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Solid mineral fuels — Guidance on the sampling of coal seams

Combustibles minéraux solides — Principes directeurs pour l'échantillonnage des veines de charbon

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Contents

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Foreword

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

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 14180 was prepared by Technical Committee ISO/TC 27, *Solid mineral fuels*, Subcommittee SC 4, *Sampling*.

Annexes A and B of this International Standard are for information only.

Introduction

A coal seam may consist of a single stratum of one lithotype of relatively uniform maceral constitution, or it may consist of a number of layers of different coal lithotypes varying in thickness and lateral extent. The seam may also contain discrete layers of inorganic sediments or carbonaceous shales of varying thickness. Veins of concordant or discordant secondary mineral matter or intrusive igneous rock may also be present. The lithotype layers may vary considerably in hardness, texture and structure according to the nature of the coal and inorganic sediments. The inorganic layers may also thicken laterally, splitting the seam into two or more separate entities. Thus, it is not always possible to obtain samples of a full seam or seam section at one sampling point. Where significant variation in seam thickness, lithotype profile and structure occurs and a representative sample is required, several samples may have to be taken.

Methods of sampling for the assessment of the physical, chemical, petrographic or utilization properties are described for the following:

a) sampling from small and large diameter drill cores;

b) sampling from exposed seam faces;

c) sampling from trial open-cut excavations;

d) sampling from underground workings.

In a seam of variable quality, it will be necessary to take a number of samples to improve the representativity of sampling.

In operating mines, the manager should be consulted and approval should be obtained before sampling sites are selected and sampling proceeds. In all sampling situations, experienced and qualified personnel will be required for supervision and to ensure that accurate records are made of location, thickness and lithotype descriptions and that all safety precautions have been addressed.

Solid mineral fuels — Guidance on the sampling of coal seams

SAFETY PRECAUTIONS — It is strongly recommended that a risk analysis of the sampling exercise be undertaken by an experienced safety officer before work begins.

1 Scope

This International Standard provides guidance on methods for taking samples from coal seams in the ground, whether from exploration tenements, or from operating underground or open-cut mines. The following methods are described:

a) bore core sampling;

b) drill cuttings sampling;

c) open-cut slot sampling;

d) adit, drift or shaft sampling;

e) pillar sampling;

f) channel sampling;

g) strip sampling.

This International Standard does not apply to sampling from moving streams in production or any other source of coal that is not *in situ*.

Recommendations are made for selection and preparation of the sampling site, and methods are described for taking both small and bulk samples, and for preparing the samples for transport.

NOTE Annex A gives an example of a sample record form that may be used to record sampling and other relevant data, and ISO 9411-1 [1] describes how to determine the mass of a representative sample at various nominal top sizes.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1213-2:1992, *Solid mineral fuels — Vocabulary — Part 2: Terms relating to sampling, testing and analysis*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 1213-2 and the following apply.

3.1
bulk sample
sample of large mass, taken in a particular operation for a specific reason, such as for pilot washing, coal preparation or burning tests

NOTE It is not possible to define the minimum size of a bulk sample.

3.2
channel sample
sample of the coal and associated inorganic material taken by removing a channel of even cross-section from the seam

NOTE Where the full section of the seam is not accessible or not required, this term may refer to a sample taken either from a specifically defined portion of the seam, or from the floor to roof as mined or exposed.

3.3
coal seam
stratum or sequence of strata composed of coal as a significant component and significantly different in lithology to the strata above and below it

NOTE It is laterally persistent over a significant area and it will be of sufficient thickness and persistence to warrant mapping or description as an individual unit.

3.4
core sample
cylindrical sample of the whole or part of a coal seam obtained by drilling using a coring barrel

NOTE The diameter of the core may vary from 50 mm to 2 000 mm depending on the reason for which the sample is required. However, 50 mm to 200 mm is the most common core diameter range.

3.5
cuttings sample
sample of coal chips produced from the rotary drilling of a coal seam using a non-coring bit such as a blade bit or roller bit

3.6
pillar sample
section of a seam taken in the form of a block, or series of blocks, of coal with associated inorganic rock which, when arranged in correct vertical sequence, represent a true section of the seam

NOTE Where the full section of the seam is not accessible or not required, this term may refer to a sample taken either from a specifically defined portion of the seam, or from the floor to roof as mined or exposed.

3.7
ply sample
sample taken from an individual ply or leaf or from a series of plies or leaves of a coal seam

3.8
strip sample
sample similar to a channel sample but smaller in cross-section

NOTE A single strip sample may often be regarded as being too small to guarantee that all horizons of the seam are adequately represented. However, a number of such samples may be taken to achieve better representativity in a variable seam.

