system of coal seam and to improve connection between coal seam fracture and wellbore, or other technology to improve production ability

3.27

hydraulic fracturing

well stimulation method where a fracturing fluid is pumped into the coal seam at high pressure and flow rate resulting in fractures in the coal seam

3.28

artificial fracture

fracture created in coal seam through fracturing technology

3.29

proppant

solid particles filling and support fracture in fracturing technology

3.30

fracture conductivity

ability to allow fluid to flow through fracture

Note 1 to entry: Equals to product of fracture permeability and fracture width.

3.31

proppant volume percentage

ratio of volume of *proppant* (3.29) added accumulated volume of proppant to volume of used liquid when pumping proppant-carrying fluid

3.32

fracture half-length radius of fracture

distance of extending of fracture through radial direction from wellbore to coal reservoir after fracturing coal reservoirs

Note 1 to entry: It is normally equal to length of *horizontal fracture* (3.41).

3.33

fracture pressure

construction pressure to start reservoir crash in fracturing

3.34

fracture pressure gradient

pressure gradient at which a specific formation interval breaks to form fractures

3.35

fracture extension pressure

pressure in fracture making fracture open and extending in fracturing

3.36

closure pressure

construction pressure to make fracture closed after pump stops in fracturing

3.37

vertically staged fracturing

pointed fracture layer by layer (segment) after separating target layers (segment) through a method

3.38

horizontally staged fracturing

technology to operate multi-stage fracturing to horizontal wells through separate layer (segment) fracturing technology

3.39

re-fracturing

fracture more than once on the same layer of the same well

3.40

vertical fracture

fracture surface is perpendicular to the coal seam, normally caused when horizontal stress is smaller than vertical stress

3.41

horizontal fracture

fracture surface is parallel to the coal seam, normally caused when horizontal crustal stress is larger than vertical crustal stress

3.42

log

systematic recording of data, such as a driller's log, mud log, electrical well log, or radioactivity log

Note 1 to entry: Many different logs are run in wells to discern various characteristics of downhole formation.

4 Terms relating to development and production

4.1

CBM development

exploitation of coalbed methane from coal seams through surface borehole

4.2

CBM well pattern

geometric arrangement mode of coalbed methane development well

4.3

inter-well interference

point which accelerates pressure falling and gas desorption when production wells' pressure falling transmit to the point in the same coal seam

4.4

CBM drainage

technology process to eject water out from CBM production well by artificial lift method, to realize CBM production

4.5

flowing bottomhole pressure
FBHP

fluid pressure at a certain depth of a deposit during process of production

4.6

casing pressure

pressure in a well that exists between the casing and the tubing or the casing and the drill pipe

4.7

coal fines

initial or secondary created solid particles of coal rock entering from coal seams to the wellbore with water or gas during coalbed methane production process

4.8

clamp off

processing measurement to decrease *coal fines* (4.7) or bridge over

4.9

bailing

operation of coal fines or sand fishing from well bottom by a kind of bucket

4.10

pump inspection

generic terms of maintenance operation to replace, deepen or lift setting depth of pump, change pump diameter, relieve coal fine block of pump, sand block, sucker rod broken, parts depreciation, etc.

4.11

well workover

repair operation of production well which require pulling out/in tubing string

4.12

gas locking

phenomenon of preventing liquid from going in or out of pump when much gas enter pump during working of deep-well pump

4.13

gas anchor

tools to separate gas and liquid on the underground tubing string, and reduce gas going to the pipeline

4.14

gas-water separator

equipment to separate water from produced gas

4.15

tubing pump

kind of oil pump whose pump barrel connect to the bottom of tubing string, enter into well with pipeline

4.16

rod pump

kind of oil pump whose external working barrel connect to the bottom of tubing string, pump barrel and plunger connect to the bottom of rod, enter into well together, and insert the external working barrel

4.17

electric submersible pump

ESP

electric-motor-driven and rodless pump sunk in liquid inside of wells, such as electric-motor-driven centrifugal pump, electric-motor-driven screw pump, electric-motor-driven diaphragm pump, etc.

4.18

jet pump

pump in which a jet of fluid in rapid motion lifts a large quantity of another fluid by its impulse

4.19

flowing fluid level

distance from fluid level in annular space of casing pipe to wellhead during production

Note 1 to entry: The unit is m.

4.20

static fluid level

distance from stable fluid level in annular space of casing pipe to wellhead when stop production

Note 1 to entry: The unit is m.

4.21

liquid column height

distance from fluid level in annular space of casing pipe to the middle of reservoir during production

Note 1 to entry: The unit is m.

4.22

production curve

group of characteristic curves which describe production well drainage status, including transformation curves indicate gas production versus time, water production versus time, fluid level versus time, *casing pressure* (4.6) and *flowing bottomhole pressure* (4.5) versus time, etc.

4.23

production system

combination of pump diameter, stroke, jig frequency rotate speed, etc. parameters during coalbed methane production depending on production design

4.24

liquid producing rate

liquid volume ejected out of well in unit time

Note 1 to entry: The unit is m³/d.

4.25

pump setting depth

entering depth of standing valve of pump

Note 1 to entry: The unit is m.

4.26

submergence

depth of pump sunk in the liquid to working fluid level when deep-well pump works

Note 1 to entry: The unit is m.

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