
**Cocoa beans — Specification and
quality requirements**

Fèves de cacao — Spécifications et exigences de qualité

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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.

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 18, *Cocoa*.

This third edition of ISO 2451 cancels and replaces ISO 2451:2014, ISO 1114:1977 and ISO 2291:1980, which have been technically revised.

Introduction

The original International Standards on cocoa beans (ISO 1114, ISO 2291, ISO 2292 and ISO 2451) were developed many years ago when cocoa production was largely within the control of governments of cocoa producing countries. Accordingly, the quality regime for cocoa was embedded in the farm to port supply chain process supported by marketing boards, which executed a regulatory and supervisory function. Governments were more actively involved in the cocoa sector and therefore had a greater interest in, and adherence to, these International Standards. With the progressive liberalisation of the cocoa production process in many of the producing countries from the mid-1980s onwards, the interest in updating the International Standards for cocoa was rather diminished and, at the same time, the private sector in the international cocoa trade recognized there was a need to ensure that appropriate International Standards were maintained within commercial contracts in order to meet trade and industry requirements.

Consequently, this document seeks to integrate relevant parts of the above mentioned International Standards and to adapt new rules and processes to ensure that the correlation between International Standards and commerce is properly maintained.

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Cocoa beans — Specification and quality requirements

1 Scope

This document specifies the requirements, classification, sampling, test methods, packaging and marking for cocoa beans.

Recommendations relating to storage and disinfestation are given as a guide in [Annexes G](#) and [H](#) respectively. [Annex I](#) is for informative purposes only and sets out a sampling procedure for preliminary quality analysis which can be adopted by agreement of all interested parties.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2292:2017, *Cocoa beans — Sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2292 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

adulteration

alteration of the composition of a *lot* ([3.18](#)) of cocoa by any means whatsoever

3.2

bean cluster

two or more beans joined together which cannot be easily separated by using the finger and thumb of both hands

3.3

bean count

total number of whole beans per 100 g determined under specific conditions

Note 1 to entry: The specific conditions and the test method are specified in [Annex D](#).

3.4

broken bean

cocoa bean ([3.5](#)) of which a *fragment* ([3.14](#)) is missing, the remaining part being more than half of a whole bean

3.5

cocoa bean

seed of the cocoa tree (*Theobroma cacao* Linnaeus)

Note 1 to entry: Commercially, and for the purposes of this document, the term refers to the whole seed, which has been fermented and dried.

3.6

cocoa related matter

bean clusters (3.2), *broken beans* (3.4) and associated *fragments* (3.14) and/or *pieces of shell* (3.21) that do not pass through the *sieve* (3.23)

3.7

contamination

presence of a smoky, hammy or other smell not typical to cocoa, or a substance not natural to cocoa, which is revealed during the *cut test* (3.8) or physical inspection of a *reference sample* (3.22)

3.8

cut test

procedure by which the cotyledons of cocoa beans are exposed for the purpose of determining the incidence of defective and/or *slaty beans* (3.25), and/or *violet or purple beans* (3.29), and/or the presence of *contamination* (3.7) within a *test sample* (3.28)

Note 1 to entry: The procedure for the cut test is specified in [Annex E](#).

3.9

defective bean

internally *mouldy bean* (3.20) and/or *insect-damaged bean* (3.17)

3.10

dry cocoa

cocoa beans (3.5) which have been evenly dried throughout and of which the moisture content meets specific requirements

Note 1 to entry: These requirements are specified in [5.2.4](#).

Note 2 to entry: Dry cocoa can be considered as a commercial term.

3.11

fair fermented beans

cocoa beans (3.5) that are not more than 10 % *slaty* and 10 % defective by count of the *test sample* (3.28)

3.12

flat bean

cocoa bean (3.5) that is too thin to be cut to give a complete surface of the cotyledons

3.13

foreign matter

any substance other than *cocoa beans* (3.5), *cocoa related matter* (3.6) and *sieving* (3.24)

Note 1 to entry: Husk and placenta are to be considered as foreign matter.

