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**Solid biofuels — Determination  
of particle size distribution for  
uncompressed fuels —**

**Part 2:  
Vibrating screen method using sieves  
with aperture of 3,15 mm and below**

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*Biocombustibles solides — Détermination de la distribution  
granulométrique des combustibles non comprimés —*

*Partie 2: Méthode au tamis vibrant d'ouverture de maille inférieure  
ou égale à 3,15 mm*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 238, *Solid biofuels*.

ISO 17827 consists of the following parts, under the general title *Solid biofuels — Determination of particle size distribution for uncompressed fuels*: [log/standards/sist/a9ed9989-9cad-4724-8a48-24623c9ec009/iso-17827-2-2016](http://log/standards/sist/a9ed9989-9cad-4724-8a48-24623c9ec009/iso-17827-2-2016)

- Part 1: *Oscillating screen method using sieves with apertures of 3,15 mm and above*
- Part 2: *Vibrating screen method using sieves with apertures of 3,15 mm and below*

Part 2 can also be used for round hole sieves with apertures of 4,0 and 5,6 mm.

# Solid biofuels — Determination of particle size distribution for uncompressed fuels —

## Part 2: Vibrating screen method using sieves with aperture of 3,15 mm and below

### 1 Scope

This part of ISO 17827 specifies a method for the determination of the size distribution of particulate biofuels by the vibrating 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. This part of ISO 17827 applies to particulate uncompressed fuels with a nominal top size of 3,15 mm and below (e.g. sawdust).

### 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.

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

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

ISO 14780<sup>1)</sup>, *Solid biofuels — Sample preparation*

ISO 16559, *Solid biofuels — Terminology, definitions and descriptions*

ISO 17225-1, *Solid biofuels — Fuel specifications and classes — Part 1: General requirements*

ISO 18134-1, *Solid biofuels — Determination of moisture content — Oven dry method — Part 1: Total moisture — Reference method*

ISO 18134-2, *Solid biofuels — Determination of moisture content — Oven dry method — Part 2: Total moisture — Simplified method*

ISO 18135<sup>1)</sup>, *Solid biofuels — Sampling*

### 3 Terms and definitions

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

### 4 Principle

A laboratory sample is subjected to sieving through vibrating sieves, sorting the particles in decreasing size classes by mechanical means.

NOTE Manual sieving is excluded due to the fact that small sieve holes could easily be clogged by particles.

1) To be published.

## 5 Apparatus

### 5.1 Sieves

For the test, an appropriate number of either circular or rectangular sieves with a minimum effective sieve area of 250 cm<sup>2</sup> is required. For laboratory samples with a top size below 3,15 mm, the sieves shall have an aperture geometry in accordance with ISO 3310-1 (metal wire cloth) and for test materials with a top size 3,15 mm or above, the sieves shall have round perforated holes in metal plate in accordance with ISO 3310-2 (perforated metal plate). The frame of the sieves shall have a height that enables the sieves to contain the samples and allows a free movement of the sample during the sieving process.

The number of sieves and the aperture sizes of the sieves shall be chosen with the size specification for the actual laboratory sample material in accordance with ISO 17225-1. For sawdust and similar fine grade materials, the following set of sieves is recommended:

- 3,15 mm round holes;
- 2,8 mm metal wire cloth;
- 2,0 mm metal wire cloth;
- 1,4 mm metal wire cloth;
- 1,0 mm metal wire cloth;
- 0,5 mm metal wire cloth;
- 0,25 mm metal wire cloth.

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NOTE If further classification of larger particles is required, sieves with round holes with an aperture of 4,0 mm and 5,6 mm can be applied.

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### 5.2 Collecting pan

For collection of material passing through the sieves, a collecting pan of adequate size is required.

### 5.3 Weighing containers

The weighing of the sieved particle fractions can be performed either by weighing the remaining material directly on the tarred weighed sieves or by collecting and weighing the material in weighing containers. For this purpose, an adequate number of weighing containers are required.