4 Selection of sampling site

If a sample is to be taken to provide a representative sample of the seam, the site should be chosen, as far as possible, to avoid cracks and breaks, random lenses of rock or mineral matter, or other abnormalities or irregularities in the face to be sampled. However, on occasion, the purpose may be to sample a particular mode of development of the seam section, in which case the sample should be taken at the best available site exhibiting this feature. The location of the sampling point should be recorded accurately (see clause 6).

5 Sampling procedures

5.1 General

Before sampling an exposed face, the section to be sampled should, as far as practicable, be uniformly dressed and squared up, and any loose, overhanging or protruding pieces of coal or rock should be removed. Where a face is weathered, the immediate surface material should be removed to a depth sufficient to eliminate weathering effects. In the case of underground face sampling, contamination by stone dust is to be avoided, as this will influence the analysis.

Care should also be taken to prevent contamination by out-of-seam materials, or other sources such as drilling fluid.

In all cases, but particularly for lower rank coals, it is imperative that the sample be promptly packed in its container to minimize loss of moisture and be transported to the laboratory as soon as practicable.

If the laboratory cannot begin analysis immediately, arrangements should be made to keep the sample in cold storage to prevent oxidation of the coal. Any coal not being analysed should be returned to cold storage until it is required.

5.2 Core sampling

5.2.1 Purpose of core sampling

Core sampling is usually employed for sampling coal seams that are not exposed in outcrop or by mining. Sometimes, however, this method is used even though exposed faces are available. This is because it is often faster, less labour-intensive and more representative than pillar or strip sampling, especially if a suitable drilling rig is readily available. For example, many open-cut mines take cores of the seam to be uncovered in the next mining strip to obtain coal quality data for mine planning purposes. Coring of the uncovered coal seam by a drilling rig sitting directly on top of the coal is also common practice where specific coal quality parameters need to be known for blending purposes or for specific cargoes where the customer may be particularly sensitive to certain coal properties or inorganic impurities.

Cores can be obtained routinely in diameters ranging from 50 mm to 200 mm depending on the amount of material required for testing. It is generally advisable that, for routine sampling operations, 100 mm cores be taken as this size provides a good compromise between representativity and cost. However, it is now possible to take very large cores where a bulk sample is required for marketing, coal processing or coal utilization studies. These cores are obtainable with a foundation drilling rig (commonly known as a bucket rig) but are generally limited to reasonably shallow depths. In this way, a 100 t sample can be obtained at reasonable cost. The coal is usually loaded directly into a truck and covered for transport to the laboratory or pilot beneficiation plant. When taking this type of sample, it is advisable to drill several small-diameter pilot drill holes at the sampling site, to locate the top of the seam accurately so that coring can begin at a predetermined distance above the seam.

5.2.2 Method of sampling cores

Once the sampling intervals have been defined, the coal from each ply is placed in a suitable container such as a thick plastics bag, 20 litre plastics drum, 200 litre lined drum, PVC split tube or gas desorption cylinder.

NOTE Guidance on core sampling and sampling intervals is contained in AS 2519 [2].

Care should be taken to collect all of the sample, including fines in the bottom of the core split tubes, to maintain representativity. This can be achieved by using a shaped scoop and a paintbrush.

5.2.3 Core sample identification and labelling

Each sample should be given a unique number within a sequential numbering system, preferably commencing with the first sample of the uppermost seam in the hole. For example, 8765/01 would be the first (shallowest) sample from hole number 8765. The sample number should be entered on the sample sheet over the appropriate sample depth interval and written in indelible ink or paint on the outside of the container in which the sample is placed. Individual samples may occupy more than one container, but each container should be clearly marked with the sample number and the number of the container relating to that sample (e.g. 8765/01, 1 of 2). As well as marking the sample number on the outside of the container, a small plastics bag containing a sample tag on which is written the sample number should be placed inside the container, in case the number on the outside is accidently damaged or erased during transport or handling. Aluminium sample tags are recommended for this purpose. If plastics bags are used as the principal sample container, the sample number should similarly be written on both the outside of the bag and on a sample tag placed inside a small plastics bag inside the main container.

Once the samples have been labelled, they should be securely sealed using thick elastic bands or packaging tape for plastics bags, clip-on lids secured with packaging tape for plastics buckets and screw-tightened lids for 200 litre drums. For extra security, plastics bags should be placed in 200 litre drums with the sample numbers, name of tenement, name of company sending the samples and name of laboratory to which they are being despatched. Prior to despatch to the laboratory, the analyst should be informed in writing of the number of samples to be sent and the analyses required. A copy of the sample record sheets should be provided to the laboratory with the analytical instructions.

