



DRAFT TANZANIA STANDARD

Sampling procedures for analysis of aflatoxin in cereals and cereal products

TANZANIA BUREAU OF STANDARDS

DRAFT STANDARD FOR STAKEHOLDERS' COMMENTS ONLY

0 Foreword

Aflatoxin is a naturally occurring mycotoxin produced by two species of mould: *Aspergillus flavus* and *Aspergillus parasiticus*. *Aspergillus flavus* is common and widespread in nature and is most often found when certain grains are grown under stressful conditions such as drought. The mould occurs in soil, decaying vegetation, hay, and grains undergoing microbiological deterioration and invades all types of organic substrates whenever and wherever the conditions are favourable for its growth. Favourable conditions include high moisture content and high temperature. At least 13 different types of aflatoxin are produced in nature with 4 types of particular concern to food safety especially aflatoxin B1 considered as the most toxic. While the presence of *Aspergillus flavus* does not always indicate harmful levels of aflatoxin, it does mean that the potential for aflatoxin production is present.

The tropical climate together with an all year round high ambient temperature and relative humidity provide optimal conditions for growth of toxigenic moulds and subsequent mycotoxin contamination in cereal grains. Given such conditions, it is essential that food is carefully and properly stored or processed in order to avoid contamination by these fungi and their toxins. Countries worldwide have established maximum limits for aflatoxins in cereal grains.

Therefore, analysis of aflatoxin levels in cereals has to be done to ensure the conformity with the set standard. Aflatoxins-contaminated units are not homogeneously distributed throughout a lot, a few units are likely to be highly contaminated (mycotoxin clusters), while most of the grains are aflatoxins -free. Therefore, proper sampling procedures is required to ensure a representative sample is achieved for the whole lot or consignment, in order to determine the extent of contamination and reach an informed decision of the consignment.

In preparation of this standard considerable help was derived from EAS 900:2017 Cereals and Pulses - Sampling

1 Scope

This Standard specifies requirements for the dynamic or static sampling, by manual or mechanical means, to obtain a representative sample for the determination of aflatoxins in cereals and cereal products.

2 Normative Reference

There is no normative references in this document.

3 Terms and Definitions

For the purpose of this standard, the following terms and definitions apply:

3.1 lot

identified quantity of material (cereal and their product) from which a sample can be taken and controlled to determine one (or several) characteristic(s)

3.2 sampling

drawing or constituting a sample

3.3 dynamic sampling

drawing or constituting a sample from flowing lot

3.4 static sampling

drawing or constituting a sample from stationary lot

3.5 Increment

amount of material taken at one time at each individual sampling point throughout a lot

3.6 aggregate sample

aggregation of two or more increments (3.5), taken by experimental sampling throughout a lot (3.1), combined and homogenized

3.7 laboratory sample

sample prepared by homogenizing and dividing an aggregate sample (3.6) for sending to the laboratory and intended for inspection or testing

3.8 retention sample

sample kept for counter analysis (e.g. for litigation issues)

3.9 homogenization

thorough blending by mechanical or manual means so that contaminants and physical properties are evenly distributed throughout the aggregate or laboratory sample

3.10 packed unit

quantity of grains or their products packed in a sack, a bag or a retail pack

3.11 sample container

bottles, jars or tins with close fitting lids and/or bags, including polythene, cotton or other suitable types of construction, which are securely tied. Such containers shall be labelled and sealed.

3.12 sampling error

error that occurs when a selected sample does not represent the entire lot

4 Requirements**4.1 General requirements**

4.1.1 For the purpose of this standard, sampling includes the following stages:

- a) taking a defined number of increments to constitute an aggregate sample;
- b) homogenization of the aggregate sample; and
- c) reduction of the aggregate sample into the laboratory sample(s).

4.1.2 Since the composition of the lots of cereals or their products is rarely homogeneous and since aflatoxins are not uniformly distributed, a sufficient number of increments shall be taken and carefully mixed to constitute an aggregate sample from which it will subsequently be possible to obtain one or several laboratory sample(s). For non-flowing commodities (static), particular care shall be taken to ensure that these increments are distributed regularly throughout the grain mass, both at the surface and deep down.

4.1.3 It is essential that cereals and their products which are damaged on transit or out of condition should be kept from the sound grain and sampled separately. Samples of the unsound material damaged in transit shall not be mixed with samples of the sound material.

4.1.4 Precautions shall be taken to ensure that all sampling equipment used are clean and dry. The sampling procedures shall be carried out in such a way that the sampled material is protected from any source of accidental contamination caused by rain, dust, etc.

4.1.5 When necessary, all sampling equipment and devices including weighing scales should be maintained and calibrated.

4.1.6 In the event of arbitration, samples shall be taken jointly by representatives of both the purchaser and the vendor (seller), or by a third party nominated by common accord.

4.1.7 Precautions shall be taken to guarantee the integrity of all samples between the moment they are taken and the moment they are used in the laboratory.

4.2 Equipment and devices

There are many different types of sampling equipment or devices. The most suitable equipment should be chosen taking into account the product to be sampled, the quantity required and the containers to be used.

Annex A describes the general types of mechanical sampling devices used on flowing grain, and shows illustrations of examples of such devices. Annex B gives examples of instruments used to sample static products, and examples of instruments used to divide samples.

5 Sampling

5.1 General

Sampling involves drawing of samples from both dynamic and static cereals and their products. In both cases, the sample can be taken using mechanical or manual means.

Sampling from packed units (3.10) only concerns static sampling and only uses manual means.

The number of increments and the masses are given in Table 1 and Table 2 for grain, in Table 3 and Table 4 for milled and other cereal products and in Table 5 for milled and other cereal products in packed units.

NOTE: One laboratory sample (3.7) is required by lot or sub-lot of 1 500 tonnes maximum, e.g. For a lot of 6 000 tonnes, analyse at least four laboratory samples.

5.2 Sampling of bulk products

5.2.1 General

Whenever possible, sampling should be carried out when the products are flowing (for example, during loading or unloading) so that all the constituent parts of the lot have the same probability of being sampled.

When mechanical means are not available, implement a manual sampling plan.

The methods (mechanical or manual) of taking samples from flowing lots shall be adapted to the speed at which the products are flowing (see Table 1 and Table 3). For static grain, whichever method of sampling is used, the increments should be taken at regular intervals over the entire width and depth, up to 9 m. Sample lots of bulk grain which are more than 9 m deep when they are flowing.

For lorries and trailers, it is recommended that samples be taken statically.

In order for the aggregate sample to be representative, the number of increments shall be as high as possible.

Note: Tables 1 to 4 specify the minimum numbers of increments to be carried out in different situations.