### 5.4 Brush

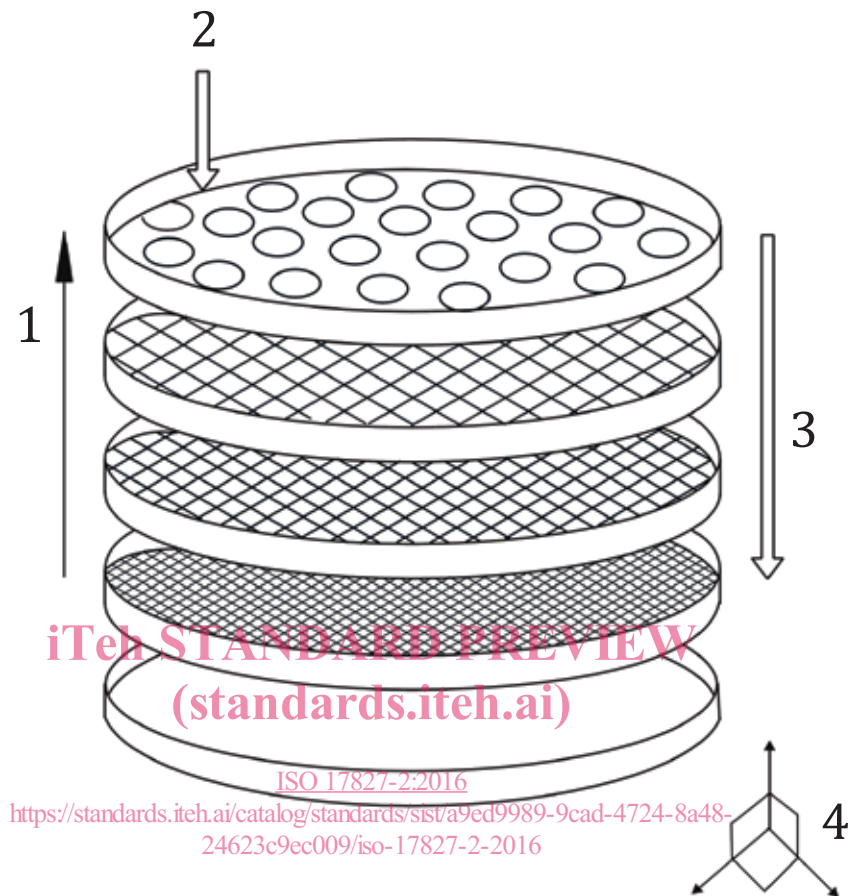
For cleaning the sieves, a brush is required.

### 5.5 Mechanical sieving equipment

The mechanical device (sieving machine) shall apply a vibration on the sieves. Some sieving machines have adjustable parameters. The results of the sieving may differ depending on how adjustable parameters are controlled. It is therefore important for comparative purposes to report how adjustable parameters have been used in terms of frequency, amplitude, duration, etc. If machines have adjustable, dimensionless settings, an estimate of the adjustable degree shall be recorded to the best of the ability of the operator.

For a principle drawing of the sieving operation, see [Figure 1](#).

NOTE Be aware that vibrating at an amplitude that is too low might lead to incomplete particle segregation. The minimum amplitude can be determined by pre-tests.



### Key

- 1 increasing hole diameter
- 2 material addition
- 3 material flow direction
- 4 vibration direction

**Figure 1 — Principle of the sieving operation**

## 5.6 Balance

The balance shall be capable of reading to the nearest 0,01 g.

## 6 Sample preparation

### 6.1 Sample size

The laboratory sample shall be obtained in accordance with ISO 18135 and a test sample of minimum 50 g shall be extracted using volume reduction methods in accordance with ISO 14780. To prevent overloading of the sieves, the height of the layer of material on the upper sieve shall never exceed 2 cm. If the material height does exceed 2 cm, then the test sample shall be divided into test portions, which

are processed in sequential sieving operations. The results of the separate determinations of the test portions shall be combined in accordance with [Clause 8](#).

The laboratory sample shall include sufficient material for determination of size distribution and moisture content.

## 6.2 Moisture conditioning

The test sample shall be sieved at a moisture content below 20 w-% wet basis, thus preventing the particles from sticking together or losing significant amount of moisture during the sieving process. If necessary, the test sample shall be pre-dried. Drying is done in accordance with ISO 14780.

NOTE By pre-drying, as described in ISO 14780, the laboratory 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 test portion by following the procedure given in ISO 18134-1 or ISO 18134-2. The moisture content shall be determined and reported concurrently with the particle size distribution determination.

## 7 Procedure

The test sample to be used for sieving shall be weighed to the nearest 0,01 g.