5.3 Cuttings sampling

5.3.1 Purpose of cuttings sampling

Cuttings sampling is used where core sampling is not possible or not justified in terms of cost for the purpose at hand. It should be realized that cuttings samples are not as representative as core samples and require a great deal of experience on the part of the driller and sampler to obtain representative samples. An instance in which cuttings samples might be adequate would be in the early stages of tenement evaluation where a broad understanding of coal quality is required as a precursor to more detailed core sampling.

5.3.2 Method of cuttings sampling

Cuttings are obtained when drilling with a non-coring drill bit. The size of the cuttings can be very variable but generally ranges from a few millimetres to a few centimetres. As the drill bit advances through the seam, the circulating medium (air, water or drilling mud) transports the cuttings from the bit to the surface and they are collected in a purpose-made container or cyclone or on a shovel held near the hole. Generally, the driller alerts the sampler when a coal seam is intersected, and stops drilling while still circulating the drilling fluid to clear the hole of out-of-seam contamination. When satisfied that the hole is clear, the driller then drills a previously agreed distance, usually one metre, while the sample is collected, and then cleans out the hole again. This procedure is continued through the seam until the seam floor is encountered. The sampler meanwhile washes and selects a representative quantity of cuttings from each sample, places them in bags and labels them while the hole is deepened to the next seam, if more than one seam is being sampled. A variation on conventional cuttings retrieval is the technique of reverse-circulation drilling. In this drilling method, the normal circulation of the drilling medium (down the centre of the drilling rods and back up the annulus between the rods and wall of the hole) is reversed and the drilling fluid is pumped down the annulus, entrains the cuttings, and returns up the centre of the rods, from which the cuttings are recovered and sampled. This method is suitable for sampling unconsolidated sediments and is ideally suited to sampling coal tailings dams.

As in the case of core sampling, foundation drilling rigs can be used to collect very large cuttings samples, generally on a whole-seam basis, where a large quantity of coal is required for utilization testing or any other purpose. Again, the sample is placed directly in a truck, or on a prepared surface for loading later onto a truck with a front-end loader or similar machine. Sizing of coal obtained in this way can be finer than the anticipated run-of-mine coal sizing, but techniques such as reaming may be used to increase the average size if this is important.

Another type of cuttings sampling is known as "keyhole sampling". This method involves the fracturing of the coal by blasting in the hole, or reaming followed by the recovery of the broken coal by circulating the drilling medium using hydraulic mobilization and lifting. This method is best suited to sampling deep coal seams that are targeted for underground mining, as an alternative to taking a number of conventional large-diameter cores.

5.3.3 Cuttings samples identification and labelling

Identification and labelling for cuttings samples is similar to the method described for core samples in 5.2.3, except that cuttings samples are generally smaller than core samples, often no more than 500 g, due to the restricted nature of analysis that can be sensibly carried out on them. There is usually no need to place an identification label inside the principal sample container, but a number of cuttings samples can be placed in a larger plastics bag or a plastics bucket for ease of transport.

5.4 Open-cut slot sampling

5.4.1 Purpose of open-cut slot sampling

Slot sampling is a form of bulk sampling used to acquire a large quantity of coal that would be representative of run-of-mine coal from undeveloped deposits amenable to open-cut mining, or undeveloped areas or seams of an existing open-cut mine. Often the purpose is to confirm coal quality, sizing, washability and utilization behaviour, on the pilot or commercial scale, or in a commercial trial. Results from these tests are more reliable than those obtained from core or channel samples and contribute substantially to a development decision.

It is imperative to realize that this type of sampling is subject to relevant legislated acts and regulations and normally can be carried out only with all appropriate authorizations in place and under the direction of suitably qualified mining personnel as prescribed in the relevant legislation.

It is necessary to obtain all of the approvals required before this type of sampling is commenced. This will include environmental approvals.

