INTERNATIONAL STANDARD

ISO 8511

Third edition
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Rubber compounding ingredients — Carbon black — Determination of pellet size distribution

Ingrédients de mélange du caoutchouc — Noir de carbone — Détermination de la distribution granulométrique

Reference number
ISO 8511:2011(E)

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Foreword

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The main task of technical committees is to prepare International Standards. 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.

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 8511 was prepared by Technical Committee ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 3, *Raw materials (including latex) for use in the rubber industry*.

This third edition cancels and replaces the second edition (ISO 8511:1995), of which it constitutes a minor revision. The following changes have been made:

— the normative references have been updated;

— in the footnote to Clause 4, the details of the suppliers of the Ro-Tap sieve shaker have been updated;

— the precision statement has been moved to an informative annex.

Rubber compounding ingredients — Carbon black — Determination of pellet size distribution

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

1 Scope

Carbon black for the rubber industry is generally pelletized to reduce dust and to improve handling and incorporation into polymers. Variations in pellet size distribution can affect dispersion in polymers, bulk handling, and conveying properties.

This International Standard specifies a method for the determination of the pellet size distribution of carbon black.

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 565, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*

ISO 1124, *Rubber compounding ingredients — Carbon black shipment sampling procedures*

3 Principle

Pelletized carbon black is passed through a succession of sieves with different-sized apertures and the amount retained by each is determined.

4 Apparatus

4.1 Mechanical sieve shaker[1)], which imparts a uniform rotary and tapping motion to a stack of nominally 200 mm diameter sieves. The mechanism shall produce 280 to 320 rotary motions per minute (4,6 to 5,3 per second) and 140 to 160 taps per minute (2,3 to 2,7 per second) to a cork fitted into the centre of the top-sieve cover (4.4) and extending 3 mm to 9 mm above it. Only cork shall be used, rubber being unsuitable.

4.2 Sieves, nominally 200 mm diameter, 25 mm high, of woven metal wire cloth, conforming to ISO 565, having apertures of 2,00 mm, 1,00 mm, 0,5 mm, 0,25 mm and 0,125 mm.

A 0,71 mm aperture sieve may be added if pellets produced by a dry process are tested.

1) A Ro-Tap sieve shaker is an example of a suitable apparatus available commercially from:
Tyler Power Systems, 8570 Tyler Boulevard, Mentor, OH 44060, USA,
or
Haver & Boecker, Ennigerloher Str. 64, D-59302 Oelde, Germany.
This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of this apparatus. Other types of apparatus may be used if they lead to the same results.

Other sizes may be added by agreement between the interested parties.

4.3 **Bottom receiver**.

4.4 **Top-sieve cover**.

4.5 **Sample splitter**, single-stage, riffle type.

4.6 **Balance**, with at least 0,1 g sensitivity.

4.7 **Container**, suitable for use when weighing test portions and sieved fractions.

5 Sampling

Samples shall be taken in accordance with ISO 1124.

6 Procedure

6.1 Stack the sieves (4.2) in the following order, from bottom to top:

bottom receiver; 0,125 mm; 0,25 mm, 0,5 mm, 1,00 mm; 2,00 mm.

If a 0,71 mm sieve is used, or sieves of sizes not specified in 4.2, place them in the appropriate position in the stack.

6.2 Pass the sample through the sample splitter (4.5) and take two test portions, each of 100 g ± 10 g.

6.3 Weigh each test portion to the nearest 0,1 g.

6.4 Transfer a test portion to the top sieve, fit the sieve cover (4.4) and place the assembly in the mechanical shaker (4.1).

6.5 Allow the assembly to shake for 60 s to 70 s.

6.6 Remove the sieve assembly from the shaker, transferring each fraction in turn to the container (4.7) and weighing the carbon black retained on each sieve and in the bottom receiver (4.3) individually to the nearest 0,1 g.

6.7 Repeat the operations in 6.4 to 6.6 for the second test portion.

7 Expression of results

7.1 Calculate the pellet size distribution as a percentage of the test portion retained by each sieve, using the formula:

$$\frac{m_i}{m_0} \times 100$$

where

m_i is the mass, in grams, of carbon black on the ith test sieve or in the bottom receiver;

m_0 is the mass, in grams, of the test portion.