3.14

fragment

piece of *cocoa bean* (3.5) equal to or less than half the original bean

3.15

germinated bean

cocoa bean (3.5) of which the seed germ has pierced the shell as evidenced either by the physical presence of the seed germ or by a hole in the shell following its detachment

3.16

good fermented beans

cocoa beans (3.5) that are not more than 5 % *slaty* and 5 % defective by count of the *test sample* (3.28)

3.17**insect-damaged bean
infested bean**

cocoa bean (3.5) of which the internal parts are found to contain insects or mites at any stage of development, or show signs of damage caused thereby, which are visible to the naked eye

3.18**lot**

quantity of *cocoa beans* (3.5) in bags or in bulk established at any point in the cocoa supply chain and from which primary samples and/or incremental samples are to be drawn for quality analysis purposes

Note 1 to entry: The requirements for sampling are specified in ISO 2292.

3.19**main crop**

bean count (3.3) consistent/typical for the beans normally produced during the main harvest period of that particular origin

Note 1 to entry: Light crop (mid crop) is the bean count consistent/typical for the beans normally produced in the period outside main harvest for that particular origin.

3.20**mouldy bean**

cocoa bean (3.5) on the internal parts of which mould is visible to the naked eye

Note 1 to entry: Mould is not to be confused with white spot, which is a concentration of theobromine or cocoa fat.

3.21**piece of shell**

part of the shell without any of the kernel

3.22**reference sample**

representative sample prepared by successively quartering the composite sample such that a minimum of 2 kg net remains

[SOURCE: ISO 2292:2017, 3.7]

3.23**sieve**

screen with round holes, the diameter of which are 5,0 mm

3.24**sieving**

material that passes through a *sieve* (3.23)

3.25**slaty bean**

cocoa bean (3.5) that shows a slaty colour on at least half of the surface of the cotyledons exposed by the *cut test* (3.8) irrespective of texture

3.26**smoky bean**

cocoa bean (3.5) with a smoke-off flavour

Note 1 to entry: A flavour that is reminiscent of wood smoke, acrid smoke, burnt rubber, smoked bacon or soot.

3.27

preliminary test sample

quarter of the reference sample obtained by using a splitter/divider, which can be less than 600 g

Note 1 to entry: [Annex I](#) specifies the procedure and flowchart for the preliminary quality analysis in which the preliminary test samples are used.

3.28

test sample

not less than 600 g of cocoa beans drawn from the *reference sample* ([3.22](#)) by using a flat-bottomed shovel drawn across the middle of the reference sample

Note 1 to entry: The test sample shall be obtained after sieving in accordance with the method specified in [Annex B](#) and removing the *cocoa related matter* ([3.6](#)), *flat beans* ([3.12](#)) and *foreign matter* ([3.13](#)) in accordance with the method specified in [Annex C](#).

3.29

violet or purple bean

cocoa bean ([3.5](#)) that shows a violet or purple colour on at least half of the surface of the cotyledons exposed by the *cut test* ([3.8](#))

4 Preparation

Cocoa beans shall be fermented and then dried until their moisture content no longer exceeds the percentage as specified in [5.2.4](#). Cocoa beans prepared in this manner are commercially referred to as dry cocoa.

5 Requirements

5.1 General requirements

5.1.1 Odour

Lots of cocoa beans shall be free from contamination.

5.1.2 Adulteration

Lots of cocoa beans shall be free from any evidence of adulteration.

5.1.3 Living insects and other infestation

Lots of cocoa beans shall be virtually free from living insects, insect eggs, larvae, and any other developmental stages, free from mites, rodents, or other types of infestation.

5.1.4 Violet or purple beans

Lots of cocoa beans shall be within the range for violet or purple beans, if specified, typical for the grade or origin.

5.2 Specific requirements

5.2.1 Cocoa related matter

The combined mass of the cocoa related matter shall not exceed 3,5 % of the mass of the reference sample representing the lot.

5.2.2 Flat beans

Flat beans shall not exceed 1,5 % of the mass of the reference sample representing the lot.

