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**Rubber compounding ingredients —  
Carbon black — Determination of sieve  
residue**

*Ingrédients de mélange du caoutchouc — Noir de carbone —  
Détermination du refus sur tamis*

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 1437 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 fourth edition cancels and replaces the third edition (ISO 1437:1992), of which it constitutes a minor revision. The following changes have been made:

- the temperature at which the sieve residue is dried has been fixed at 125 °C (previously, there was a choice between 105 °C and 125 °C);
- precision data have been introduced.

# Rubber compounding ingredients — Carbon black — Determination of sieve residue

**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

This International Standard specifies a method for determining the water-wash sieve residue from regular, untreated carbon black for the rubber industry. It may not be applicable to oil-treated blacks because the oil could prevent proper wetting of the black by water.

## 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/TR 9272:2005, *Rubber and rubber products — Determination of precision for test method standards*

## 3 Principle

A known mass of carbon black is washed through a test sieve by a controlled flow of water, and the residue dried and weighed. The test sieve aperture is chosen from the range given in the appropriate material specification.

## 4 Apparatus

**4.1 Sieving apparatus** (see Figure 1), comprising the following main items:

**4.1.1 Test sieve**, on which the residue is retained. Test sieves shall be of phosphor bronze or stainless steel, having the characteristics described in ISO 565. Typical nominal apertures are 500 µm, 125 µm and 45 µm.

**NOTE** By mutual agreement between the interested parties, it is permissible to use sieves with a different aperture size.

**4.1.2 Funnel or container**, into the bottom of which the test sieve fits.

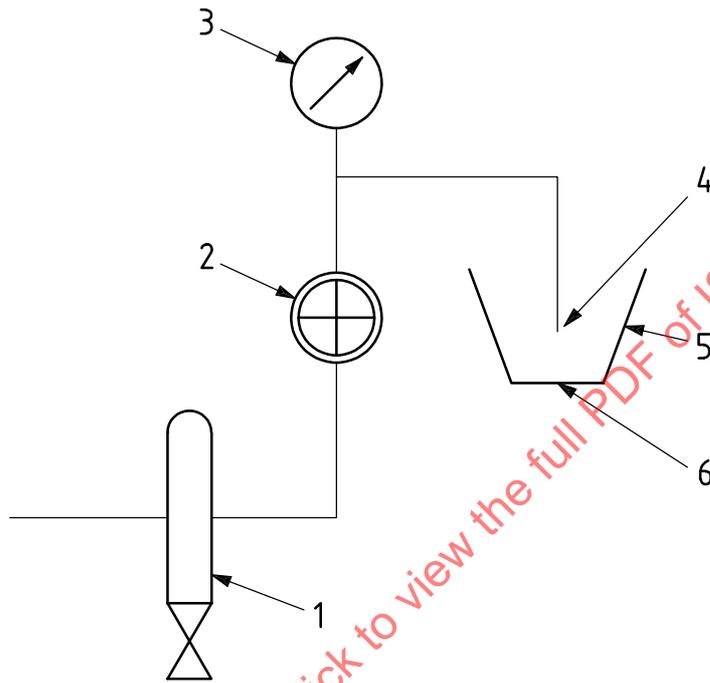
**4.1.3 Nozzle**, fed with clean water under controlled pressure by which the carbon black is washed through the sieve.

**4.1.4 Water pressure regulating device.**

**4.1.5 Filter**, in the water supply line, incorporating a wire screen at least as fine as that in the test sieve.

The tubing downstream of the filter shall not be liable to corrosion by tap water (use copper or stainless steel, for example).

NOTE Suitable apparatus includes the Gallie-Porrit type of apparatus and the one described in ASTM D1514-04.



**Key**

- 1 water filter
- 2 regulating valve
- 3 pressure gauge
- 4 nozzle
- 5 funnel or container
- 6 sieve

**Figure 1 — Schematic diagram of apparatus**

**4.2 Balance**, with an accuracy of 0,1 g.

**4.3 Analytical balance**, with an accuracy of 0,1 mg.

**4.4 Weighing dishes.**

**4.5 Oven**, gravity-convection type, capable of temperature regulation within  $\pm 1$  °C at 125 °C and temperature uniformity of  $\pm 5$  °C.

## 5 Procedure

### 5.1 Precautions

- 5.1.1 Keep the apparatus clean at all times to prevent contamination.
- 5.1.2 Examine the sieve each time it is used to make sure no cracks or holes develop.
- 5.1.3 Examine the wire screen in the filter periodically to ascertain if the filter screen is in good condition.