5.2.2 Sampling of dynamic bulk products

5.2.2.1 General

Since the characteristics and make-up of the lot can vary, the increments shall be taken from the whole lot, that is, as long as the material is dynamic.

5.2.2.2 Mechanical sampling

Adjust the equipment so that the size of the increments or the frequency of sampling can be varied over a wide range.

A series of fixed-size increments shall be taken at pre-determined intervals according to the flow and in such a way that each part of the lot has the same chance of entering the sampling device intake.

Example: Crosscut sampling devices meet this requirement irrespective of the type of flow.

5.2.2.3 Manual sampling

Take increments at regular intervals by using sampling scoop devices See figure A.7

Table 1 — Sampling of flowing grain by mechanical or manual means

Method	Range of mass of increment (g)	Minimum number of increment ^a	Minimum mass of laboratory sample for analysis of aflatoxin
Mechanical sampling	300 - 1 900	<ul style="list-style-type: none"> • 20 per lot or sub-lot of 500 tonnes • 25 per lot or sub-lot of 1500 tonnes for large batches of size greater than 1500 tonnes 	10kg
Manual sampling		For aflatoxin <ul style="list-style-type: none"> • 20 per lot or sub-lot of 500 tonnes • 25 per lot or sub-lot of 1500 tonnes for large batches of size greater than 1500 tonnes 	
^a Frequency according to grain flow			

5.2.3 Sampling of static bulk products

For static bulk samples sampling, the means and methods of taking samples shall take into account the height of the product to be sampled.

Up to a depth of 2m, manual probes can be used. Up to a depth of 2.5 m, mechanical sampling devices can be used if the principle of sampling according to which they function does not create any segregation at the

probe tube intake and does not cause damage to the grains. Otherwise, if the height of the product exceeds 2.5 m, only suction sampling devices shall be used.

Lots of bulk grain which are more than 9 m deep shall be sampled when they are flowing.

The lot should be sampled over its entire depth using a grid method (see Figure 1 and Figure 2).

In the current state-of-the-art, the sampling probes used for grain are not correctly adapted to the powdery nature of flours.

5.2.4 Number and mass of samples of grain

5.2.4.1 Number and mass of increments

The number and the mass of the increments are given in Table 1 and Table 2. All the increments taken together constitute the aggregate sample which shall be homogenized and divided (7.1 and 7.2) to form the laboratory sample.

5.2.4.2 Mass of laboratory samples

The recommended mass of a laboratory sample is determined by the type and the requirements of the tests that are to be carried out (see Table 1 and Table 2).

5.2.4.3 Sampling of flowing bulk products by mechanical or manual means

The mechanical sampling device (refer Annex A) shall be set up so that increments of the size specified in Table 1 can be obtained. The sampling procedure to obtain the minimum mass of laboratory sample for flowing grain shall be as specified in Table 1.

5.2.5 Sampling of static bulk products

The sampling procedure to obtain the minimum mass of laboratory sample for static grain shall be as given in Table 2.

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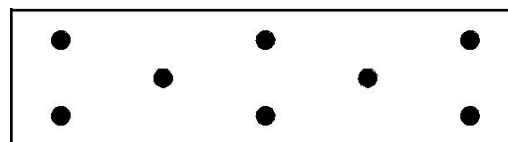
Table 2 — Sampling of static bulk grain (mechanical sampling systems recommended) in trailers or lorries, wagons, ships or bulk tankers, silos or warehouses

Size of lot or sub-lot <i>m</i>	Range of mass of increment ^a g	Minimum number of increment ^b	Minimum mass of laboratory sample for aflatoxins
$m \leq 15$ t	400 - 3 000	3 sampling points	10 kg
$15 < m \leq 30$ t		8 sampling points	
$30 < m \leq 45$ t		11 sampling points	
$45 < m \leq 100$ t		15 sampling points	
$100 < m \leq 300$ t		18 sampling points	
$300 < m \leq 500$ t		20 sampling points	
$500 < m \leq 1500$ t		25 sampling points	
Per lot or sub-lot of 1 500 t		25 sampling points	
<p>a If taken mechanically, the mass of the sample can be appropriate to the equipment.</p> <p>b Frequency according to grain flow</p>			

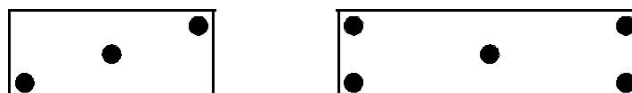
Each lot which is to be examined must be sampled separately. Large lots should be subdivided into sublots to be sampled separately. The subdivision can be done following provisions laid down in Table 6. Taking into account that the weight of the lot is not always an exact multiple of the weight of the sublots, the weight of the subplot may exceed the mentioned weight by a maximum of 20 %.

If the mass of the laboratory sample cannot be complied with, the number of increments shall be increased.

Figure 1 shows examples of the distribution of eight sampling points and Figure 2 for 25.



a) For lorries “in one piece” (for example, dumper truck, semi-trailer)



Chassis trailer

b) For lorries distributed in chassis and trailer

Figure 1 — Examples of the distribution of sampling points for 8 points

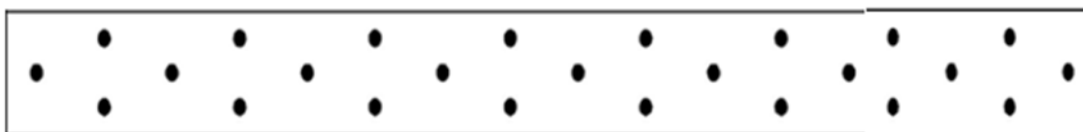


Figure 2 — Examples of the distribution of sampling points for 25 points

5.2.6 Number and mass of samples for cereal products

The sampling procedure to obtain the minimum mass of laboratory sample for flowing cereal products shall be as given in Table 3.

Table 3 — Sampling of flowing cereal products by mechanical or manual means

Method	Indicative of mass of increment g	Minimum number of increments	Minimum mass of laboratory sample for aflatoxins
Mechanical sampling	300 - 1900	15 per lot or sub-lot of 100 tonnes (frequency according to flow)	For powdery products: 1 kg
Manual sampling	300 - 1900	15 per lot or sub-lot of 100 tonnes, that is, for a flow <ul style="list-style-type: none"> • ≤20 t/h, minimum of 3 per hour • 20 t/h minimum of 3 per 20 t 	For agglomerated products, (for example, pellets): 3 kg
NOTE 1	Additional increment may be required to reach the minimum mass of laboratory sample.		
NOTE 2	As it is assumed that powdery products are more homogeneous than grains, a laboratory sample of 1 kg is sufficient for aflatoxin analysis.		

The sampling procedure to obtain the minimum mass of laboratory sample for static milled and other cereal products shall be as given in Table 4.