5.2.3 Foreign matter

Foreign matter shall not exceed 0,75 % of the mass of the reference sample representing the lot.

5.2.4 Moisture content

The moisture content of lots of cocoa beans on loading in the producing country shall not exceed 8,0 % by mass, and on discharge outside the producing country shall not exceed 7,5 % by mass.

5.2.5 Sieving

The sieving shall be carried out in accordance with the method specified in [Annex B](#). The mass of the sieving shall not exceed 1,5 % of the mass of the reference sample representing the lot.

5.3 Other quality characteristics

Lots of cocoa beans shall be

- reasonably free from germinated beans,
- uniform in size and colour,
- fermented, and
- fit for production of foodstuff.

5.4 Grade determination

5.4.1 Classification for cocoa beans

Lots of cocoa beans shall be classified according to the categories listed below. Either [Table 1](#), [Table 2](#) or [Table 3](#) shall be used for the classification. For all three types of classifications, the proportion of beans with defects shall be determined by the test method specified in [Annex E](#). As an exception, for the purpose of [Table 3](#), germinated beans shall not be considered as beans with defects.

Table 1 — Producing country internal classification for fermented beans

Grade	Percentage of beans		
	Mouldy	Slaty	Insect-damaged and/or germinated
1	3	3	3
2	4	8	6

NOTE 1: The percentages are the maximum.

NOTE 2: The percentages given in the last column apply to the combined total of all the defects specified in the column header.

Table 2 — Producing country internal classification for “unfermented” beans

Grade	Percentage of beans		
	Mouldy	Slaty	Insect-damaged and/or germinated
1	3	≥ 20	3
2	4	≥ 20	6

NOTE 1: The percentages are the maximum.

NOTE 2: The percentages given in the last column apply to the combined total of all the defects specified in the column header.

Table 3 — International trade classification for fermented beans

Grade	Percentage of beans	
	Slaty	Mouldy and/or insect-damaged
Good fermented	5	5
Fair fermented	10	10

NOTE 1: The percentages are the maximum.

NOTE 2: The percentages given in the last column apply to the combined total of all the defects specified in the column header.

When a bean has several defects, it shall be classified in one category only, i.e. the least favourable. The decreasing order of gravity is as follows:

- mouldy beans;
- slaty beans;
- insect-damaged beans;
- germinated beans (not applicable to [Table 3](#)).

5.4.2 Substandard cocoa (applicable to [Tables 1](#) and [2](#) only)

Lots of fermented cocoa beans that exceed one of the limits accepted for grade 2 shall be regarded as substandard. Lots of unfermented cocoa beans that either do not meet the minimum level of slaty specified or exceed one of the other limits accepted for grade 2 shall be regarded as substandard.

NOTE Substandard is marked “SS” for English- and Spanish-speaking countries. For French-speaking countries it is marked “HS” (hors standard).

5.5 Bean size

Bean size is defined by the bean count and is usually expressed by the number of beans per 100 g.

- a) Standard size beans: bean count of less or equal to 100.
- b) Medium size beans: bean count of 101 to 110.
- c) Small size beans: bean count of 111 to 120.
- d) Very small size beans: bean count greater than 120.

NOTE Main crop is often referred to as the bean count consistent/typical for the beans normally produced during the main harvest period of that particular origin.

6 Sampling

Sampling shall be carried out in accordance with the requirements of ISO 2292. [Figure A.1](#) shows flowcharts of derivative samples when sampling from bags or bulk. For all the test methods described in [Annexes B](#) to [E](#), the reference sample shall be prepared in accordance with the method described in ISO 2292.

7 Test methods

Testing shall be carried out in accordance with the requirements of the methods specified in [Annexes B to E](#). [Figure A.2](#) shows a flowchart of the sequence of testing in accordance with the test methods prescribed in [Annexes B to E](#).

NOTE [Annex I](#) is for informative purposes only and outlines the sequence of testing in accordance with the test methods prescribed in [Annexes B to E](#), using a quarter of the reference sample for the (sampling procedure for) preliminary quality analysis to ascertain if a lot of cocoa beans meets the requirements of this document.

