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

Part 2: Briquettes

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

Partie 2: Briquettes

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Foreword

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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).

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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 assigned to either 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.

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

Part 2:
Briquettes

1 Scope

This part of ISO 17831 defines a method for determining the mechanical durability of briquettes. 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 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

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

4 Principle

The test portion is subjected to controlled shocks by collision of briquettes against each other and against the walls of a specified rotating test chamber. The durability is calculated from the mass of the sample remaining after separation of abraded and fine broken particles.

1) In preparation.

5 Apparatus

5.1 Briquette tester

The briquette tester (durability drum) shall be a cylindrical steel drum with a nominal volume of 160 l, having the following dimensions (see Figure 1):

— internal length or depth: (598 ± 8) mm;

— internal diameter: (598 ± 8) mm.

The drum shall be made of minimum 1 mm steel plate. The internal surface area of the drum shall be smooth and any disturbances of the surface such as ridges or furrows shall be avoided.

The durability drum shall be equipped with a rectangular steel baffle having the following dimensions:

— length: (598 ± 8) mm;

— height: (200 ± 2) mm;

— thickness: 2 mm.

The baffle shall be welded on its length to the full height of the internal curved surface of the drum, parallel to the axis of the drum and perpendicular to the tangent of the curve. The baffle tip shall be shaped in a smooth curve of 90° to obtain a rim perpendicular to the baffle. The curve shall have a radius of r = 10 mm and the curved tip shall have a total vertical height of 30 mm. The direction of rotation and further details are illustrated in Figure 1.

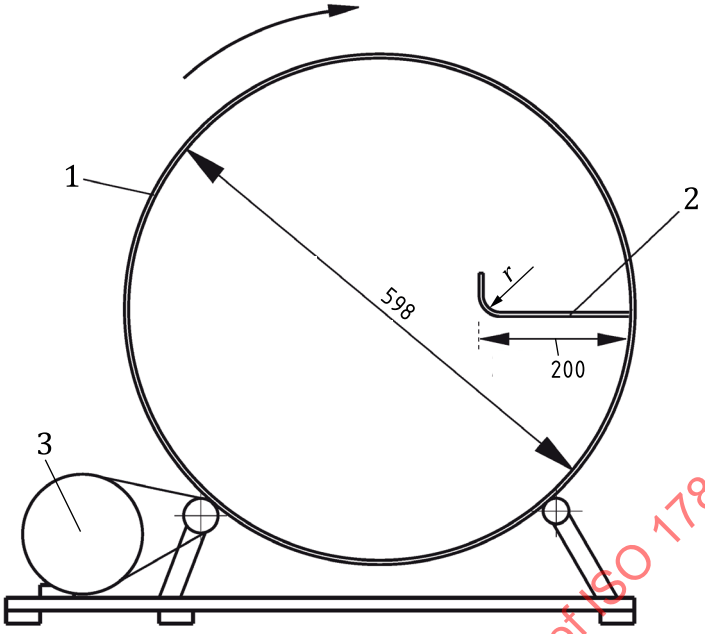
The drum is open on one of the ends. This opening shall be fitted with a dustproof lid of the same diameter as the internal diameter of the drum (598 ± 8) mm. When the lid is in position, it shall be approximately flush with the side of the cylinder. This lid shall be made of minimum 1 mm steel plate.

It shall be possible to fasten the lid securely by four rotating bolts (or any other suitable mechanism) fixed on the external part of the drum.

The drum shall be capable of being constantly driven at (21 ± 0,1) r/min by an electric motor, by suitable pulleys or gearings, in order to avoid vibrations. A rotation counter should be connected to the drum.

The rotation counter can also be connected to the motor so that the latter is automatically switched off after a defined number of rotations.

Dimensions en millimètres



Key

1 drum
2 baffle
3 motor

Figure 1 — Principle of the durability drum

5.2 Sieve

Depending on the briquette diameter, a sieve with a metal wire cloth conforming to ISO 3310-1 shall be chosen so that the aperture size is approximately equivalent to 2/3 of the briquettes diameter or diagonal but not exceeding 45 mm. The sieve is selected from the series between 16 mm and 45 mm in accordance with ISO 3310-1. The sieve shall have a diameter of 400 mm or above.

5.3 Balance

A balance with a weighing capability of at least 2 kg and capable of measuring the mass to the nearest 0,1 g.

