PD CEN/TR 15149-3:2014

BSI Standards Publication

Solid biofuels — Determination of particle size distribution

Part 3: Rotary screen method

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee PTI/17, Solid biofuels.

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

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ISBN 978 0 580 73877 7

ICS 75.160.10

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 November 2014.

Amendments issued since publication

Date	Text affected

TECHNICAL REPORT

RAPPORT TECHNIQUE

TECHNISCHER BERICHT

CEN/TR 15149-3

November 2014

ICS 75.160.10

Supersedes CEN/TS 15149-3:2006

English Version

Solid biofuels - Determination of particle size distribution - Part 3: Rotary screen method

Biocombustibles solides - Détermination de la distribution granulométrique - Partie 3 : Méthode au tamis rotatif

Feste Biobrennstoffe - Bestimmung der Teilchengrößenverteilung - Teil 3: Verfahren mit rotierendem Sieb

This Technical Report was approved by CEN on 18 July 2011. It has been drawn up by the Technical Committee CEN/TC 335.

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Foreword

This document (CEN/TR 15149-3:2014) has been prepared by Technical Committee CEN/TC 335 “Solid biofuels”, the secretariat of which is held by SIS.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 15149, *Solid biofuels — Determination of particle size distribution*, consists of the following parts:

— *Part 1: Oscillating screen method using sieve apertures of 1 mm and above;*

— *Part 2: Vibrating screen method using sieve apertures of 3,15 mm and below*;

— *Part 3: Rotary screen method* [Technical Report; the present document].

The most significant changes since the latest edition of this text are the following ones:

— The former edition was a Technical Specification; it was turned into the present Technical Report.

— References have been consistently updated.

Introduction

Part 1 describes the reference method for size classification of samples with a nominal top size of 3,15 mm and over.

Part 2 describes the reference methods for all samples with a nominal top size below 3,15 mm.

Part 3 describes an innovative method, by which the degree of overestimating the fine particle fractions is reduced. As it is currently not generally available, it is here proposed for research and development purposes or for individual quality management processes, in which the quality requirements are bilaterally defined between the suppliers and consumers based on this method.

NOTE The nominal top size is defined as the aperture size of the sieve where at least 95 % by mass of the material passes (see Bibliography).

1 Scope

This Technical Report specifies a method for the determination of the size distribution of particulate biofuels by the rotary screen method. The method described is meant for particulate biofuels only, namely materials that either have been reduced in size, such as most wood fuels, or are physically in a particulate form e.g. olive stones, nutshells, grain, etc. This document applies to particulate uncompressed fuels with a nominal top size of 3,15 mm and over, e.g. wood chips, hog fuel, olive stones, etc.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14778, *Solid biofuels — Sampling*

EN 14780, *Solid biofuels — Sample preparation*

EN 14774-1, *Solid biofuels — Determination of moisture content - Oven dry method — Part 1: Total moisture — Reference method*

EN 14774-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified method*

EN 15149-2, *Solid biofuels — Determination of particle size distribution — Part 2: Vibrating screen method using sieve apertures of 3,15 mm and below*

EN ISO 16559, *Solid biofuels — Terminology, definitions and descriptions (ISO 16559)*

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

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN ISO 16559 apply.

3.1
nominal top size
aperture size of the sieve where at least 95 % by mass of the material passes

4 Principle

A sample is subjected to sieving through sieves in a rotary sieving machine sorting the particles by increasing size.