8 Packaging

Bags for packaging shall be clean, sound, sufficiently strong, and properly sewn. Cocoa beans shall be shipped in new bags only. Bags woven from natural fibres and liners, if used, shall be suitable for food contact use. Ink or paint used for marking shall be of food grade.

9 Marking

Each bag of cocoa beans shall be officially sealed. The bag or seal shall show at least the following information:

- a) the producing country;
- b) the name of the product;
- c) shipping marks when applicable;
- d) any other applicable identification marks.

NOTE National regulations can apply to identification markings for the bags/seals.

10 Test report

The test report shall include at least the following:

- a) all details required for complete identification of the reference sample;
- b) the methods used and the results obtained;
- c) any details of procedures not specified in this document, or regarded as optional;
- d) any circumstances that may have influenced the result.

Annex A (normative)

Flowcharts

[Figure A.1](#) shows flowcharts of derivative samples when sampling from bags or bulk. See ISO 2292 for further descriptions and requirements for the different types of samples. [Figure A.2](#) shows a flowchart of the sequence of testing that shall be followed for the test methods specified in [Annexes B](#) to [F](#) of this document.

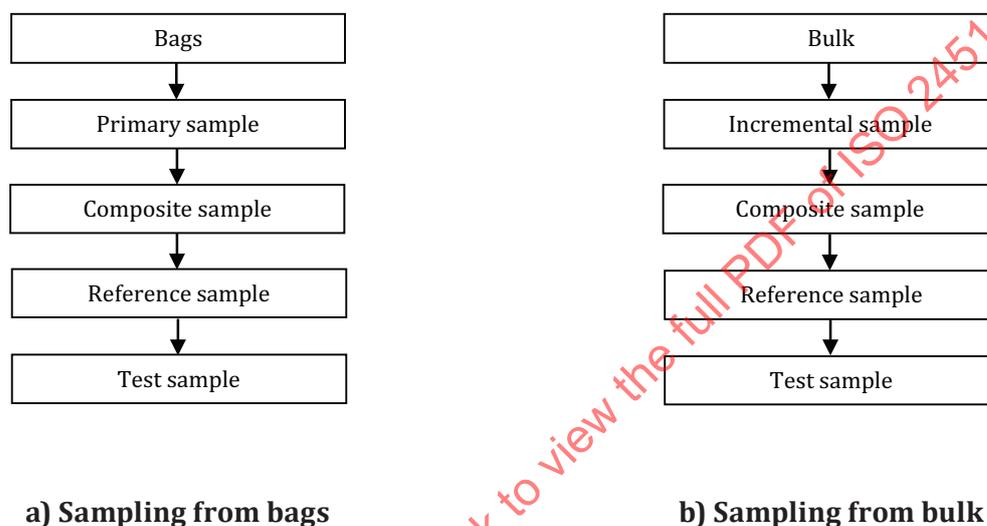


Figure A.1 — Flowcharts of derivative samples when sampling from bags or bulk

The sample for the determination of the moisture content should be safeguarded from drying out, which can be done by using a plastic bag or air-tight container.