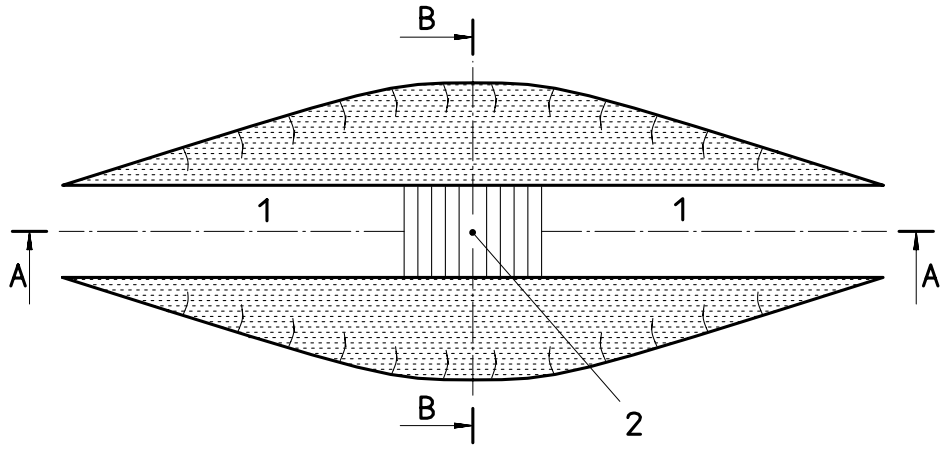
5.4.2 Method of open-cut slot sampling

Slot sampling requires a full mine design produced by qualified and experienced civil or mining engineers and geologists. Detailed slot design is outside the scope of this International Standard and only general concepts will be discussed.

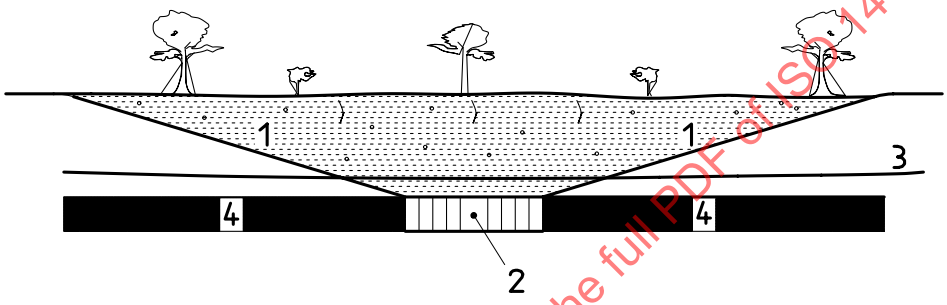
Factors to be considered in the overall design of the slot include shape, seam dip and depth, ramp grade and width, side-wall and end-wall angles, water management, and topsoil and spoil pile management.

The size of the slot and therefore the complexity of design will depend on the depth to fresh coal, the thickness of the coal seam to be sampled and the size of the sample required. Thus, the first decision to be made is the quantity of coal required for the purposes for which the sample is being taken. This is influenced by mining and preparation factors such as mining loss, dilution from mining, expected yield of clean coal after washing and whether subsequent samples are required. The quantity of finished coal product is the basis upon which the whole mine plan is based. The depth to coal and the strength of the overburden are particularly important factors in design because they dictate the type of slot that can be used and hence the cost involved.

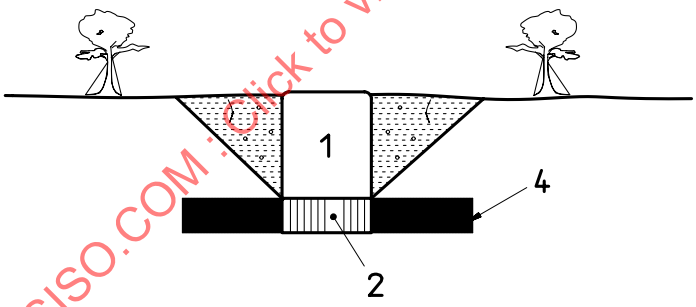
Where the coal is relatively shallow and the overburden can be removed by scrapers, the preferred slot design is a double-ramp design as shown in figure 1. In this design, the scrapers remove the overburden down to the top of the coal seam and uncover sufficient coal to produce the amount of finished product that was determined before excavation commenced. This type of slot has the advantage of being easily enlarged later, if more material is required. One common strategy is to uncover twice the width of coal required and mine only half the width using an excavator sitting on the half that is not to be mined, as shown in figure 1. This allows recovery of a similar quantity later for further testing.