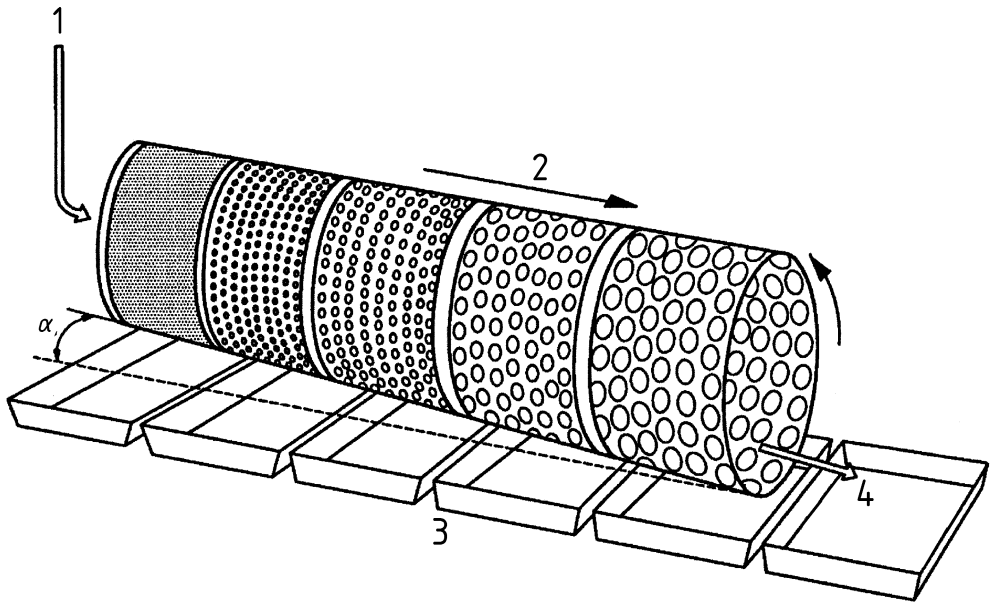
5 Apparatus

5.1 Rotary screen.

For the test a rotary sieving device is required for which the operating principle is shown in Figure 1. The rotary sieving device consists of five joined cylindrical sieve rings each with an inner diameter of 500 mm

(± 15 mm). The height (length) of each of the 5 sieve rings is 400 mm with a maximum of 20 mm imperforated ("blind") surface at each side; as a consequence each ring is having an effective sieving length of 360 mm or higher. All five cylinder rings (sieves) are evenly long and consecutively connected to each other, thus forming a drum. The inner surface of the drum shall be constructed in a way, which allows the particles to slide from one ring to another without interruption. Downward to the direction of flow the drum is inclined at an angle of 3° (± 0,2°) towards the horizontal ground. The drum shall be rotating at a speed 16 rotations per minute.

Due to both, inclination and rotation of the drum, the sample is continuously being transported forward in the drum over the rotating sieves. Thereby the particles are separated by their size by passing through the sieve holes and falling into individual collecting pans underneath each sieve cylinder. Large particles, which have not passed through any sieve holes, are finally being discharged from the drum into a final collecting pan. The size of each individual pan should be at least 70 % of the initial test sample volume.



Key

1 material addition

2 increasing hole diameter

3 material flow direction

4 collecting pans

Figure 1 — Operating principle of rotating sieves

The geometry of the apertures and the thickness of the sieves shall be in accordance with the requirements of ISO 3310-2. The aperture sizes of the sieves shall be chosen according to the size specification of the sample material. It is recommended that the diameters of the holes in the sieves are 3,15 mm, 8 mm, 16 mm, 45 mm and 63 mm. On the rotating drum the cylinders shall be arranged by increasing sieve hole diameters, starting with the smallest sieve holes where the sample material shall be fed on (see Figure 1).

5.2 Balance.

A balance capable of measuring the mass of the sample to be sieved to the nearest 0,1 g is required.

6 Sample preparation

6.1 Sample size

The minimum size of the test sample for the determination of the size distribution shall be 8 l and shall have been sampled according to EN 14778. For fine grade biofuels, where 100 % of the particles pass sieve holes of 45 mm diameter, a smaller sample size of minimum 4 l can be used.

The sample should include material for determination of size distribution and moisture content.

6.2 Sample preparation

The sample shall be sieved at a moisture content below 20 % wet base, thus preventing the particles from sticking together or loosing moisture during the sieving process. If necessary the sample shall be pre-dried. Drying is done according to EN 14780.

NOTE By pre-drying, as described in EN 14780, the sample is brought into equilibrium with the humidity of the surrounding atmosphere.

Determine the moisture content of the material to be sieved on a separate sub-sample following the procedure given in EN 14774-1 or EN 14774-2. The moisture content shall be determined and reported concurrently with the particle size distribution determination.