### 5.2 Determination

- 5.2.1 Clean the filter used in the water line before starting a test.
- 5.2.2 Regulate the water pressure to the recommended pressure of  $(0,2 \pm 0,04)$  MPa. Attach a sieve (4.1.1) of the specified aperture to the funnel or container (4.1.2) and allow water to flow through it for 3 min. Examine the sieve for particles. If none are observed, the apparatus is ready for use.
- 5.2.3 Weigh, to the nearest 0,1 g, a test portion of carbon black of at least 100 g.
- 5.2.4 Start the water flow. Carefully add carbon black to the funnel or container, taking care to prevent plugging of the sieve.
- NOTE A wetting agent may be used before starting the water flow.
- 5.2.5 Wash down the carbon black from the funnel or container sides. Continue to wash the residue on the sieve until the wash water coming through the sieve is clear.
- 5.2.6 Remove the sieve and rub the residue lightly with the finger to break up any agglomerates of carbon black which have not been thoroughly wetted by the water. Do not exert so much pressure with the finger that the sieve mesh is distorted.
- 5.2.7 Replace the sieve and wash for an additional 2 min.
- 5.2.8 Remove the sieve and dry in the oven (4.5) at 125 °C for 1 h.
- 5.2.9 Transfer the dried residue to a piece of smooth, white bond paper and rub gently to remove any carbon black remaining in the residue. Rub until the white paper no longer shows any smears.
- 5.2.10 Transfer the residue to a tared weighing dish (4.4) and weigh to the nearest 0,1 mg.

## 6 Expression of results

Either calculate the sieve residue  $R$  expressed in parts per million (mg/kg) using the equation

$$R = \frac{m_1}{m_0} \times 10^6$$

or calculate the sieve residue  $R$  expressed as a percentage (%) using the equation

$$R = \frac{m_1}{m_0} \times 100$$

where

$m_0$  is the mass of the test portion, in grams (g);

$m_1$  is the mass of the residue retained on the sieve, in grams (g).

## 7 Precision and bias

### 7.1 Precision

7.1.1 The precision of this test method was determined in accordance with ISO/TR 9272:2005, level 2 method. Refer to ISO/TR 9272:2005 for terminology and other statistical details.

7.1.2 The precision results give an estimate of the precision to be expected. 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.

7.1.3 A type 1 precision interlaboratory-trials programme was conducted. Both the repeatability and the reproducibility determined represent short-term testing conditions. 16 laboratories tested two carbon blacks, twice on each of two different days: one with a considerable level and one with a very high level of sieve residue. Therefore,  $p = 16$ ,  $q = 2$  and  $n = 4$ . A test result is the value obtained from a single determination. Acceptable difference values were not measured.

7.1.4 The results of the precision calculations are given in Table 1, with the materials arranged in descending order of mean sieve residue. Outliers have been removed. The number of laboratories remaining after outlier deletion is given in Table 1.

Table 1 — Precision calculations

Material	Number of laboratories	Mean sieve residue mg/kg (ppm)	Within-laboratory			Between laboratories		
			$s_r$	$r$	( $r$ )	$s_R$	$R$	( $R$ )
A	13	98,6	10,14	28,69	29,09	30,10	89,85	91,11
B	15	362,0	55,88	158,04	43,66	194,37	572,02	158,01
Average	14	230,3						
Pooled values			40,16	113,58	37,10	139,08	409,44	128,97

The symbols used are defined as follows:

- $s_r$  is the within-laboratory standard deviation;
- $r$  is the repeatability (in measurement units);
- ( $r$ ) is the repeatability (in percent);
- $s_R$  is the between-laboratory standard deviation;
- $R$  is the reproducibility (in measurement units);
- ( $R$ ) is the reproducibility (in percent).

7.1.5 The precision for the pooled values of the sieve residue may be expressed as follows:

a) Repeatability

The repeatability ( $r$ ) for the sieve residue has been established as 37,1 %. Two single test results (or determinations) that differ by more than 37,1 %, shall be considered suspect and dictate that some appropriate investigative action be taken.

b) Reproducibility

The reproducibility ( $R$ ) for the sieve residue has been established as 129,0 %. Two single test results (or determinations), produced in separate laboratories, that differ by more than 129,0 %, shall be considered suspect and dictate that some appropriate investigative action be taken.

## 7.2 Bias

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

## 8 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) all details necessary for the identification of the sample;
- c) the nominal values of the sieve apertures;
- d) the type of apparatus used and the water pressure;
- e) the results and the units in which the results were expressed;
- f) the date of the test.

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