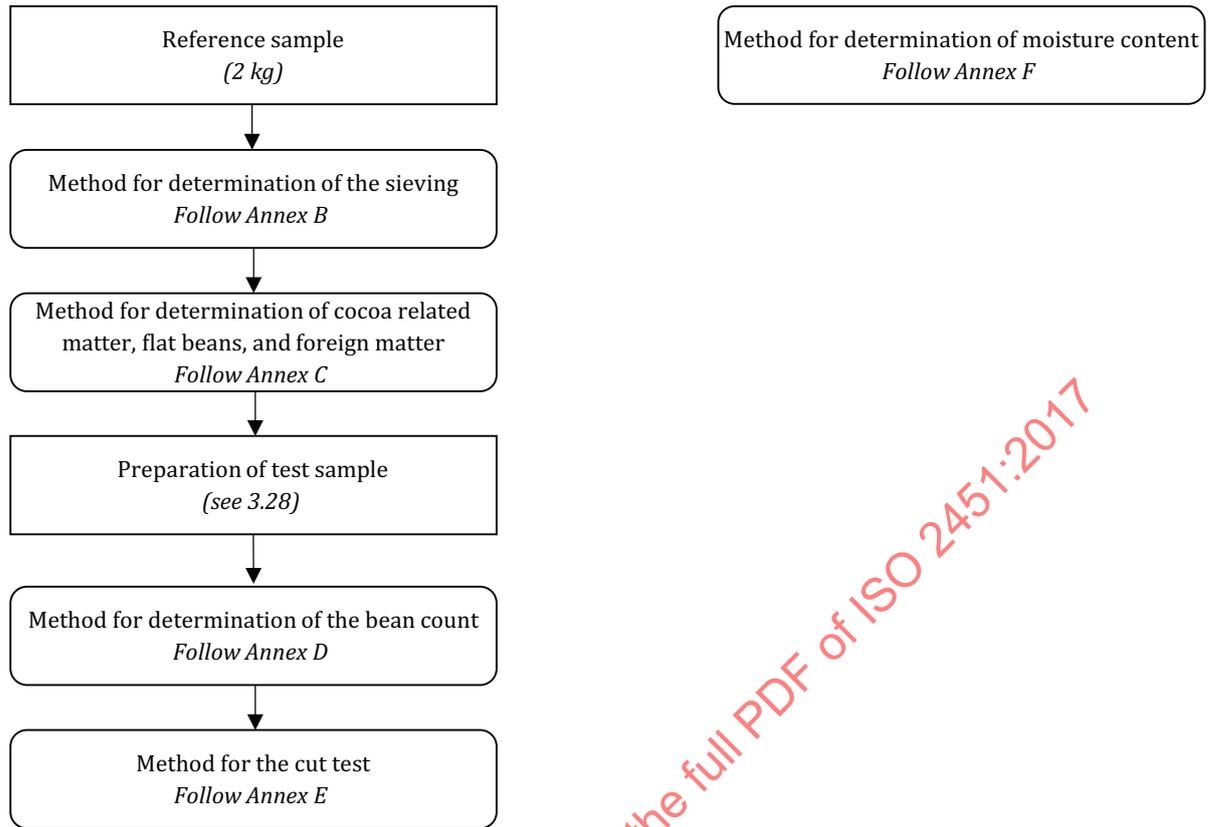


Figure A.2 — Flowchart of sequence of test methods

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Annex B (normative)

Method for determination of the sieving

B.1 Procedure

Weigh the entire reference sample (m_{TOTAL}) and then sieve through a sieve. Collect and weigh the quantity passing through the sieve, which is known as “the sieving”.

Obtain the percentage of the sieving by comparing the mass of the sieving against the total net mass of the reference sample multiplied by 100.

Once the measurement has been taken, do not re-integrate the sieving into the remainder of the reference sample (Derivative 1).

B.2 Expression of result

The value of the sieving, S (%), is given by [Formula \(B.1\)](#):

$$S = \frac{m \times 100}{m_{\text{TOTAL}}} \quad (\text{B.1})$$

where

m is the mass of the sieving, in g;

m_{TOTAL} is the total net mass of the reference sample, in g.

Annex C (normative)

Method for determination of cocoa related matter, flat beans and foreign matter

C.1 Procedure

Empty the remainder of the reference sample in [Annex B](#) (Derivative 1) onto a tray of sufficient size to facilitate the measurement of cocoa related matter, flat beans and foreign matter.

Separate, aggregate and weigh each category, i.e. cocoa related matter, flat beans and foreign matter, and express the mass of the quality parameter in relation to the net mass of the reference sample (m_{TOTAL}) in [Annex B](#) multiplied by 100.

Once the measurement has been taken, do not re-integrate the matter that has been extracted for testing into the remainder of the reference sample (Derivative 2).

C.2 Expression of result

The quality parameter, P_{QUALITY} (%), is given by [Formula \(C.1\)](#):

$$P_{\text{QUALITY}} = \frac{m_{\text{QP}} \times 100}{m_{\text{TOTAL}}} \quad (\text{C.1})$$

where

m_{QP} is the mass of the quality parameter, in g;

m_{TOTAL} is the total net mass of the reference sample, in g.

