
**Solid biofuels — Determination of
mechanical durability of pellets and
briquettes —**

**Part 1:
Pellets**

*Biocombustibles solides — Détermination de la résistance mécanique
des granulés et des briquettes —*

Partie 1: Granulés



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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).

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).

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 17831 consists of the following parts under the general title *Solid Biofuels — Determination of mechanical durability of pellets and briquettes*:

- *Part 1: Pellets*
- *Part 2: Briquettes*

Introduction

Compressed solid biomass fuel is usually classified either as pellets or briquettes, of which pellets usually have a diameter below 25 mm while for briquettes the diameter is higher (see ISO 17225-1). To account for the different particle dimensions, it was necessary to define different test apparatuses for determination of durability for pellets and briquettes.

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Solid biofuels — Determination of mechanical durability of pellets and briquettes —

Part 1: Pellets

1 Scope

This part of ISO 17831 defines a determination method for testing the mechanical durability of pellets. The mechanical durability is a measure of the resistance of compressed fuels towards shocks and/or abrasion as a consequence of handling and transportation.

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 14780, *Solid biofuels — Sample preparation*¹⁾

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

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, *Solid Biofuels — Sampling*¹⁾

3 Terms and definitions

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

4 Principle

A test portion is subjected to controlled shocks by collision of pellets against each other and against the walls of a specified rotating test chamber. The durability is calculated from the mass of test portion, after separation by sieving of particles less than 3,15 mm, and the mass of the test portion after tumbling.

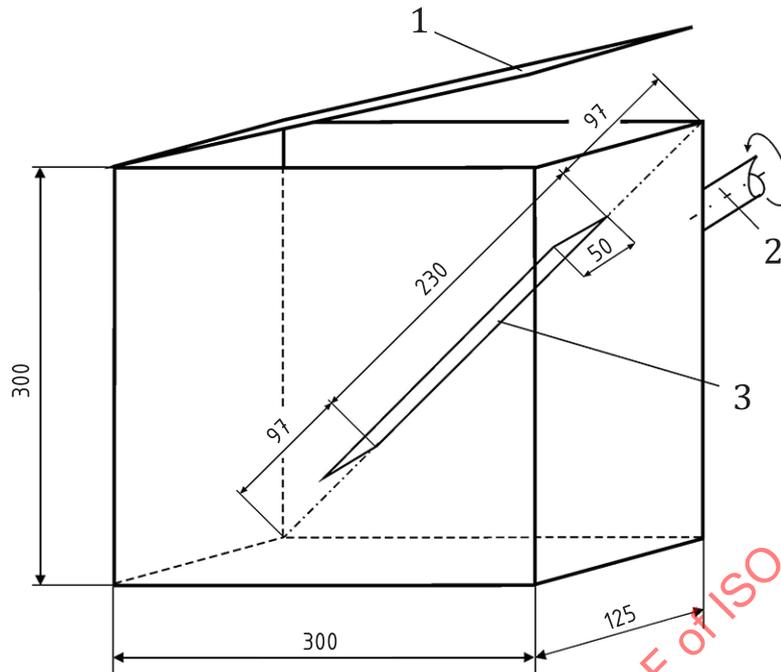
5 Apparatus

5.1 Pellets tester

The structure and dimensions of the pellet tester are shown in [Figure 1](#) (see also Annex A).

1) In preparation.

Dimensions in millimetres



Key

- 1 filling door
- 2 drive shaft
- 3 baffle

Figure 1 — Structure of the main parts of the pellet tester

The pellets tester shall consist of a dust tight box with an internal baffle for mixing of the pellets and a driving mechanism.

The box shall have an internal smooth surface and projections such as rivets and screws shall be kept to a minimum and well rounded (alternatively flathead screws can be used). A door can be placed at any side.

Specification of box and inner dimensions:

Material: stainless steel (1,5 ± 0,1) mm thick

Width (300 ± 3) mm

Height (300 ± 3) mm

Breadth (125 ± 1,3) mm

Specification of baffle and dimensions:

Material: stainless steel (1,5 ± 0,1) mm thick

Length: (230 ± 2,3) mm

Width: (50 ± 1,0) mm

The baffle is affixed on a diagonal of one of the 300 mm × 300 mm side of the box. The baffle extends (50 ± 1,0) mm into the box (see [Figure 1](#)) and is securely fastened to the back of the box. The edges of the baffle shall not be sharp but rounded to avoid any cutting effect.