7 Procedure

Assemble and operate the rotary sieve with the appropriate sieves in accordance with 5.1.

Weigh the sample to the nearest 0,1 g of the total sample mass.

Feed the sample material continuously into the rotating sieve at a constant feeding rate of 1 l per min. This can, for example, be achieved by letting the sample material fall over an infeed slide onto the edge of the first cylinder.

The homogeneous feeding rate can be achieved either by a mechanical feeding mechanism or by hand feeding onto the slide. If feeding is done by hand, the sample should be divided into several portions (for example 8 portions) of equal volume; these portions are then dropped onto the slide sequentially in a way that ensures an even and uninterrupted flow throughout the total feeding time (e.g. 8 × 1 min).

If a larger sample size (more than 8 l) is processed, the capacity of the collecting pans may be exceeded or the sample may have to be separated in two or more portions and be processed subsequently.

Stop the rotation when no more material is remaining in the rotating drum. In case that a particle sticks in a sieving hole, the sieve shall be stopped and the particle shall be re-fed in the sieve. Restart the rotary sieve and let the sieve empty.

All particles larger than 100 mm (maximum dimension) shall be hand sorted into one or more fractions regardless from which sieve or collecting pan they are collected.

Weigh the net material in each fraction with an accuracy of 0,1 g and record the mass in a scheme equal to Table 1.

NOTE In many cases it is useful to identify the largest particle (maximum dimension) and record it in a scheme equal to Table 1. The information on the longest particle may be required for computing the median particle size or for illustrating the results in a cumulative size distribution curve.

In size classification by sieving, some of the thin particles, which are longer than the hole diameter, will pass the sieve and mix with the particles in the smaller size fractions. Most of these particles shall remain in that fraction. Only particles which are over 100 mm (maximum dimension) shall be sorted by hand, regardless from which collecting pan they are collected.

If fractionation of the finest material, which fell through the sieve holes of the first cylinder ring, is required, proceed as described in EN 15149-2.

8 Calculation

The result is expressed as a percentage of the total mass of all fractions. If more than one sample (sub-sample) is processed the weight of the respective fractions shall be added up before calculating the overall percentage of each class. This procedure is demonstrated in Table 1.

Table 1 — Results of the size distribution analysis

Fraction name	Fraction, in mm	(1) Mass of fraction in subsample 1, in grams	(2) Mass of fraction in subsample 2, in grams	(3) Mass of fraction in subsample 3, in grams *(add more columns if necessary)*	(4) Total mass of fractions in Columns 1, 2 and 3 (or more), in grams	(5) Percentage of fraction (by mass), in % (based on total mass in Column 4)
1st Collecting pan	below 3,15					
2nd Collecting pan	3,15–8					
3rd Collecting pan	8–16					
4th Collecting pan	16–45					
5th Collecting pan	45–63					
6th Collecting pan	63–100					
Hand sorting	To be specified					
Hand sorting	To be specified					
Total mass of all fractions	all					100 %

Other recordings:

Total mass of test portion

Number of Overlong (Specify fraction in mm)

Number of Overlong (Specify fraction in mm)

Length of longest particle overall, in mm

Difference between the total mass of the test portion and the total mass of all fractions (column 4) in percent of the total test portion

Moisture content of the sieved sample, in % w/w.

The difference between the total mass of test portion and the total mass of all fractions as indicated in Table 1 shall be smaller than 2 %. Larger differences may occur due to lost or retained particles or due to changes in moisture content. In this case the causes for the deviation should be investigated and the measurement repeated. In case this is impossible or the result still deviates more than accepted this shall be reported.

9 Precision and bias

Because of the varying nature of solid biofuels covered by this document it is not possible at this time to give a precision statement (repeatability or reproducibility) for this test method.

