BS ISO 4150:2011

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Green coffee or raw coffee — Size analysis — Manual and machine sieving

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National foreword

This British Standard is the UK implementation of ISO 4150:2011. It supersedes BS5752-5:1991 (R96) which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AW/15, Coffee.

A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

ISO 4150

Third edition
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Green coffee or raw coffee — Size analysis — Manual and machine sieving

Café vert — Analyse granulométrique — Tamisage manuel et à la machine

Reference number
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Foreword

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

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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.

ISO 4150 was prepared by Technical Committee ISO/TC 34, *Food products*, Subcommittee SC 15, *Coffee*.

This third edition cancels and replaces the second edition (ISO 4150:1991), which has been technically revised.

INTERNATIONAL STANDARD ISO 4150:2011(E)

Green coffee or raw coffee — Size analysis — Manual and machine sieving

1 Scope

This International Standard specifies a routine method for carrying out size analysis of green coffee by manual and machine sieving using laboratory test sieves.

2 Normative references

The following referenced documents are indispensable for the application 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 3, *Preferred numbers — Series of preferred numbers*

ISO 2395, *Test sieves and test sieving — Vocabulary*

ISO 2591-1, *Test sieving — Part 1: Methods using test sieves of woven wire cloth and perforated metal plate*

ISO 3310-2, *Test sieves — Technical requirements and testing — Part 2: Test sieves of perforated metal plate*

ISO 3509, *Coffee and coffee products — Vocabulary*

ISO 4072, *Green coffee in bags — Sampling*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2395 (for test sieves) and ISO 3509 (for coffee) apply.

4 Principle

A laboratory sample is separated into fractions according to size by manual (or machine) sieving, and the results are expressed as percentage mass fractions.

5 Apparatus

5.1 Balance, capable of weighing to the nearest 0,1 g.

5.2 Nest of test sieves.

For the dimensions and sieving medium, the test sieves shall have a sieve surface area of between 550 cm^2 and 1 000 cm^2. Suitable test sieves are, for example, square sieves of size 300 mm, complying with the requirements of ISO 2591-1, except that the approximate depth of the sieve may be reduced to 25 mm.

The perforated metal plate used as the sieving medium shall be made of metal of suitable strength, such as stainless steel, ordinary steel or zinc, 0,8 mm to 1 mm thick. Each plate shall be perforated in accordance with the requirements given in Annex A or Annex B.

The test sieves shall be marked by means of a label attached to the sieve giving the following details:

a) traditional numbering (see Annex A);

NOTE The traditional numbering is given for information purposes. It corresponds to the nominal aperture size of round apertures or to the width of slotted apertures, expressed in 64ths of an inch, closest to the metric dimension adopted.

b) nominal aperture size or the dimensions of slotted apertures (see Annex B);

c) in the case of round holes, the diameter of the sieve current is determined in the verification (see Annex A);

d) reference to the International Standard(s) with which the sieve complies;

e) material of the sieving medium and that of the frame;

f) name of the firm (manufacturer or vendor) taking responsibility for the sieve;

g) identification number.

In terms of construction, the test sieve frames shall nest snugly with each other and with the lid and receiver.

The frame shall be smooth and the seal of the sieve so constructed as to prevent lodging of the coffee beans being sieved.

For verification, new test sieves shall be tested (for example using the methods described in ISO 3310-2) and a certificate shall be available to this effect. Periodic checking should also be performed, since some changes in the dimensions of the apertures can occur after a period of use.

5.3 Test sieves.

5.3.1 Test sieves with round holes, 11 sieves (see Annex A).

5.3.2 Test sieves with slotted holes, 7 sieves (see Annex B).

5.4 Lid.

The lid shall comply with the requirements of ISO 2591-1.

5.5 Receiver.

The receiver shall comply with the requirements of ISO 2591-1.