a) Top view



b) Section A-A



c) Section B-B

Key

1 Ramp
2 Sampled coal
3 Base of weathering
4 Coal seam

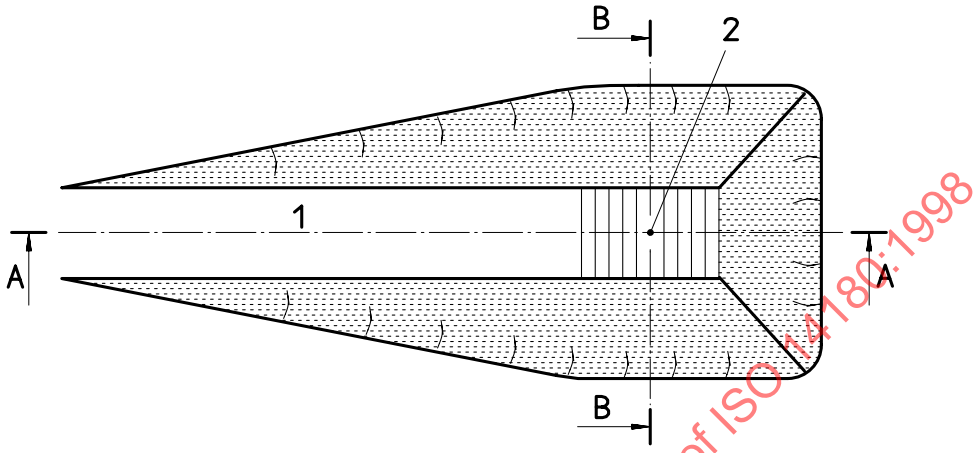
Figure 1 — Slot bulk sample excavation

Where the strength of overburden or the depth to fresh coal prohibits the use of the double-ramp method, a single ramp is excavated down to the floor of the seam in such a way that sufficient coal is exposed as a block ahead of the ramp, as shown in figure 2.

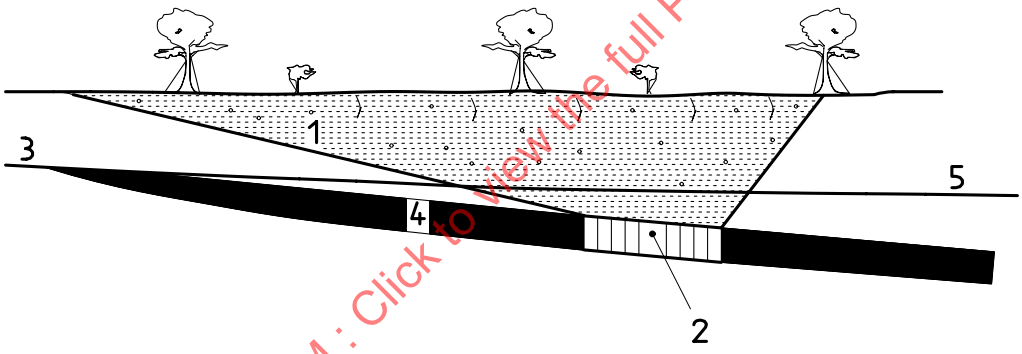
In both types of slot, the coal block to be mined is carefully squared up so that a full seam section is available for mining and it is then drilled and lightly blasted, if required, or ripped with a bulldozer. The coal can then be mined with an excavator sitting on the unblasted block and either placed on a clean pad on that block or loaded directly into trucks for transport to the surface for stockpiling and blending, again on a specially prepared pad to minimize contamination.

It is recommended that a channel sample, as described in 5.7, is also taken to compare the analysis with that of the bulk sample.

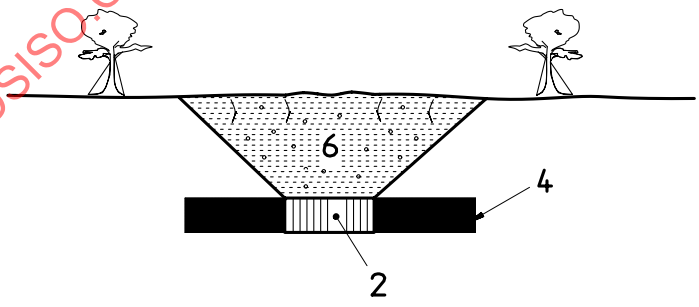
SAFETY PRECAUTIONS — Note that excavations of this type represent a potential safety hazard and, if they are to remain open, should be securely fenced to prevent entry to humans and wildlife. Adequate use of warning signs is also necessary.



a) Top view



b) Section A-A



c) Section B-B

Key

1 Ramp
2 Sampled coal
3 Subcrop
4 Coal seam
5 Base of weathering
6 End wall

Figure 2 — Boxcut bulk sample excavation

5.5 Adit, drift or shaft sampling

An adit, drift or shaft may be more appropriate than an open-cut slot for obtaining large samples from coal seams having greater overburden cover or for seams outcropping in cliff faces or exposed in an open-cut mine.

