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**Solid biofuels — Particle size  
distribution of disintegrated pellets**

*Biocombustibles solides — Détermination de la distribution  
granulométrique des granulés désintégrés*

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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*.

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## Introduction

In power plants with powder fuel burners for energy production, the operators need information about the particle size distribution of the fuel for optimising particle burnout during combustion. Fuel preparation equipment, such as pulverizers, are used for crushing pellets into the original particle sizes before the material was pressed into pellets. The method described in this International Standard is intended to characterize particle size distribution of the material contained within fuel pellets and also allows for a relative comparison of pellets of different manufacturing.

This method is based on experience with pellets made from sawdust, wood shavings and milled wood, as well as straw. The method may also be applicable for pellets produced from other solid biofuel materials provided that they can be dissolved into its constituents in water.

Pellets that are engineered to resist water, e.g. pellets from materials which have undergone some thermal treatments, cannot be characterised by this method.

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# Solid biofuels — Particle size distribution of disintegrated pellets

## 1 Scope

This International Standard aims to define the requirements and method used to determine particle size distribution of disintegrated pellets. It is applicable for pellets that fully disintegrate in hot water.

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

ISO 17827-2<sup>1)</sup>, *Solid biofuels — Determination of particle size distribution for uncompressed fuels — Part 2: Vibrating screen using sieves for classification of samples with apertures of 3,15 mm and below*

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

EN 14778, *Solid biofuels — Sampling*

EN 14780, *Solid biofuels — Sample preparation*

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## 3 Terms and definitions

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

### 3.1

#### sieve fraction

material collected on a sieve

## 4 Principle

The particle size distribution is determined after the sample pellets have been disintegrated in hot deionised water and dried in a drying cabinet or oven. The determination is performed by sieving the dried material in accordance with ISO 17827-2.

## 5 Reagents

Deionised water.

1) To be published.

## 6 Apparatus

**6.1 Disintegration container**, water proof container made of material such as stainless steel capable of withstanding a temperature of 100 °C. The container shall be able to hold at least 2 000 ml of the deionised water and the entire test portion of pellets without spilling over during stirring.

A lid or a cover, e.g. aluminium foil, shall be used to cover the container during the dissolving of the pellets in water.

Volume of container should be about 5 l.

**6.2 Electric kettle or other suitable equipment for water heating**, capable of heating at least 2 000 ml of water.

**6.3 Drying cabinet or oven**, shall be capable of maintaining a temperature of  $(60 \pm 5)$  °C with at least three air exchanges per hour. The air velocity shall be such that the test sample particles are not dislodged from the drying container(s).

NOTE Higher air exchange rates will shorten the drying time.

**6.4 Drying containers**, shall consist of non-corrodible heat-resistant material such as metal, glass or porcelain and be able to hold sufficient volume to accommodate the slurry from the disintegration container.

**6.5 Balance**, shall be capable of reading to the nearest 0,01 g.

**6.6 Sieves**, set of sieves described in ISO 17827-2 and listed in [Table 1](#) shall be considered the default sieve set. However, other sieve sets can be used based on the specific requirements as agreed upon by the interested parties such as listed in [Table 2](#).

**6.7 Weighing containers**, an adequate number of weighing containers are required.

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.

**6.8 Spoon**, shall be made of non-corrodible material for stirring the disintegration slurry.

**6.9 Mechanical sieving equipment**, sieving equipment in accordance with ISO 17827-2 shall be used for determination of the particle size distribution of the disintegrated pellets and to break down agglomerates of particles formed during the drying of the slurry.

Some sieving machines have adjustable parameters. The results of the sieving might differ depending on how adjustable parameters are controlled. It is therefore important, for comparative purposes, to report how the adjustable parameters have set 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.

**6.10 Flat surfaced tool**, or flat brush, shall be used for stirring the dried material and for separating agglomerated particles after drying and sieving.



## 7 Sample preparation

The laboratory sample used for the determination of particle size of disintegrated pellets shall be obtained in accordance with EN 14778 and a test sample shall be extracted using volume reduction methods in accordance with EN 14780. The recommended size of the test sample is  $(300 \pm 10)$  g.

NOTE If a larger test sample is used, the amount of water, container sizes, etc. needs to be adjusted accordingly.

## 8 Procedure

### 8.1 Disintegration

The test sample of pellets shall be transferred into the disintegration container.

Approximately 2 000 ml of deionised water at the temperature just below the boiling point shall be poured over the pellets. In order to avoid chemical dissolving components of the material, the water temperature shall not be maintained when the pellets are disintegrating. The amount of water used shall be sufficient to assure that the material fully absorbs its maximum capacity of water. This is indicated by the presence of free water in the disintegration container after about 30 min.

For pellets with high swelling ratio, such as straw pellets, the test sample can be reduced and/or the water volume be increased.

Using a spoon, the slurry shall be carefully stirred from the bottom and up until particles are segregated from each other.

The spoon shall be rinsed with deionised water in the container ensuring that all particles remain in the slurry.

The container shall be covered with a lid to protect from contamination and to prevent evaporation of water and left for at least 30 min or as long as is required to disintegrate the pellets. Some pellets may require longer time for full disintegration.

NOTE Some pellets can take 16 h to 24 h or more to disintegrate.

### 8.2 Drying

The disintegrated slurry shall be mixed well and transferred to an adequate number of drying containers. The disintegration container shall be rinsed carefully with deionised water and emptied into the drying containers.

Dry at a temperature not exceeding 60 °C in a drying cabinet or oven to reach a moisture content of between 5 w-% and 15 w-%.

NOTE The moisture content can be checked by periodic weighing provided that the exact weight of the empty drying container(s) and the exact weight and moisture content of the test sample are known.

### 8.3 Moisture conditioning

After drying is completed, stir the dried slurry with a flat surfaced tool to break up any agglomerates of particles or crust. The drying container(s) with the dried slurry are then placed in room atmosphere for at least 2 h in order for the material to reach moisture equilibrium with the room atmosphere.

The equilibrated test sample of the disintegrated pellets shall be divided into two test portions of approximately 150 g each in accordance with EN 14780 and marked with test portions "A" and "B".

Use test portion "A" to verify that the moisture content of the equilibrated test sample prepared for determination of the particle size distribution is between 5 % and 15 % by conducting a moisture test in accordance with ISO 18134-1.