5.6 Machine for sieving, having the following features.

a) The results obtained over each sieve shall be equal to using the manual method. In Annex D, a guide is presented to carry out this verification.

b) The machine shall contain a tray to allow for the assembly of a set with any number of sieves in order to carry out a complete analysis.

c) It shall consist of sieves which are easy to fix.

d) It shall have an adjustable timer in the 0 min to 3 min range.

6 Sampling

Take a laboratory sample of 300 g, prepared in accordance with ISO 4072.

NOTE The same laboratory sample as used for the examination and determination described in ISO 4149 can be used for the purposes of this International Standard, provided the sample is fully reconstituted before the test portion is taken for the test sieving.

7 Procedure

7.1 Test portion

Weigh, to the nearest 0,1 g, 300 g of the laboratory sample.

7.2 Selection of sieves

Select a nest of sieves (5.2) with round apertures (5.3.1). Assemble the sieves in descending order of aperture size. If dealing with a sample of substantially peaberry coffee, to determine the percentage mass fraction of peaberry in the test portion, use a sieve with slotted openings (5.3.2).

Discard the sieves with larger apertures through which all beans can pass.

NOTE The common sieve numbers are 18, 17, 16, 15, 14 and 12.

Place the receiver (5.5) under the sieve with the smallest apertures.

7.3 Sieving and weighing

Pour the test portion (7.1) on to the upper sieve and put the lid (5.4) in place.

7.3.1 Manual sieving

7.3.1.1 Spread a clean, dry, soft cloth under the receiver, in order to obtain smooth sliding.

Spread the cloth (see 7.2) over a flat surface and then put the nest of sieves on it.

7.3.1.2 Agitate uniformly the nest of sieves for 3 min, one way (back and forth) without raising it from the surface at a speed of between 110 cycles per min and 130 cycles per min with a displacement of 10 cm approximately.

NOTE A speed with 150 cycles per min and 160 cycles per min and a displacement of 5 cm can be used.

If using slotted aperture sieves, agitate in a direction parallel to the length of apertures. Beans remaining in apertures shall be considered to be retained on the sieve in question.

Remove all the beans from each sieve separately, to avoid loss of the beans. Put the lid on the top of the respective sieve, then put one hand under the sieve and push the beans up. Then, carefully place the beans on a tray.

7.3.1.3 Weigh to the nearest 0,1 g, the beans collected on each of the sieves used and in the receiver.

7.3.2 Machine sieving

7.3.2.1 Put the nest of sieves on the machine (5.6) firmly, and turn the equipment on for 3 min. If using slotted aperture sieves, agitate in a direction parallel with the length of apertures. Beans remaining in apertures shall be considered to be retained on the sieve in question.

7.3.2.2 Remove all the beans from each sieve separately, to avoid loss of the beans. Put the lid on the top of the respective sieve, then put one hand under the sieve and push the beans up. Then, carefully place the beans on a tray.

7.3.2.3 Weigh to the nearest 0,1 g, the beans collected on each of the sieves used and in the receiver.

7.4 Additional observations

Note whether any of the fractions contains a significant proportion of foreign matter, bean fragments or broken beans. In this case, apply ISO 4149.

8 Statement of results

8.1 The result, w_{gc}, is expressed as a mass fraction retained over each sieve in the following manner:

$$w_{gc} = \frac{m_S}{m_T} \times 100$$

where

w_{gc} is the mass fraction retained with the sieve number, S;

m_S is the coffee bean mass, with the sieve number, S, expressed in grams;

m_T is the total mass of the sample, expressed in grams.

8.2 The total percentage of all sieves shall be equal to (100 ± 0,5) % of the mass of the test portion. If this is not the case, the test is not valid and shall be repeated using another laboratory sample.

9 Precision

9.1 General

The results of an interlaboratory test are given in Annex C.

9.2 Repeatability

The absolute difference between two single test results for a given sieve size, S, obtained using the same method on the identical test material in the same laboratory by the same operator using the same equipment within a short interval of time, should not be greater than the repeatability limit, r_S, for this sieve.

$$r_S = 2{,}8 \times S_r = 0{,}0187 \times \overline{w}_S + 0{,}099\ 1$$

where $\overline{w}_S$ is the mean of the results on the respective sieve.