An adit is driven into the coal seam outcrop, either by mining machinery or by hand excavation, to reach unweathered/unoxidized coal. The affected coal is discarded. The required coal sample is obtained by continuing mining. Smaller channel or strip samples may be taken at intervals along the adit to determine coal quality before the larger bulk sample is mined.

A cross-measures drift may be driven or a vertical shaft may be sunk to intersect deeper coal seams.

As for open-cut slot sampling, these methods are likely to require permits before commencing, and should be supervised by suitably qualified mining personnel.

5.6 Pillar sampling

5.6.1 Purpose of pillar sampling

The main purpose of pillar sampling is to provide large, generally intact samples for detailed observations in the laboratory or field office, and for conducting laboratory strength and shear box testing for definition of geomechanical properties.

Pillar sampling of complete, continuous sections of a coal seam can be limited by soft, friable coal, hard, fractured coal, or coal containing hard, non-coal bands. It is facilitated by the availability of compressed air tools and a chain saw to obtain relatively smooth pillar surfaces.

Before pillar sampling is attempted, it is essential that

a) a suitable location is available;

b) the sample can be extracted efficiently and safely; and

c) no permanent damage or potential safety hazard is created.

5.6.2 Marking of sampling site

Two parallel vertical chalk lines or other suitable markings should be made on the dressed face of the seam from floor to roof, at least 400 mm apart and as far apart as necessary to obtain the required volume of sample. The coal and other material between these lines should form the pillar sample, which should be of sufficient depth to give an area in the bedding plane that will yield the required mass or volume of sample.

5.6.3 Method of pillar sampling

The sample may be obtained by one of the following methods, as shown in figure 3.

a) The sample is taken by cutting into the face at an angle on each side of the chosen and marked sampling position, thus isolating a triangular pillar from the face. This may be freed by cutting into the roof and undercutting the floor, and the sample is then removed either *en bloc* or in sections as described in c) below.

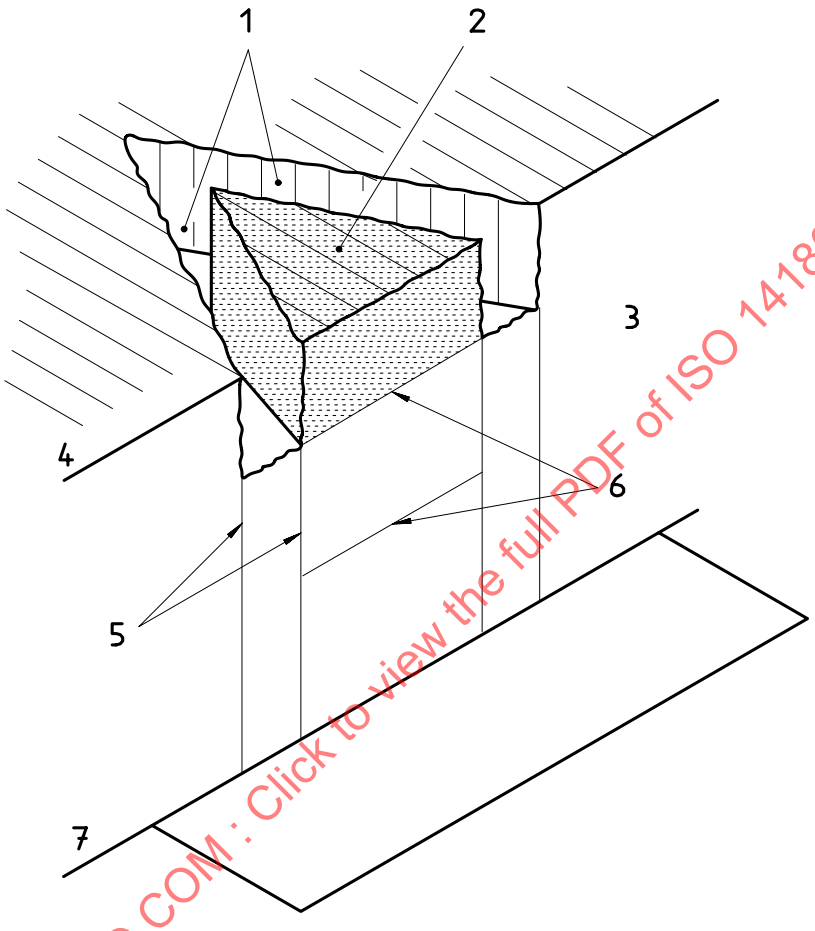
b) Channels are cut on the outside of the markings, leaving a standing pillar of sufficient cross-section to obtain the required sample size. Working in the channels will enable the back of the pillar to be cut free from the seam. The pillar may then be freed from the roof and, if sufficiently stable and of suitable size and mass, removed *en bloc* after undercutting from the floor.