6 Test sample preparation

The laboratory sample used for the determination of mechanical durability shall be obtained, and if necessary, divided in mass in accordance with ISO 18135 and prepared in accordance with ISO 14780. The size of the laboratory sample shall conform to the requirements of this part of ISO 17831 (depending on the nominal top size) but shall be at least 25 kg. For briquettes of type A, as defined in Table 1, the minimum required laboratory sample mass shall be 10 kg.

Divide the laboratory sample to obtain two test samples: one to be used for moisture content determination (5 kg), as received, the other for the mechanical durability test. The moisture content as received shall be determined on a non-sieved test sample simultaneously with the durability test; moisture shall be determined in accordance to ISO 18134-1 or ISO 18134-2.

The test sample for durability testing shall be stored in airtight containers to avoid moisture changes. While the test is being conducted, the test sample shall be at room temperature.

A test portion for a durability test shall be selected based on the average mass of a single briquette. The required size is determined after assigning the briquette to one of three briquette types A, B or C as described in Table 1. For this assignment, select 15 undestroyed briquettes from the test sample randomly. Then, weigh each briquette individually to the nearest 0,1 g using the balance as defined in 5.3. Calculate the average briquette mass of the 15 briquettes at moisture content as received. Then, select the applicable size of a test portion in accordance with Table 1. Do not cut or break any briquette of the test portion.

NOTE A briquette is undestroyed if all physical dimensions which define its shape are clearly recognizable. Abrasion and broken edges are not regarded as destruction. Cylindrical briquettes where the actual length is a result of natural breaking instead of cutting are also regarded as undestroyed.

Table 1 — Size of a test portion for briquette types A, B or C

Briquette type	Description	Size of a test portion
A	briquettes with a mass lower than 0,5 kg (as received)	≥2,0 kg (add max. 1 additional briquette to meet the requirement)
B	briquettes with mass of (0,5 to 1,0) kg (as received)	2 briquettes
C	briquettes with a mass higher than 1,0 kg (as received)	1 briquette

For briquettes of type A, prepare two test portions for the determination of durability. For briquettes of type B and type C, prepare five test portions for the determination.

The test portions shall not contain any small, broken particles. Small particles shall be separated from the test portion by the use of the sieve mentioned in 5.2 or by sorting out briquettes manually.

7 Procedure

7.1 Tumbling procedure

Select a test portion as described in Table 1. Weigh the test portion to the nearest 0,1 g and place it in the durability drum of the briquette tester (5.1). Tumble the test portion in the drum at (21 ± 0,1) r/min for 5 min (i.e. for 105 rotations ± 0,5 rotations). After this, the test portion is removed and manually sieved (7.2) for separation of the fines.

For briquettes of type A, as defined in Table 1, perform the same procedure for a second test portion.

For briquettes of type B or type C, as defined in Table 1, perform the same procedure with the other four test portions in order to achieve five test portion measurements in total.

NOTE Due to inconsistent sample sizes a comparison of results for briquettes of type A, B and C is not recommended.

7.2 Sieving procedure

For sieving use a sieve described in 5.2. The sieving of the test portions, after the tumbling procedure shall be done in such a way as to avoid generation of new particles. The sieving shall be performed by shaking the previously tumbled test portions one after the other in about 5 to 10 circular movements.

The sieving has to be done completely. The material remaining on the sieve shall be weighed and calculated as percent of the material loaded into the briquette tester. The durability of briquettes is defined according to Clause 8.

8 Calculation of the mechanical durability

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

$$DU = \frac{m_A}{m_E} \times 100 \quad (1)$$

where

DU is the mechanical durability, in percent;

m_E is the mass of sieved briquettes before the drum treatment, in g;

m_A is the mass of sieved briquettes after the drum treatment, in g.

The result for each test portion shall be calculated to two decimal places and the mean result for all test portions for a particular briquette type as per Table 1 shall be rounded to the nearest 0,1 % for reporting.

9 Performance characteristics

For the time being, not enough data is available for a precision statement regarding this test method.

10 Test report

The test report shall include at least the following information:

a) identification of laboratory performing the test and the date of the test;

b) identification of product (or sample) tested;

c) reference to this part of ISO 17831, i.e. ISO 17831-2;

d) result of the mechanical durability (at moisture as received) as mean value and the moisture content (as received);

e) results of the mechanical durability (at moisture as received) for all individual test portions;

f) shape and dimensions of the briquettes;

g) assignment of briquette to type A, B or C in accordance with Table 1;

h) any unusual features noted during the determination, which can affect the result;

i) any deviation not included in this International Standard, or regarded as optional.