7.2 Add the masses of carbon black retained by all the sieves and in the bottom receiver. If the loss exceeds 2 %, the test results shall be regarded as invalid.

7.3 Calculate the mean distribution of the pellet size retained by each sieve from the two sets of results.

8 Precision

See Annex A.

9 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the sample;

c) the mean values of the two test results, to the nearest whole number, as follows:

- the percentage retained on the 2,00 mm sieve,
- the percentage passing the 2,00 mm sieve but retained on the 1,00 mm sieve,
- the percentage passing the 1,00 mm sieve but retained on the 0,5 mm sieve,
- the percentage passing the 0,5 mm sieve but retained on the 0,25 mm sieve,
- the percentage passing the 0,25 mm sieve but retained on the 0,125 mm sieve,
- the percentage passing the 0,125 mm sieve.

If a mesh size different from those specified in 4.2 is used, its results shall be included in the appropriate position in the test report.

Annex A
(informative)

Precision statement

A.1 General

The precision data give an estimate of the precision as described below. The precision parameters should not be used for acceptance/rejection testing of any group of materials without documentation that they are applicable to those particular materials and the specific testing protocols that include this test method.

The repeatability and reproducibility were calculated in accordance with ISO/TR 9272:1986, *Rubber and rubber products — Determination of precision for test method standards* (now withdrawn).

A.2 Details of test programme

These precision data are based on duplicate tests of three samples by seven laboratories on two days. The range of samples studied is given in Table A.1 for each sieve.

Table A.1 — Range of samples

Sieve aperture mm	Range %
2,00	0,6 to 3,5
1,00	26,9 to 68,7
0,50	24,6 to 44,9
0,25	3,2 to 21,4
0,125	1,2 to 6,2
Receiver	0,8 to 1,9

Both the repeatability and the reproducibility values represent short-term testing. Precision is expressed in percent relative terms.

A.3 Single test

A.3.1 Repeatability (single operator)

The repeatability r has been estimated as reported in Table A.2.

Two single test results that differ by more than the values given in Table A.2 should be considered suspect and dictate that some appropriate investigative action be taken.

Table A.2 — Repeatability of single test

Sieve aperture mm	Repeatability % relative
2,00	34,7
1,00	12,2
0,50	15,3
0,25	22,7
0,125	62,7
Receiver	67,6

A.3.2 Reproducibility (between laboratories)

The reproducibility R has been estimated as reported in Table A.3.

Two single test results produced in separate laboratories that differ by more than the values given in Table A.3 should be considered suspect and dictate that some appropriate investigative action be taken.

Table A.3 — Reproducibility of single test

Sieve aperture mm	Reproducibility % relative
2,00	100,8
1,00	56,5
0,50	73,1
0,25	74,0
0,125	119,2
Receiver	139,6

A.4 Duplicate test average

A.4.1 Repeatability (single operator)

The repeatability r has been estimated as reported in Table A.4.

Two duplicate test averages that differ by more than the values given in Table A.4 should be considered suspect and dictate that some appropriate investigative action be taken.

Table A.4 — Repeatability of duplicate tests

Sieve aperture mm	Repeatability % relative
2,00	26,8
1,00	8,7
0,50	12,9
0,25	19,9
0,125	44,8
Receiver	52,2

A.4.2 Reproducibility (between laboratories)

The reproducibility R has been estimated as reported in Table A.5.

Two duplicate test averages produced in separate laboratories that differ by more than the values given in Table A.5 should be considered suspect and dictate that some appropriate investigative action be taken.

Table A.5 — Reproducibility of duplicate tests

Sieve aperture mm	Reproducibility % relative
2,00	101,8
1,00	53,9
0,50	72,3
0,25	69,3
0,125	91,0
Receiver	107,2

A.5 Bias

In test method terminology, bias is the difference between an average measured test property value and an accepted reference (true) value. Reference values do not exist for this test method since the value of the test property is defined solely by the test method. The bias cannot, therefore, be determined.

A.6 Recommendation

Due to the poor reproducibility of the method, it is recommended that the test be limited to within-laboratory usage.

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