Table 4 — Sampling of static bulk milled and other cereal products (mechanical sampling systems recommended) in trailers or lorries, wagons

Size of lot or sub-lot <i>m</i>	Indicative mass of increment g	Minimum number of increment	Minimum mass of laboratory sample for aflatoxins
$m \leq 15$ t	400 - 3 000	3 sampling points	For powdery products: 1 kg For agglomerated products, (for example, pellets): 3 kg
$15 < m \leq 30$ t		3 sampling points per compartment	
$30 < m \leq 45$ t		5 sampling points per compartment	
$m \geq 45$ t		5 sampling points per compartment	
NOTE 1 Additional increments may be required to reach the minimum mass of laboratory sample.			
NOTE 2 As it is assumed that powdery products are more homogeneous than grains, a laboratory sample of 1 kg is sufficient for aflatoxin analysis.			

It is recommended to sample milled and other cereal products when flowing, during manufacturing or upon shipment. The sampling in silos is not recommended. Each lot which is to be examined must be sampled separately. Large lots should be subdivided into sublots to be sampled separately. The subdivision can be done following provisions laid down in Table 5 below. Taking into account that the weight of the lot is not always an exact multiple of the weight of the sublots, the weight of the subplot may exceed the mentioned weight by a maximum of 20 %.

Table 5: Subdivision of Large Lots into Sublots for Sampling

Commodity	Lot weight – tonne (T)	Weight or number of sublots	Number of incremental Samples	Laboratory Sample Weight (kg)
Cereal products (Powder)	≥ 500	100 tonnes	100	1
	>100 and <500	5 sublots	100	1
	≥ 25 and ≤ 100	25 tonnes	100	1
	>15 and ≤ 25	--1 subplot	100	1
Cereal products (Agglomerates)	≥ 500	100 tonnes	100	3
	>100 and <500	5 sublots	100	3
	≥ 25 and ≤ 100	25 tonnes	100	3
	>15 and ≤ 25	--1 subplot	100	3

5.3 Sampling from bagged grains

5.3.1 General

Increment samples shall be drawn from original bags selected at random from the consignment which are clearly identifiable with the appropriate markings. The minimum number of bags to be sampled in each consignment shall be in accordance with the scheme in Table 6.

Table 6 — Minimum number of bags to be sampled in each consignment

Number of bags	
In consignment	To be sampled (min)
For up to 20 bags,	a sample will be drawn from every bag
For up to 100 bags	Not less than 20 of the bags shall be sampled
101 to 1 000 bags	Not less than 50 of the bags shall be sampled
over 1 000 bags	Not less than 0.5 % (1 in 200 bags) with a minimum of 50 of the bags shall be sampled

Increment samples shall be drawn uniformly, by a piercing spear from the top, middle and bottom of each bag. If it is not possible to draw a sample by spear efficiently, then the original bags may be opened to sample by handscoop. So far as are possible samples shall be drawn from the ends and middle of the bags in rotation.

Each lot which is to be examined must be sampled separately. Large lots should be subdivided into sublots to be sampled separately. The subdivision can be done following provisions laid down in Table 7. Taking into account that the weight of the lot is not always an exact multiple of the weight of the sublots, the weight of the subplot may exceed the mentioned weight by a maximum of 20 %.

Table 7: Subdivision of Large Lots into Sublots for Sampling

Commodity	Lot weight – tonne (T)	Weight or number of sublots	Number of incremental samples	Laboratory Sample Weight (kg)
Grains	≥ 500	100 tonnes	100	10
	>100 and <500	5 sublots	100	10
	≥ 25 and ≤100	25 tonnes	100	10
	>15 and ≤25	--1 subplot	100	10

5.4 Sampling of milled and other cereal products in packed units

5.4.1 Bales, “crates boxes” or sacks and bags to be sampled

A lot is constituted by a group of basic units (“packed unit”) which originate from one or several sources of manufacture which have the same traceability identification code on the individual packaging.

The packed units are generally transported in crates, boxes or pallets which contain an appropriate number of basic units. The method applicable to sacks (see 6.4.3) shall be used to define the appropriate number of crates boxes or pallets that are to be sampled.

5.4.2 Increments or packed units

The packed unit shall be the increment sampled at random from the overall contents of the lot selected for sampling.

IMPORTANT — Avoid selecting packed units which occupy the same position in several crates, boxes or pallets.

5.4.3 Number and mass of increments

The increments shall be taken from the centre and over the whole length of each packed unit to be sampled using a tapered sampling probe specially designed for sacks (see B.1.2). They shall be taken from the number of sacks specified in Table 5.

The following equation shall be used as a guide for determining the frequency of sampling per lot, $F(n)$, for lots marketed in individual packages (sacks, retail packages, etc.).

Take an incremental sample from every n th sack or bag (decimal figures should be rounded to the nearest whole number), where n is the number of packed units between two increments.

$$F(n) = \frac{m_B m_i}{m_A m_P}$$

where

m_B is the mass, in kilograms, of the lot;

m_i is the mass, in kilograms, of the increments (approximately 0.100 kg);

m_A is the mass, in kilograms, of the aggregate sample

NOTE For analyses of aflatoxin, m_A is approximately 1 kg for powdery products and 3 kg for agglomerated products (for example, pellets).

m_P is the mass, in kilograms, of the individual package.

The frequency of sampling per lot calculated with a mass of increment of 0.100 kg corresponds to a minimum number of increments to be taken. If the mass of the increment is greater than 0.100 kg, the frequency of sampling calculated with 0.100 kg shall be applied.

Practical examples of a calculated frequency of sampling for lots of 25 t, 50 t and 100 t are given in Table 8 and Figure 3.

Table 8 — Sampling procedure to obtain the minimum mass of laboratory sample for milled and other cereal products in packed units: practical examples for lots of 25, 50 and 100 tonnes and an average mass of 800 kg per pallet

Lot size	Mass of individual sacks	Mass of increment	Calculated frequency of sampling for aflatoxin analysis on agglomerated product	Equivalent per pallet
Kg	kg	kg	1 increment every n th packed unit	1 sample shall be all n bags, or 1 sample shall be all x pallets
25 000	1	0.100	833	1 sample every 833 packed unit, or 1 sample per pallet
25 000	5	0.100	167	1 sample every 167 packed unit, or 1 sample per pallet
25 000	25	0.100	33	1 sample every 33 packed unit, or 1 sample per pallet
25 000	40	0.100	21	1 sample every 21 packed unit, or 1 sample per pallet
25 000	50	0.100	17	1 sample every 17 packed unit, or 1 sample per pallet
50 000	1	0.100	1 667	1 sample every 1 667 packed unit, or 1 sample every 2 pallets
50 000	5	0.100	333	1 sample every 333 packed unit, or 1 sample every 2 pallets
50 000	25	0.100	67	1 sample every 67 packed unit, or 1 sample every 2 pallets
50 000	40	0.100	42	1 sample every 42 packed unit, or 1 sample every 2 pallets
50 000	50	0.100	33	1 sample every 33 packed unit, or 1 sample every 2 pallets
100 000	1	0.100	3 333	1 sample every 3 333 packed unit, or 1 sample every 4 pallets
100 000	5	0.100	667	1 sample every 667 packed unit, or 1 sample every 4 pallets
100 000	25	0.100	133	1 sample every 133 packed unit, or 1

				sample every 4 pallets
100 000	40	0.100	83	1 sample every 83 packed unit, or 1 sample every 4 pallets
100 000	50	0.100	67	1 sample every 67 packed unit, or 1 sample every 4 pallets