9.3 Reproducibility

The absolute difference between two single test results for a given sieve size, S, obtained using different equipment, should not be greater than the reproducibility limit, R_S, for this sieve.

$$R_S = 2{,}8 \times S_R = 0{,}1237 \times \overline{w}_S + 0{,}590\ 9$$

where $\overline{w}_S$ is the mean of the results on the respective sieve.

10 Test report

The test report shall contain at least the following information:

a) reference to this International Standard, i.e. ISO 4150:2011;

b) all the information necessary for the complete identification of the sample;

c) specification of the method and type of sieve used;

d) the test result(s) obtained;

e) the details of any foreign matter or defect found and recorded in accordance with 7.4;

f) all operating details not specified in this International Standard or regarded as optional, together with any incidents which can have influenced the result(s).

Annex A
(normative)

Characteristics of perforated metal plate test sieves with round holes

The sequence of aperture diameters is taken from the R 40 series of preferred numbers in ISO 3.

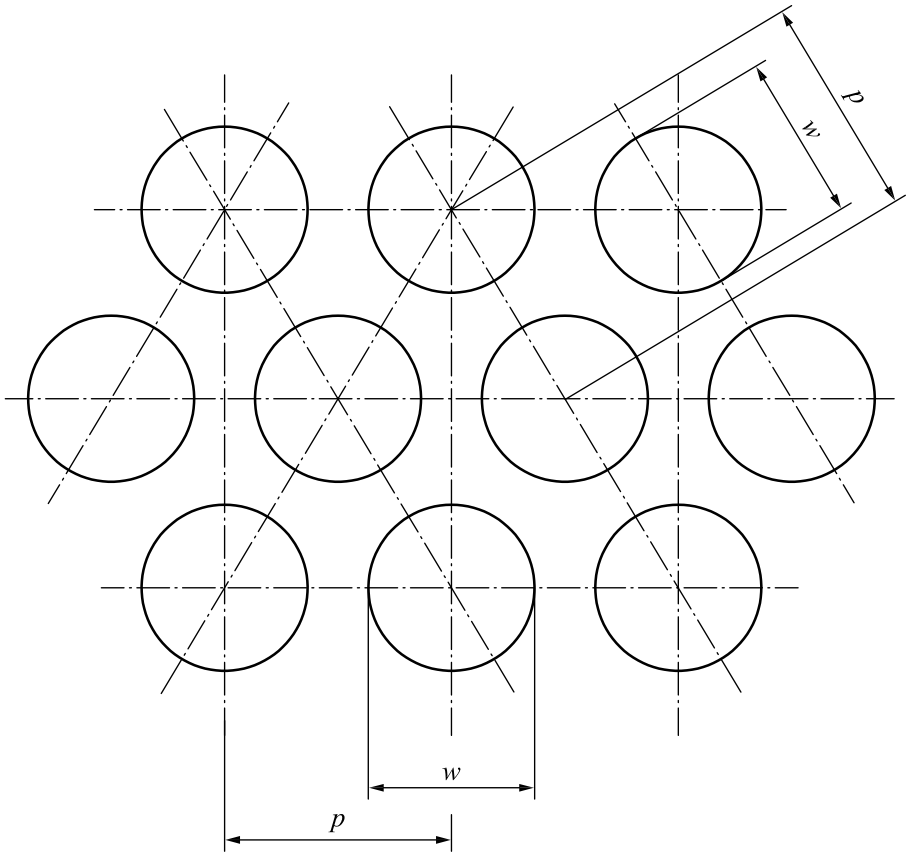
The sieves numbers 7, 10, 12, 121/2, 14, 15, 16, 17, 18, 19 and 20 shall comply with the requirements of ISO 3310-2, except that the tolerance on the normal diameter shall be as shown in Table A.1.