10 Test report

The test report shall include at least the following information:

— identification of the laboratory and the testing date;

— identification of the product or sample tested (see EN 14778);

— a reference to this Technical Report;

— any deviation from this Technical Report;

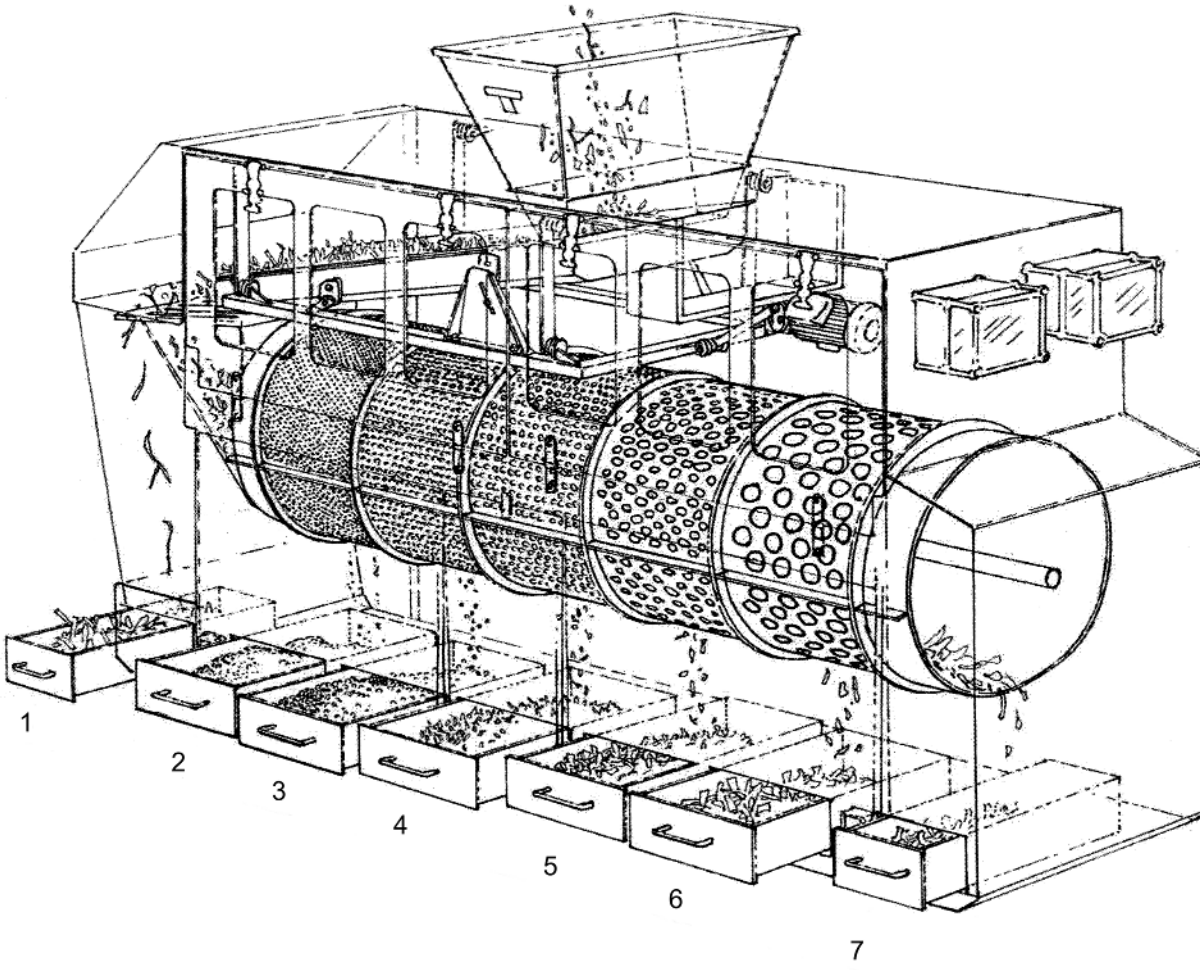
— conditions and observations, e.g. unusual occurrences during the test procedure, which may affect the result;

— the test results as demonstrated in Table 1;

— if the 2 % difference between the total mass of test portion and the total mass of all fractions in percent of the total test portion as given in Table 1, Column 4, has been exceeded it shall be clearly stated.

Annex A
(informative)

Example of a rotary sieving machine



Key

1–7 collecting pan

Figure A.1 — Example of a rotary sieving machine

Bibliography

[1] EN 14961 (all parts), *Solid biofuels — Fuel specifications and classes*

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