6 Laboratory sample

6.1 Homogenization

The aggregate sample shall be thoroughly homogenized prior to any division procedure intended to obtain the laboratory sample.

NOTE Division without prior homogenizing results in unrepresentative laboratory samples.

6.2 Division of the aggregate sample

Reduce the aggregate sample to obtain the required number of laboratory samples of specified mass (see tables 1 to 4) by using a method and equipment that will give representative laboratory samples. Examples are given in 6.2.1, 6.2.2 and B.3. Alternative equipment may be used when handling very large aggregate samples, but it shall be capable of producing representative laboratory samples.

The equipment has to be thoroughly cleaned between each sample to avoid cross-contamination.

6.2.1 Coning and quartering method

6.2.1.1 Thoroughly mix the aggregate sample by repeating operations 6.2.1.2 and 6.2.1.3 at least twice before dividing as described in operations 6.2.1.3 and 6.2.1.4. Work on a clean, non-absorbent surface.

6.2.1.2 Gather the grains together into a cone-shaped pile.

6.2.1.3 Flatten out the surface of the pile and then divide the pile into quarters, A, B, C, and D.

6.2.1.4 Discard two diagonally opposed quarters (B and C) and mix the two remaining quarters (A and D) (see Figure 4).

6.2.1.5 Repeat the whole process until the laboratory sample of the required size is obtained.

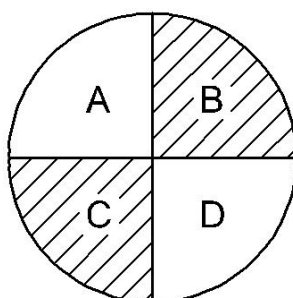


Figure 4 — Coning and quartering method

6.2.2 Sample dividers

Use the divider on a flat surface.

6.2.2.1 Cone-shaped divider

6.2.2.1.1 To reduce an aggregate sample, use an apparatus with a stand if necessary, and use collection boxes or buckets.

6.2.2.1.2 Homogenize the sample by repeating operations 6.2.2.1.3 and 6.2.2.1.4 at least three times and by remixing the subsamples in the hopper.

6.2.2.1.3 Pour the aggregate sample into the closed hopper.

6.2.2.1.4 Two sub-samples are obtained in the two collection boxes (or buckets).

6.2.2.1.5 Keep the contents of one of the two collection boxes.

6.2.2.1.6 Put two empty collection boxes back in position.

6.2.2.1.7 Repeat operations 6.2.2.1.2 to 6.2.2.1.6 as many times as necessary using the sub-sample from 6.2.2.1.5, alternating the collection boxes to be kept until the laboratory sample of the required size is obtained.

6.2.2.2 Rotary mechanical divider

Switch on the centrifugal divider. Pour the aggregate sample into the upper hopper. Proceed as in 6.2.2.1.4 to 6.2.2.1.6. Repeat operations 6.2.2.1.2 to 6.2.2.1.6 as many times as necessary, alternating the collection boxes until the laboratory sample of the required size is obtained.

6.2.2.3 Riffle divider

Riffle dividers shall only be used for small samples (less than 2 kg).

Proceed as in 6.2.2.1.4 to 6.2.2.1.6. Repeat operations 6.2.2.1.2 to 6.2.2.1.6 as many times as necessary, alternating the collection boxes until the laboratory sample of the required size is obtained.

7 Packaging and labelling of samples

7.1 General

Laboratory samples shall be placed in clean containers. The containers shall be suitable for the masses of the laboratory samples. The masses shall be appropriate for all the analyses that are to be carried out. The containers shall also preserve the initial characteristics of laboratory samples.

Ideally these containers shall be completely full and shall be sealed to avoid any change in their contents. If present, seals shall be tamper-proof and identifiable.

7.2 Labels for samples

The following information shall be legibly and indelibly marked on the labels on the laboratory sample and shall include the instructions required under the terms of the contract, for example:

- a) nature of the product;
- b) mass represented;
- c) lot identifier (number);

- d) contract number (if necessary);
- e) sampling date; and
- f) location and point of sampling.
- g) Sample reference information/ number

8. Shipment of samples

Samples should be sent to the laboratory immediately after sampling. The samples should be stored and transported in conditions appropriate to the preservation of their integrity.

9. Sampling report

The sampling report should contain some or all of the following information:

- a) date of sampling;
- b) name and signature of the persons authorized to carry out sampling;
- c) if necessary:
 - (i) name and signature of the client/ vendor/seller;
 - (ii) name and signature of the purchaser/buyer; and
 - (iii) name and signature of the deliverer;
- d) description of the product, including:
 - (i) sample reference number/information;
 - (ii) sample mass;
 - (iii) lot size; and
 - (iv) sample origin (for example, flat silo, vertical silo, lorry);
- e) the description of the sampling operation, including:
 - (i) location and point of sampling;
 - (ii) number of increments per lot;
 - (iii) number of laboratory samples per lot;
 - (iv) sampling procedure used (equipment, static/flowing, etc.);
 - (v) destination of the sample, e.g. the name and address to which the samples are to be shipped; and
 - (vi) comments if any; and
- f) transportation and storage conditions.

10 Hygiene and safety

The sampling device used shall comply with applicable hygiene and safety requirements and, in particular, have sufficient lighting for inspection, manoeuvring and maintenance. Appropriate personnel protective gears should be worn during the sampling procedures.

WARNING — Walking on grain stored in storage bins, ships' holds, silos and lorries is dangerous. In some cases, the atmosphere in silos may be asphyxiating or toxic as a result of the accumulation of gas caused by the metabolism of the grain and fungi/mould. Local legislation and industrial safety standards shall be observed.