The box shall be capable of rotating at a constant speed of (50 ± 2) r/min by means of an electric motor with suitable pulleys or gear in order to avoid vibrations. A rotation counter shall be connected to the drum.

The rotation counter can also be connected to the motor for automatic shut-off after a defined number of rotations.

5.2 Sieve

The sieve shall have a screen with 3,15 mm diameter round holes and suitable for manual screening (see ISO 3310-2). The recommended diameter of sieve is 400 mm or above.

5.3 Balance

The balance shall be capable of reading to the nearest 0,1 g and a weighing capacity of 2 kg.

6 Sample preparation

A laboratory sample of minimum 2 kg material for the determination of mechanical durability shall be obtained in accordance with ISO 18135 and prepared in accordance with ISO 14780. The test sample shall be divided into four equal test samples.

One test sample shall be used for determination of the total moisture content in accordance with ISO 18134-1 or ISO 18134-2.

Simultaneously for the determination of the durability each of the remaining three test samples shall be sieved separately in order to remove the fines (particles less than 3,15 mm) using a sieve as described in [5.2](#).

The sieving shall be performed by manually shaking each of the test portions in about 5-10 circular movements. The recommended amount of material in the sieve shall be less than $0,8 \text{ g/cm}^2$ of sieve area. This requirement will be achieved for example by using a sample of 1,0 kg on a sieve 400 mm diameter. If a sieve with a different diameter is used, the amount of the material shall be adjusted to achieve the same degree of filling.

The three test samples may be unified and divided into two portions in preparation for the tumbling ([7.1](#)).

7 Procedure

7.1 Tumbling procedure

Select one of the test portion of (500 ± 10) g from the unified sample (see [Clause 6](#)). For pellets above 12 mm diameter a test portion of (500 ± 50) g is allowed. Weigh the test portion to the nearest 0,1 g and place it in the tumbling box of the pellet tester (see [5.1](#)). Tumble the test portion at (50 ± 2) r/min for 500 rotations. After this, the test portion is removed and manually sieved ([7.2](#)) for separation of the fines.

The same procedure shall be performed for the second test portion from the unified sample (see [Clause 6](#)).

7.2 Sieving procedure

For sieving using a sieve described in [5.2](#). Sieving of the test portions after the tumbling procedure shall be done in such a way as to avoid generation of new fines. The sieving shall be performed by shaking each of the previously tumbled test portions one after the other with about 5-10 circular movements. The recommended sieve diameter shall be chosen in order to achieve a load of less than $0,8 \text{ g/cm}^2$ of sieve area (see also [Clause 6](#)).

The sieving has to be done completely. Weigh the material remaining on the sieve for each of the tumbled test portions. The pellets durability shall be calculated in accordance with [Clause 8](#).

8 Calculation of the mechanical durability

The mechanical durability of pellets shall be calculated using Formula (1):

$$DU = \frac{m_A}{m_E} \times 100 \tag{1}$$

where

DU is the mechanical durability, in %;

m_E is the mass of the sieved pellets before the tumbling treatment in g;

m_A is the mass of the sieved pellets after the tumbling treatment in g.

The result for each of the two test portions shall be calculated to two decimal places and the mean value result from the two test portions shall be rounded to the nearest 0,1 percent for reporting.

9 Performance characteristics

9.1 General

Table 1

Durability	Maximum acceptable differences between results	
	Repeatability limit	Reproducibility limits
Durability above or equal to 97,5 %	0,3 % absolute	0,6 % absolute
Durability under 97,5 %	2 % absolute	3 % absolute

9.2 Repeatability

The results of the duplicate determinations (performed within a short period of time, but not simultaneously) in the same laboratory by the same operator using the same apparatus on two representative test portions taken from the same laboratory sample, shall not differ by more than the values given in [Table 1](#) (see References [3], [4], [5], [6], and [7]).

9.3 Reproducibility

The mean value of the results of duplicate determinations, performed in each of two different laboratories on representative test portions taken from the same laboratory sample shall not differ by more than the values given in [Table 1](#) (see References [3], [4], [5], [6], and [7]).

10 Test report

The test report shall include at least the following information:

- a) identification of the laboratory performing the test and the date of the test;
- b) identification of product (or sample) tested;
- c) a reference to this part of ISO 17831, i.e. ISO 17831-1;
- d) result of the mechanical durability (as received) as mean value and the moisture content (as received);
- e) result of the mechanical durability (as received) for all individual replications (optional);

- f) any unusual features noted during the determination which can affect the result;
- g) any operation not included in this part of ISO 17831, or regarded as optional.

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