The technical specifications of sieves numbers 15 and 19 shall be obtained by interpolation from those given in ISO 3310-2, except that the tolerance on the normal diameter shall be as shown in Table A.1.

The arrangement of the apertures shall be such that the aperture centres are at the apices of equilateral triangles (see Figure A.1).

Table A.1 — Characteristics of perforated metal plate test sieves with round holes

Aperture size mm		**Sieve number**
Nominal diameter w	**Tolerance**	
8,00	± 0,09	20
7,50	± 0,09	19
7,10	± 0,09	18
6,70	± 0,08	17
6,30	± 0,08	16
6,00	± 0,08	15
5,60	± 0,07	14
5,00	± 0,07	12 1/2
4,75	± 0,07	12
4,00	± 0,06	10
2,80	± 0,05	7



Key

p pitch

w hole size

NOTE Values of the pitch, p, are given in ISO 3310-2.

Figure A.1 — Round holes — Staggered arrangement

Annex B
(normative)

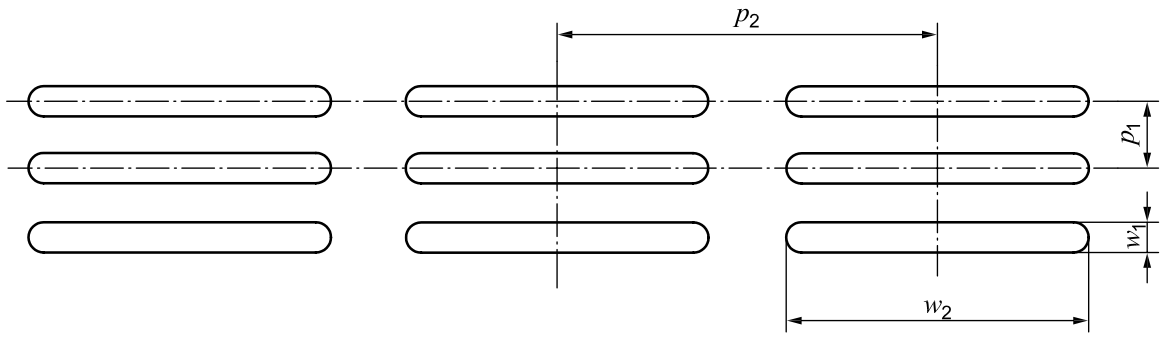
Characteristics of perforated metal plate test sieves with slotted apertures

The sequence of slot widths is taken from the R 40 series of preferred numbers in ISO 3.

The slots shall be arranged in rows (see Figure B.1) or staggered. The values given for the pitches should be regarded as a nominal guide.

Table B.1 — Characteristics of perforated metal plate test sieves with slotted apertures

Aperture size mm			Pitch mm		Sieve number
Width w_1	Tolerance on width	Length w_2	p_1	p_2	
5,60	± 0,07	30	9,6	36	14
5,00	± 0,07	30	9,0	36	13
4,75	± 0,07	20	8,6	25 or 26	12
4,50	± 0,07	20	8,2	25 or 26	11
4,00	± 0,06	20	7,5	25 or 26	10
3,55	± 0,06	20	6,8	25 or 26	9
3,00	± 0,05	20	6,0	25 or 26	8



Key

p_1 width pitch
p_2 length pitch
w_1 hole width
w_2 hole length

Figure B.2 — Slotted apertures — Arrangement in rows

Annex C
(informative)

Interlaboratory

An interlaboratory test carried out in 2005, in which 17 laboratories participated, each of which carried two determinations on the sample**,** gave the statistical results (evaluated in accordance with ISO 5725-2) shown in Table C.1.