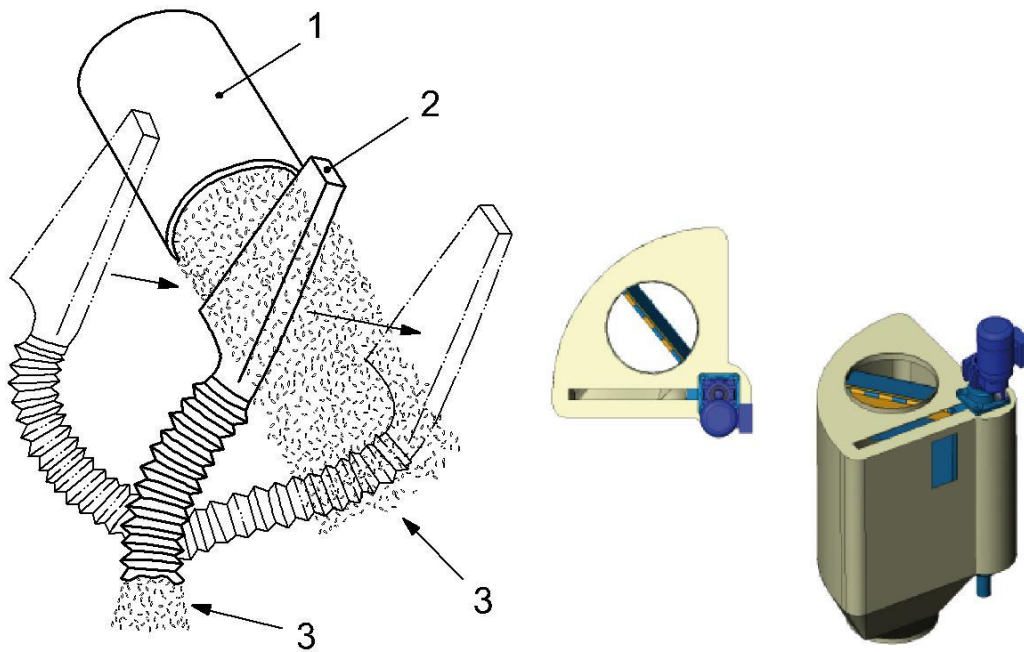
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Annex A
(informative)

Examples of mechanical sampling devices used on flowing grain

A.1 Crosscut sampling devices

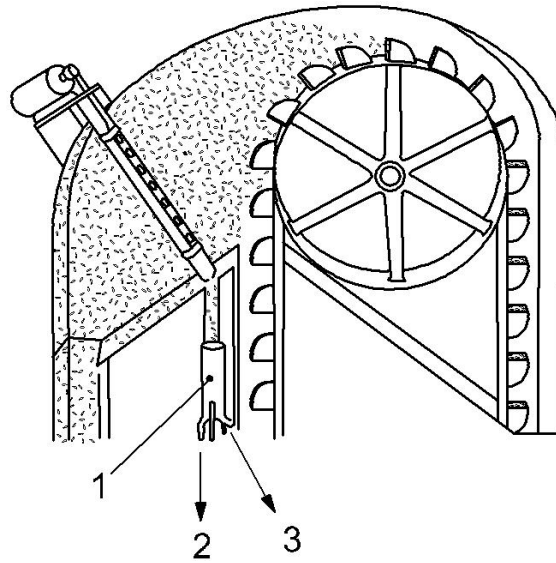
Crosscut sampling devices allow a complete cross-section of a freely falling flow of grains to be taken. They may be open-nozzle sampling devices (see Figure A.1), tubular sampling devices with adjustable apertures (see Figure A.2) or tubular sampling devices with a worm screw (see Figure A.3).



Key

- 1 nozzle
- 2 sampling device
- 3 grain

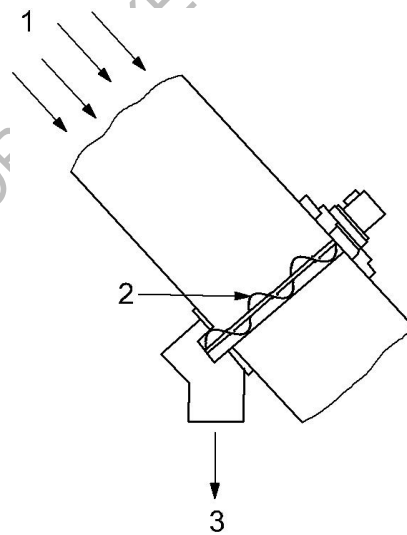
Figure A.1 — Open-nozzle crosscut sampling device, ensuring intermittent, repeated sampling



Key

- 1 sample divider
- 2 sampling flow
- 3 return of excess grains into system

Figure A.2 — Tubular crosscut sampling device with adjustable apertures



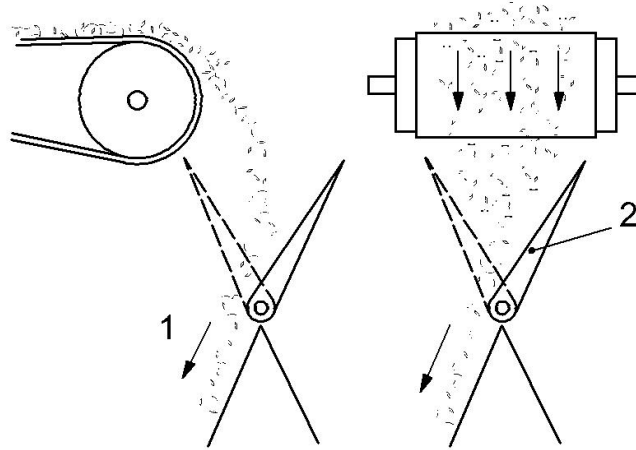
Key

- 1 grain flow
- 2 worm screw
- 3 sample flow

Figure A.3 — Tubular sampling device with worm screw

A.2 Full-flow diverter-type sampling devices

In this type of sampling device, a flap or shutter intermittently diverts the flow of grain (see Figure A.4).



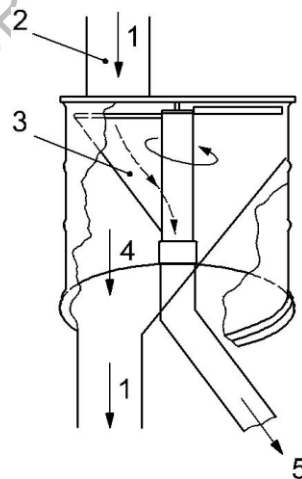
Key

- 1 sample flow
- 2 flap or shutter

Figure A.4 — Full-flow diverter-type sampling device

A.3 Rotating cup sampling devices

The freely falling flow of grain is intermittently sampled by a cup which rotates around a central vertical axis (see Figure A.5).