   Should the pillar show signs of instability or tend to collapse, it may be suitably supported so that it can be removed.

   Should the pillar be too high or fragile to remove in one piece, it may be removed in plies or subsections as described in c) below.

c) Channels are cut on the outside of the marking as in b) and the pillar material removed in plies or subsections. Where a pillar is removed in plies or subsections, it should be freed from the roof and the plies or subsections wedged off, wherever possible along the bedding planes, in sequence, from the roof to the floor.

As each piece is removed, a mark should be placed on its upper surface and a label prepared giving its position in relation to the rest of the sample. The label should be enclosed with the piece as it is wrapped. Immediately after each piece is obtained, it should be placed in the sample box (see 7.1) for safe transport.



Key

1 Channel cuts to expose triangular pillar
2 Pillar of upper ply ready for extraction
3 Base of upper ply to be cleaned smooth after pillar section is removed
4 Seam roof
5 Vertical marks
6 Subsection sample markers
7 Seam floor

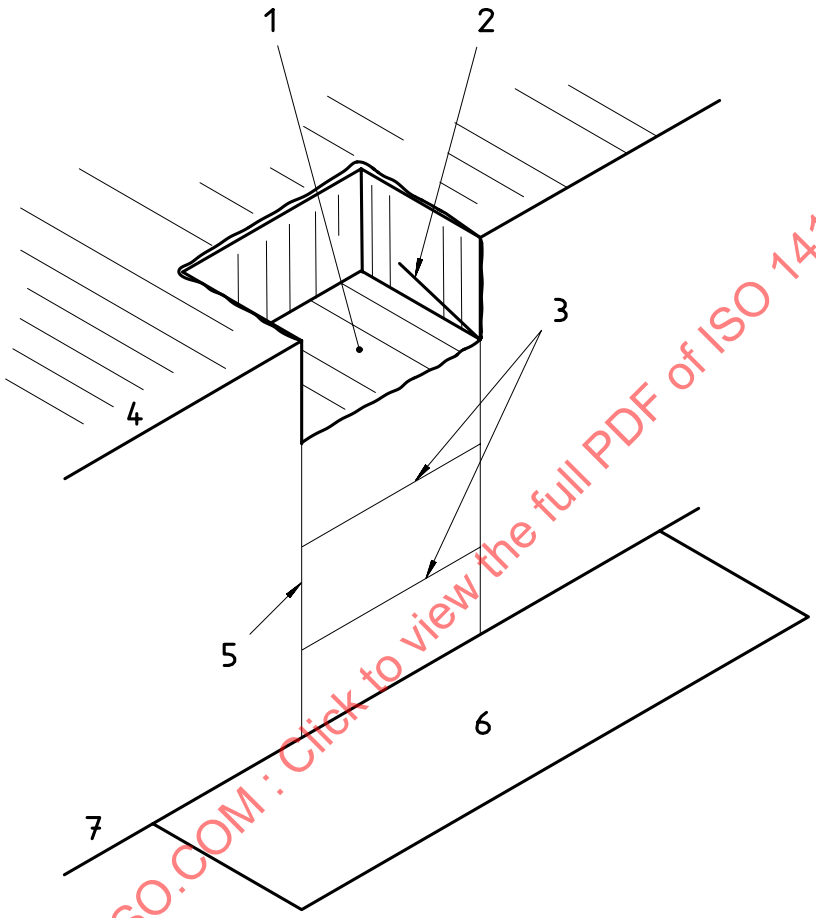
Figure 3 — Pillar sampling

Frequently, it is necessary to obtain overlap of some of the blocks to overcome problems such as fragility or difficulty of separation at certain horizons. Careful measurement at all stages in the removal of blocks from the seam permits a true pillar section to be reconstructed in the laboratory from the overlapping pieces. A pillar sample enables a division into plies or subsections to be made after careful examination in good light. This is obviously an advantage where a seam shows marked changes from ply to ply or contains carbonaceous shale and shaly coal bands which may not be readily distinguishable if the sample is taken underground where the lighting is not satisfactory for accurate observation.

5.7 Channel sampling

5.7.1 Purpose of channel sampling

Channel samples enable relatively large samples, representative of a full seam at the location or an individual subsection at the location, to be taken. Channel samples can be taken manually or using mining equipment. With the latter method, representation of the various layers in the seam is not as certain as with a properly taken hand-mined sample; however, the preparation of the sample to coal preparation plant size is much easier and more certain. Channel sampling is shown in figure 4.