Table C.1 — Determination of values of means ($\overline{w}_S$), S_r and S_R

Sieve	18	17	16	15	14	12	Receiver
Number of laboratories retained after eliminating outliers	17	17	17	17	17	17	17
Mean ($\overline{w}_S$), %	24,27	32,16	24,30	11,39	5,38	2,07	0,43
Standard deviation of repeatability, S_r	0,23	0,26	0,14	0,11	0,10	0,05	0,02
Coefficient of variation of repeatability, %	0,93	0,82	0,57	0,93	1,88	2,21	5,62
Repeatability limit, r_S = 2,8 S_r	0,64	0,75	0,40	0,30	0,29	0,13	0,07
Standard deviation of reproducibility, S_R	1,11	1,61	1,39	0,72	0,64	0,21	0,15
Coefficient of variation of reproducibility, %	4,57	5,02	5,72	6,34	11,93	10,16	33,93
Reproducibility limit, R_S = 2,8 S_R	3,14	4,57	3,93	2,04	1,82	0,60	0,41

Table C.2 — Characteristics of test sieves with round holes used in this interlaboratory test

Sieve number	Nominal diameter mm	Tolerance between sieves mm
18	7,14	± 0,03
17	6,75	± 0,03
16	6,35	± 0,03
15	5,95	± 0,02
14	5,56	± 0,02
12	4,76	± 0,02

Annex D
(informative)

Verification of mechanical equipment of sieving machines

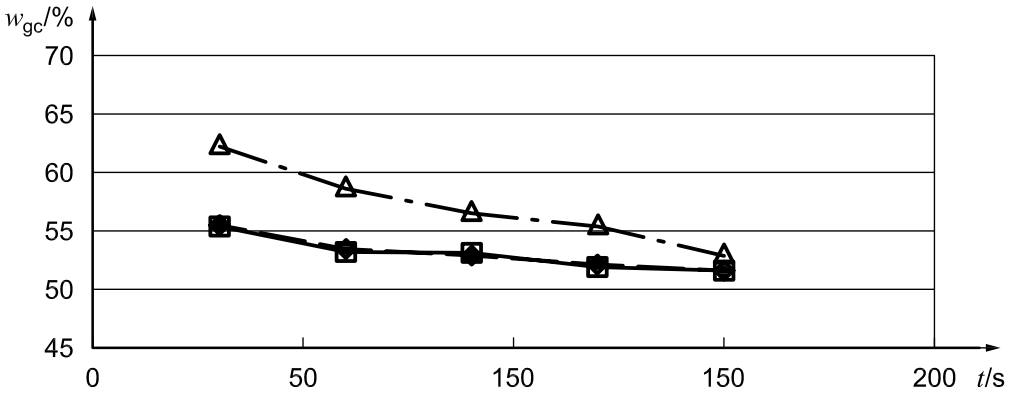
In the market, there are many available machines that have similar performance to the manual method. They should be used if they meet the requirements in 5.3. This procedure deals with a guide to verify whether the machine is suitable for use for size analysis. Manual sieving described in this International Standard is the reference method for comparison of the machines.

A well-designed machine should have a time performance equal to the manual method. It means that the coffee bean stratification should take equal or less time than manual sieving. To check this, take a sieve (for example no. 17) on which between 40 % to 60 % of the coffee is retained; in this way, it is easy and fast to find differences between both methods.

Table D.1 and Figure D.1 present an example of time response using two machines in comparison with the manual method.

Table D.1 — Time evaluation for manual and machine methods using sieve no. 17

Time s	Coffee beans retained using manual method w %	Coffee beans retained using machine A w %	Coffee beans retained using machine B w %
30	55,5	55,4	62,4
60	53,4	53,2	58,8
90	53,1	53,3	56,7
120	52,1	52,0	55,6
150	51,6	51,6	53,0



Key

w_{gc}	mass fraction retained on no. 17 sieve
t	time
	manual method
	machine A
	machine B

Figure D.1 — Evaluation of machines vs. manual method

The time response for machine A is comparable to the manual method, while machine B gives a slow response and is not suitable for sieving.

A calibration certificate shall be available for each machine used for size analysis against the reference manual method.

Bibliography

[1] ISO 4149, *Green coffee — Olfactory and visual examination and determination of foreign matter and defects*

[2] ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

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