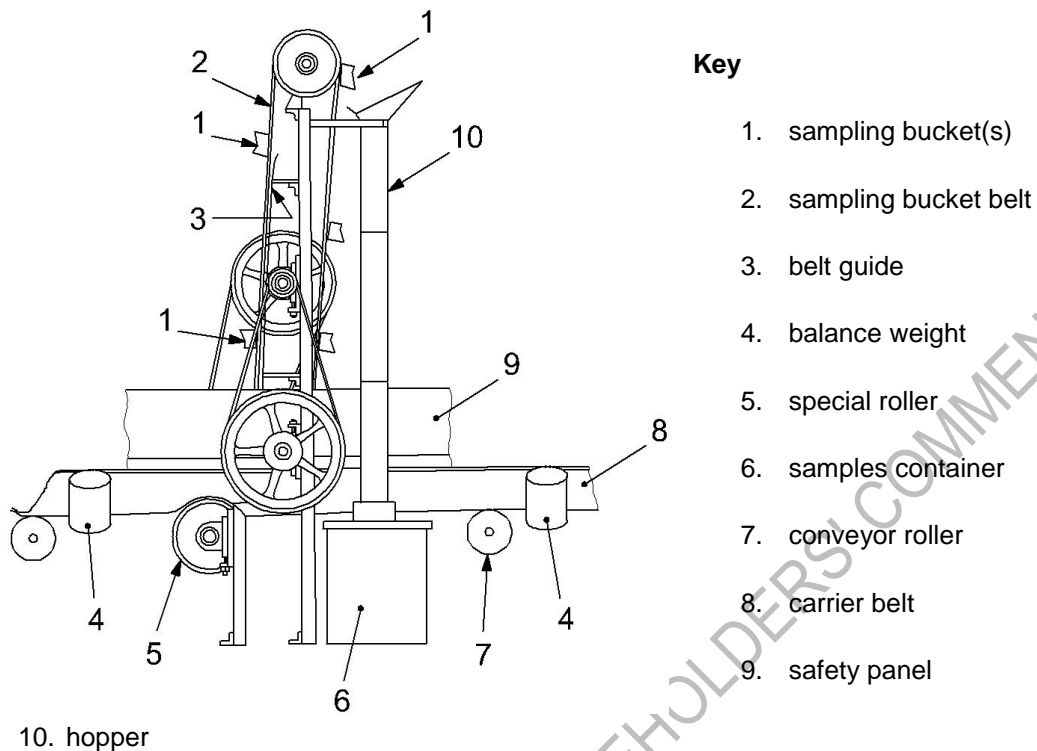
Key

- 1 grain flow
- 2 vertical chute
- 3 rotating cup
- 4 flow
- 5 sample flow

Figure A.5 — Rotating cup sampling device

A.4 Bucket elevator sampling devices

This type of sampling device samples grain from a moving belt or conveyor. Buckets travelling in a continuous loop take samples over the entire width of the grain flow because the configuration of the lateral rollers concentrates the grain on the belt. Once the buckets have pivoted around the upper roller, the samples are delivered into the hopper (see Figure A.6).



NOTE As they are elevated, the buckets sample the grain from a belt or conveyor and, once they have pivoted around the upper roller, deliver the samples into the hopper.

Figure A.6 — Bucket elevator sampling device

Figure A.7 Scoop



Annex B
(informative)

Examples of instruments used to sample static products and instruments used to divide samples

B.1 Cereal sampling instruments

B.1.1 Instruments used to sample static bulk products in tote bags and rigid containers

B.1.1.1 Manual concentric tapered sampling probes

B.1.1.1.1 Open or closed shaft: with one or several apertures. See Figures B.1 and B.2.

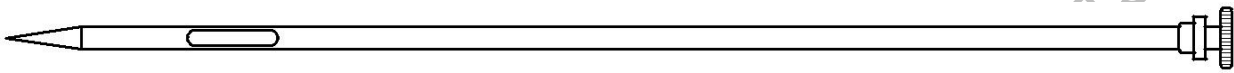


Figure B.1 — Open shaft with single aperture



Figure B.2 — Open shaft with several apertures or closed shaft with compartments and several apertures

B.1.1.1.2 Open shaft with sequentially staggered apertures: several apertures. See Figure B.3.

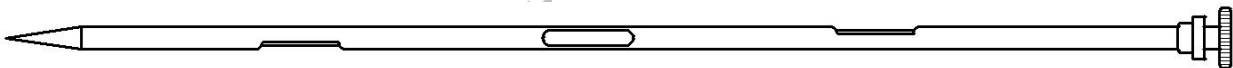


Figure B.3 — Open shaft with several sequentially staggered apertures

B.1.1.2 Gravity-type sampling probes with extension rods and T-shaped handles

B.1.1.2.1 Gravity-type sampling probe: concentric. See Figure B.4.

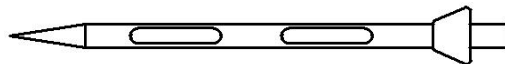


Figure B.4 — Concentric gravity-type tapered probe head

B.1.1.2.2 Gravity-type sampling probe: cup-type. See Figure B.5.

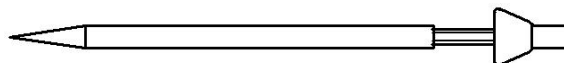


Figure B.5 — Cup-type (head represented in open position)

B.1.1.3 Mechanical sampling devices

B.1.1.3.1 There are three main categories of mechanical sampling devices (see B.1.1.3.2 to B.1.1.3.4).

B.1.1.3.2 Gravity-type sampling device. See Figure B.6.