Assemble and operate the mechanical shaking device with the appropriate sieves with decreasing aperture, ending with the collecting pan at the bottom. If the size of the test sample is significantly larger than the minimum 50 g proposed in [6.1](#), the test sample shall be divided into two or more test portions, which are to be processed subsequently.

Spread the material in an even layer on the top sieve and start the sieving operation. As a pre-test, a sieving operation shall be continued until the mass changes between two sequential sieves do not exceed a maximum of 0,3 % of the sample mass under test per 1 min time of sieving operation. As an alternative to the pre-test, a 30 min duration of the sieving operation is recommended.

The required minimum sieving time shall be determined for each equipment and type of fuel in separate pre-tests. Avoid losing any particles when determining individual weight differences during such pre-tests.

NOTE 1 If shorter sieving time is applied for the purpose of decreasing the abrasion, the results could be affected by machine characteristics.

During the sieving operation, particles may stick on the edge of the sieves due to static electricity generated during the shaking of the material. Any tendency of such problem should be observed during pre-testing and remediated by means of earthing the sieves using copper wires or braids.

NOTE 2 Be aware that an excessive sieving time might cause abrasion and a higher portion of fine fraction.

NOTE 3 If it is observed that the sample under test is not evenly distributed on each of the sieves, turn each of the sieves approximately 180° after approximately half of the sieve time has elapsed and complete the sieving operation.

In size classification by sieving, thin particles, which are longer than the diameter of a hole in the sieve, may pass through the sieve and mix with the particles in the smaller size fractions. In such case, these particles shall remain part of the fraction where they are retained.

Weigh the material in each sieve and in the collecting pan to an accuracy of 0,01 g and record each mass in a scheme equal to [Table 1](#). If a particle gets stuck in a hole of a sieve, it shall be removed and added to the mass of the fraction retained on that sieve (as if it did not pass the hole).



## 8 Calculation

The results of the particle size determination shall be expressed as percentages of the total mass of all fractions. If the test sample has been divided into two or more test portions, the mass of the respective fractions shall be added up before calculating the overall percentage of each size class. This procedure is illustrated in [Table 1](#), assuming the test sample is divided in two test portions. The table provides guidance for how a table can be structured but has to be adjusted for the number of test portions to be analysed.

The obtained mass for each test portion shall be summed up vertically in columns 1 and 2, respectively (or additional columns as applicable) and recorded in grams.

The total mass of each sieve fraction shall be summed up horizontally in column 3 and recorded to the nearest 0,01 g and expressed in column 4 as percent of the sum of all mass fractions. The cumulative w-% passing through is summed up in column 5. [Annexes A](#) and [B](#) provide research data for comparison.

The moisture content of the test sample shall be recorded in the lower section of [Table 1](#) and expressed as w-%.

The difference between the mass of the test sample and the sum of the mass of all sieve fractions in column 3 of [Table 1](#) shall be less than 2 %. Larger differences may occur due to lost or retained particles or due to changes in moisture content. In these cases, the causes for the deviation should be investigated and the measurement repeated. If this is not practical or the result still deviates by more than 2 %, then it shall be noted in the Test Report.

If an assessment of the performance characteristics is required (see [Clause 9](#)), the sieving operation shall be repeated using another test sample of the laboratory sample material. If sufficient sample material is not available, the fractions from the first determination may be re-mixed and used for the second determination.

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**Table 1 — Results of the particle size distribution analysis**

Sieve name	Fraction mm	(1)	(2)	(3)	(4)	(5)
		Mass of fraction in test por- tion 1  g	Mass of fraction in test portion 2  g (add more columns if necessary)	Total mass of fractions in columns 1 + 2 or more  g	Percentage mass fraction, based on the total mass of all fractions in column 3	Cumulative w-% passing through (summing up the mass fraction percentages in column 4)
First sieve (3,15 mm)	above 3,15					
Second sieve (2,8 mm)	2,8 to 3,15					
Third sieve (2,0mm)	2,0 to 2,8					
Fourth sieve (1,4 mm)	1,4 to 2,0					
Fifth sieve (1,0 mm)	1,0 to 1,4					
Sixth sieve (0,5 mm)	0,5 to 1,0					
Seventh sieve (0,25 mm)	0,25 to 0,5					
Collecting pan	below 0,25					
Total mass of all fractions	all				100 %	