Key

1 Cleaned-up bedding plane marking the base of ply sample
2 Seam dipping into face
3 Marks along bedding to indicate subsectional sample intervals
4 Seam roof
5 Vertical marks to outline channel
6 Plastics sheet or brattice cloth
7 Seam floor

Figure 4 — Channel sampling

5.7.2 Manual sampling

Two parallel vertical chalk lines or other suitable markings should be made on the dressed face of the seam from roof to floor, as far apart as necessary to obtain, in relation to the proposed depth of cut, a sample of the required mass and particle size.

If subsectional or ply samples are required, the vertical intervals should be marked at previously agreed points along the bedding plane between the two vertical marks, to facilitate their successive removal as the channel is excavated in sections down to the floor or the base of the selected section, as appropriate.

A channel sample is taken by removing a vertical channel of even cross-section down the full height of the seam from roof to floor. A large sheet of brattice cloth or plastics material (e.g. PVC) should be placed on the floor against the face and below the channel to collect the sample(s) as excavated. Two methods may be used, as follows.

a) The channel is excavated progressively from the roof down to the required depth from the face, forming relatively smooth, even sides over sufficient cross-sectional area to yield the required sample volume, using a miner's pick, or preferably, a mattock having a presharpened blade and point. Where subsectional plies are to be taken, the excavation is continued to the bedding plane at the base of the sample interval and the channel sides and basal plane are excavated smoothly, taking care not to cut below the selected plane. The subsectional sample is then transferred from the floor sheet into the sample container.

b) The channel sample is taken in an adaptation of the methods described for taking pillar samples (5.6.3.). In this way, a more coarsely graded sample can be obtained. The material chipped from the two cuts on either side of the pillar should be discarded, and only the material removed from the central pillar used in the sample. In this method of cutting, care is required to maintain a uniform lateral section of sample as the excavation progresses downward. This method usually provides the best means of securing relatively thin ply samples.

The dimensions of the lateral section through which the channel is cut will depend, for a given height of sample, on the sample mass required and the bulk density of the coal, which may be taken as the apparent relative density of the raw, *in situ* coal.

The channel sampling method should also be used for obtaining intermediate-sized bulk samples from trial open-cut excavations, to ensure that the sample is fully representative of the seam or a particular seam section. Samples should not be taken from the spoil piles of the trench, because they will yield a disproportionate amount of coal from the upper part of the seam by virtue of the shape of the excavation.

Channel sampling is facilitated by having a large selection of tools available to enable cutting of the channel to yield smooth faces, together with a sample having a large nominal top size with the minimum of fines.

5.7.3 Continuous miner sampling

Ranging drum-type continuous miners can be operated so that they will cut a channel of uniform depth over the normal working height in a coal seam, and thus provide a channel sample. An experienced driver can usually judge the depth of cut required so that the sample can be accommodated in a single shuttle car. The coal may then be discharged through the breaker feeder, if used, and spread on the panel belt for subsampling.

The face should be squared up to remove the possibility of contamination of the sample by protruding top coal or other coal. The floor should be cleaned up and examined so that it can be confirmed that mining is to the true floor. The shuttle car and feeder breaker should be examined and any loose coal that could fall into the sample removed.

The continuous miner is then driven to the appropriate depth and a uniform vertical cut made. The floor has to be cleaned of all cut coal, and the shuttle car and feeder breaker examined when emptied. It is preferable to aim for a 75 % full shuttle car so that any error in judgement of the channel depth will not result in spilling part of the sample.

In this method with a 7 t shuttle car, a primary sample of approximately 5 t will be taken. The effect of accidental contamination on a sample of this size should be small. However, in a seam with dirt banding of variable thickness, the site of the cut should be carefully examined and any local peculiarities in dirt-band thickness should be noted.

5.8 Strip sampling

5.8.1 Purpose of strip sampling

Strip samples can be described as small pillar or channel samples in which equal representation of all horizons in a seam is attempted, but may not be achieved as successfully as in the larger 400 mm pillar or channel samples. In a variable seam, it allows the taking of a number of samples for the same effort as one large sample. The coal obtained will still allow the preparation of a product containing 40 % to 60 % of particle size −22,4 mm +16 mm, at which sizing the ash release will be similar to that obtained in normal coal preparation. Results from a number of such samples will give a better idea of average production from this variable seam, and its potential variability, than a single large pillar or channel sample.