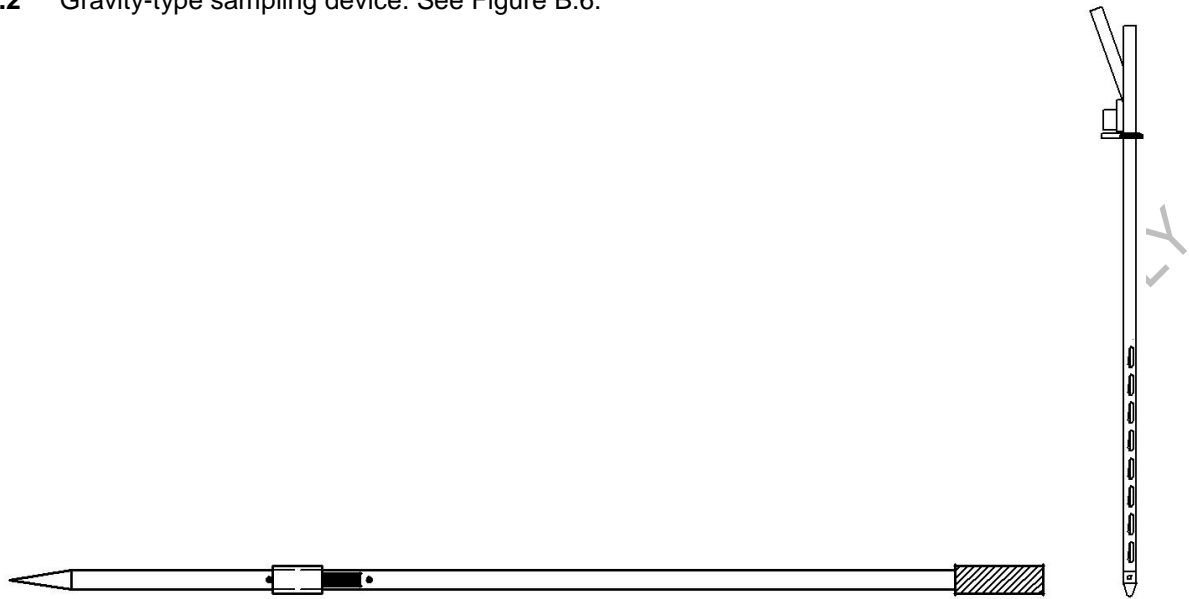
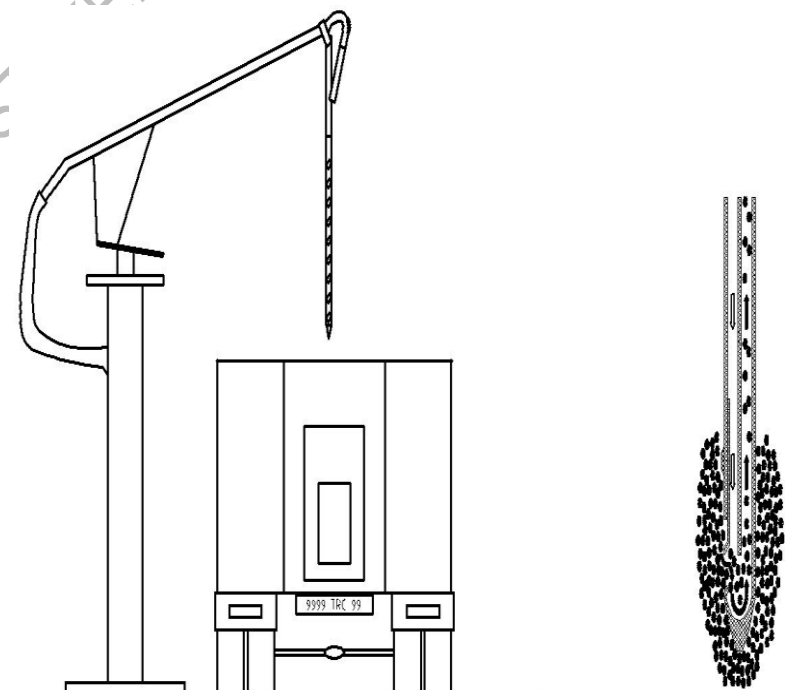


Figure B.6 — Gravity-type sampling device

B.1.1.3.3 Suction sampling device (sometimes called “vacuum sampling device”). See Figure B.7.

Key

1. sample
2. grain mass
3. porous head unit
4. air
5. grain sample
6. sampling head unit
7. coupling
8. extra sampling length
9. automatic discharge of collected sample
10. tank for collected sample
11. vacuum chamber
12. duct



Example of sampling at depth over 2 m (ships, bulk tankers, etc.)

Figure B.7 — Suction (or “vacuum”) sampling device

B.1.1.3.4 Pneumatic sampling device (not represented)

B.1.2 Instruments used to take samples from sacks or bags including bulk sacks

B.1.2.1 Tapered sampling probes for sacks

Minimum diameter: 17 mm; aperture: 40 mm \square 15 mm. See Figure B.8.

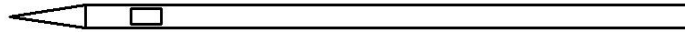


Figure B.8 — Tapered sampling probe for sacks

B.1.2.2 “Walking stick”-type sampling probe

Concentric tubes, minimum diameter: 20 mm:

- 5 Open shaft: with one or several apertures;
- 6 With compartments: with one or several apertures (see Figure B.9).



Figure B.9 — “Walking stick”-type, concentric sampling probe for sacks: open shaft with several compartments

B.1.2.3 Cone-shaped sampling device

See Figure B.10.

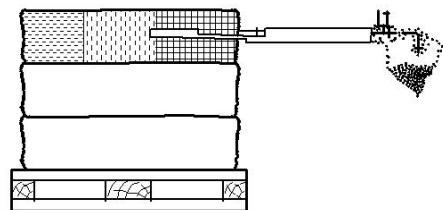
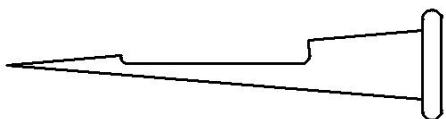


Figure B.10 — Cone-shaped sampling device

B.1.2.4 Gravity-type sampling probes with extension rods and T-shaped handles for open-topped sacks

See Figures B.4 and B.5.

B.1.2.5 Archimedes' screw sampling probe

Generally a small, portable, electric sampling probe. See Figure B.11.

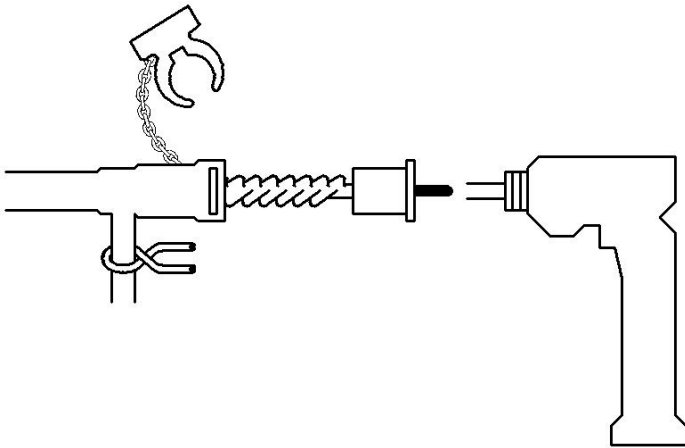


Figure B.11 — Archimedes' screw sampling probe (portable)

B.2 Instruments used to sample milled products, excluding products in granular form

B.2.1 Instruments used to sample static bulk products

B.2.1.1 Identical to those used to sample cereals (B.1.1), except for mechanical sampling devices. Only two types of mechanical sampling device are suitable for the sampling of milled products (see B.2.1.2 and B.2.1.3). In general, pneumatic sampling devices are not suitable for this usage.

B.2.1.2 Electromechanical Archimedes' screw sampling probe (Figure B.12).

