

INTERNATIONAL STANDARD

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Second 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 8511:1995(E)

Foreword

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International Standard 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 second edition cancels and replaces the first edition (ISO 8511:1987), which has been technically revised.

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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 standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent

editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 565:1990, *Test sieves — Metal wire cloth, perforated metal plate and electroformed sheet — Nominal sizes of openings*.

ISO 1124:1988, *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 shaker¹⁾, which imparts a uniform rotary and tapping motion to a stack of nom-

1) A Ro-Tap sieve shaker is satisfactory for this purpose. It is available from Tyler Power Systems, 8648 Tyler Boulevard, Mentor, OH - 44060, USA,

or

Stein Industrie, 19 Avenue Morane-Saulnier, F-78140 Vélizy-Villacoublay, France.

This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the apparatus named. Other types of apparatus may be used if they can be shown to lead to the same results.

inally 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.

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 $100 \text{ g} \pm 10 \text{ g}$.

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 $(60 \pm 10) \text{ s}$.

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 i th 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 and bias

8.1 General

The precision data give an estimate of the precision as described below. The precision parameters shall 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.

8.2 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 shown in table 1 for each sieve.

Table 1

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.

8.3 Single test

8.3.1 Repeatability (single operator)

The repeatability r has been estimated as reported in table 2.

Table 2

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

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

8.3.2 Reproducibility (between laboratories)

The reproducibility R has been estimated as reported in table 3.

Table 3

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

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

8.4 Duplicate test average

8.4.1 Repeatability (single operator)

The repeatability r has been estimated as reported in table 4.

Table 4

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

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

8.4.2 Reproducibility (between laboratories)

The reproducibility R has been estimated as reported in table 5.

Table 5

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

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

8.5 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.

NOTES

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

2 For guidance on the interpretation of precision and bias information, the user is referred to ISO/TR 9272:1986, *Rubber and rubber products — Determination of precision for test method standards*.

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.

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