Annex D (normative)

Method for determination of the bean count

D.1 Procedure

The bean count determines the average number of whole cocoa beans that weigh 100 g. After sieving in accordance with [Annex B](#) and removing cocoa related matter, flat beans and foreign matter in accordance with [Annex C](#), empty the remainder of the reference sample (Derivative 2) onto a clean, dry, flat surface and thoroughly mix. Take a test sample of not less than 600 g cocoa beans from the reference sample by using a flat-bottomed shovel drawn across the middle of the remainder of the reference sample (Derivative 2).

D.2 Determination

Remove any cocoa related matter, flat beans and foreign matter still remaining following the procedure set out in [Annex C](#) from the test sample, and then weigh and replace by an equivalent mass of whole beans taken randomly from the remainder of the reference sample (Derivative 2). Then count the total number of beans in the test sample. The resulting number is known as the bean count.

D.3 Expression of result

The bean count, n_{BEAN} , shall be expressed as number of beans per 100 g, as given by [Formula \(D.1\)](#):

$$n_{\text{BEAN}} = \frac{n_{\text{WHOLE}} \times 100}{m_{\text{WHOLE}}} \quad (\text{D.1})$$

where

n_{WHOLE} is the number of whole beans;

m_{WHOLE} is the mass of whole beans, in g.

Annex E (normative)

Method for the cut test

E.1 Procedure

The cut test is conducted on the test sample of whole beans from the determination of the bean count in [Annex D](#). Select 300 whole beans irrespective of size, shape and condition, from the test sample.

E.2 Determination

Open or cut these 300 beans lengthwise through the middle, so as to expose the maximum cut surface of cotyledons. Visually examine both halves of each bean in full daylight or equivalent artificial light. Count separately each defective type of bean, i.e. those that are mouldy, slaty, insect-damaged (or germinated, flat).

When a bean is defective in more than one respect, count only the defect that appears first in the list of defects expressed in their decreasing order of gravity, as specified in [5.4.1](#).

E.3 Expression of result

Express the result for each kind of defect as a percentage of the 300 beans examined.

Annex F (normative)

Method for determination of moisture content (oven method)

F.1 General

This annex specifies the oven method for the determination of the moisture content of cocoa beans. The moisture content of cocoa beans is, conventionally, the loss in mass determined by the method specified in this annex, and expressed as a percentage by mass.

In addition to the oven method, there are alternative methods of moisture determination using machines or other apparatuses applying technologies such as infrared, capacitance measurement, conductivity, dielectric, nuclear magnetic resonance or neutron probe. Such machines and apparatuses may be used provided that such other technology is correlated to the oven method by a methodology published by the manufacturer together with operational instructions as to frequency and procedure for calibration thereof.

The oven method, however, is the standard reference method and other machines or apparatuses should as far as possible be correlated therewith.

F.2 Principle

After grinding, weighing and drying of cocoa beans for 16 h in a ventilated oven controlled at $103\text{ °C} \pm 2\text{ °C}$, determine the moisture content by calculating the difference in mass.

F.3 Apparatus

Usual laboratory equipment and the following.

F.3.1 Grinder, which allows the beans to be ground without heating.

F.3.2 Ventilated oven, preferably fitted with a fan, capable of being controlled at $103\text{ °C} \pm 2\text{ °C}$.

F.3.3 Dish with lid, of metal, resistant to attack under the conditions of the test, or of glass, with at least 35 cm^2 of useful surface (for example minimum diameter 70 mm) and 20 mm to 25 mm deep.

F.3.4 Desiccator, containing an efficient desiccant.

F.3.5 Analytical balance, with a readability of 1 mg.

F.4 Procedure

F.4.1 General

Grind a fraction of one quarter of the reference sample with a grinder ([F.3.1](#)) to form particles that do not exceed 5 mm, but avoiding the formation of a paste. The beans used shall be representative of the reference sample.