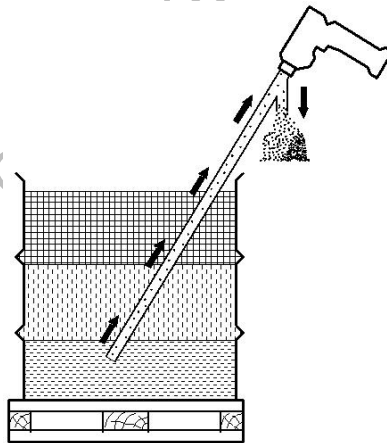


Figure B.12 — Electromechanical Archimedes' screw sampling probe

B.2.1.3 Gravity-type mechanical sampling device (Figure B.6).

B.2.2 Instruments used to take samples from sacks and bags

Identical to those used to sample cereals (B.1.2).

B.3 Instruments used to divide samples

Made of materials which are not liable to contaminate samples.

B.3.1 Quartering irons

See Figure B.13.

B.3.2 Multiple-slot dividers (with partitions and plates)**B.3.2.1** Small laboratory dividers for milled samples.

Minimum of 12 slots; chutes of: 12.7 mm. See Figure B.14.

B.3.2.2 Medium-sized dividers for samples of cereals in the form of grain.

Minimum of 18 slots; chutes of: 12.7 mm. See Figure B.14.

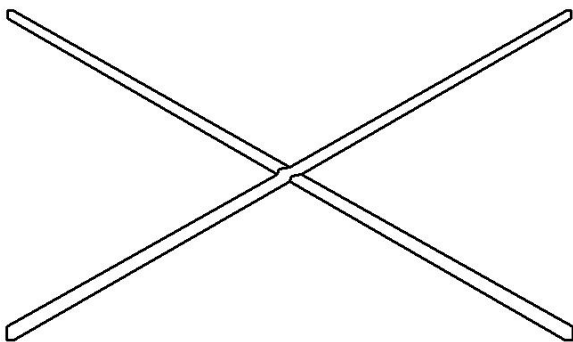


Figure B.13 — Quartering iron

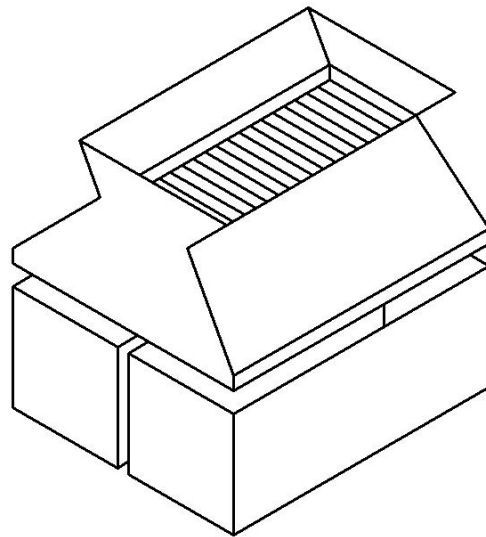


Figure B.14 — Riffle divider: multiple-slot divider (of the type with partitions and plates) with two collection boxes

B.3.3 Cone-shaped dividers (Boerner type)

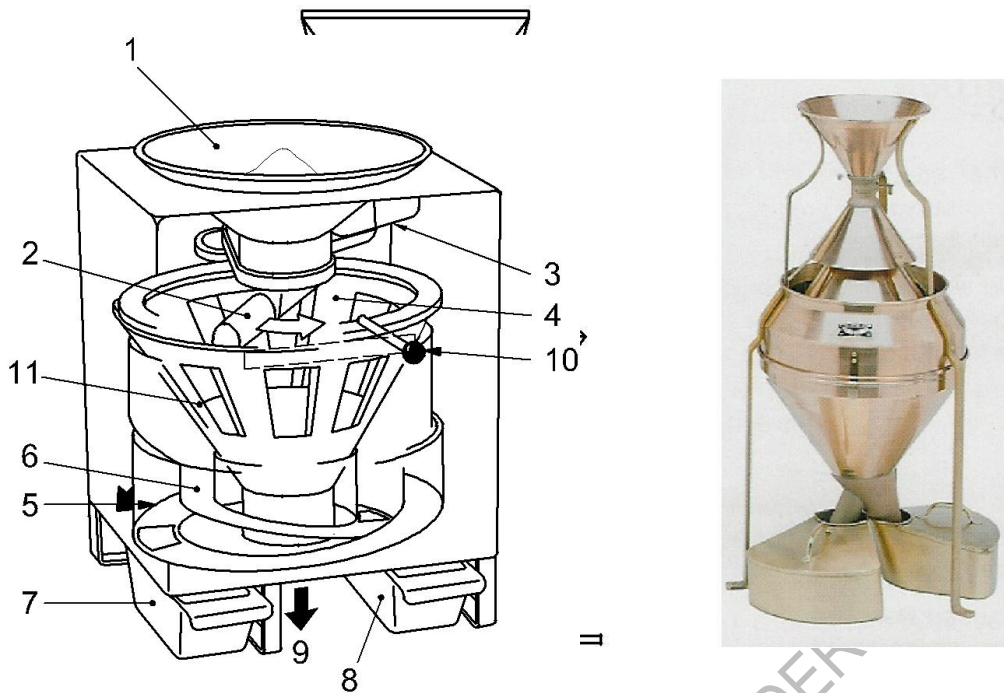
See Figure B.15.

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Figure B.15 — Cone-shaped divider (Boerner type)

B.3.4 Rotating mechanical divider

Allows multiple samples to be obtained simultaneously. See Figure B.16.



Key

1. loading hopper
2. rotating chute
3. driving motor
4. cone-shaped hopper with eight apertures
5. sub-sample collection
6. sub-sample collection spout
7. two sub-sample collection boxes
8. excess grain evacuation, grain to put back in the divider
9. adjustment of flaps to modify division factor
10. one of eight adjustable apertures

Figure B.16 — Rotating mechanical divider

B.4 Guide to instruments suitable for sampling cereals and cereal products

Storage condition	Reference to Figures in Annex B	
	Cereals in the form of grain	Milled and other cereal products
Static bulk products in silos, bins and warehouses	B.1, B.2, B.3, B.4, B.5, B.6, B.7	B.12
Wagons, ships and containers for transportation of bulk products	B.1, B.2, B.3, B.4, B.5, B.6, B.7	B.12
Tote bags and rigid containers	B.1, B.2, B.3, B.4, B.5, B.6, B.7	B.12
Sacks and bags (textile fibre, paper and plastic)	B.4, B.5, B.8, B.9, B.10, B.11	B.8, B.9, B.10, B.11, B.12
NOTE The minimum dimensions of the instruments are given for information only.		

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