International Standard

ISO 17828

Solid biofuels — Determination of bulk density

Biocombustibles solides — Détermination de la masse volumique apparente

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Principle ... **1**
5 Apparatus ... **2**
5.1 Measuring containers ... 2
5.1.1 Standardized containers ... 2
5.1.2 Large standardized measuring container ... 2
5.1.3 Small standardized measuring container ... 2
5.1.4 Measuring container for coarse biofuels ... 3
5.2 Balances ... 3
5.2.1 Balance 1 ... 3
5.2.2 Balance 2 ... 3
5.2.3 Balance 3 ... 3
5.3 Scantlings ... 3
5.4 Wooden board and impact surface ... 4
5.5 Apparatus for controlled shock exposure (optional) ... 4
5.6 Spill prevention aid (optional) ... 4
6 Sample preparation ... **4**
7 Procedure ... **4**
7.1 Determination of the container volume ... 4
7.2 Container selection ... 5
7.3 Measurement procedure ... 5
7.3.1 Procedure for standardized containers according to 5.1.2 and 5.1.3 ... 5
7.3.2 Procedure for non-standardized containers according to 5.1.4 ... 5
8 Calculation ... **6**
8.1 Calculation of bulk density as received ... 6
8.2 Calculation of bulk density on dry basis (optional) ... 6
9 Performance characteristics ... **7**
9.1 General ... 7
9.2 Repeatability ... 7
9.3 Reproducibility ... 7
10 Test report ... **7**
Annex A (informative) **Measuring differences of sample treatment with and without shock exposure** ... **8**
Annex B (informative) **Example of an apparatus for controlled shock exposure** ... **9**
Bibliography ... **10**

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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 document 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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This document was prepared by Technical Committee ISO/TC 238, *Solid biofuels and pyrogenic biocarbon,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 335, *Solid biofuels and pyrogenic biocarbon,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 17828:2015), which has been technically revised.

The main changes are as follows:

— introduction has been revised;

— dimensions of the small standardised container were modified to better reflect industry standard equipment, its volume has not changed;

— scope has been expanded to cover coarse fuels having a nominal top size larger than 63 mm;

— procedure for measuring bulk density of the newly included coarse fuels has been added;

— for newly included coarse fuels, a new measuring container has been defined;

— for fuels having a nominal top size of 63 mm and below, the optional use of an apparatus for controlled shock exposure is described; an example of such apparatus is added as informative Annex B;

— option to use a spill prevention aid has been included;

— rule for rounding reported result in the test report has been changed;

— test report clause has been revised.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Bulk density is an important parameter for fuel deliveries on volume basis, and together with the net calorific value, it determines the energy density. It also facilitates the estimation of space requirements for transport and storage. This document describes the determination of the bulk density of pourable solid biofuels which can be conveyed in a continuous material flow. For practical reasons, containers with different volumes are applied:

— standardized container of 5 l, e.g. for pellets, shavings, sawdust or grain kernels;

— standardized container of 50 l, for materials with a nominal top size of up to 63 mm;

— non-standardized container of more than 1 m^3 volume, for coarse bulk material with larger particle sizes.

The actual storage volume of a solid biofuel depends on the storage conditions, which can differ markedly from the conditions of sample analysis (e.g. height of heap versus volume of the standard measuring container, moisture content).

The described method using the standardized containers includes a defined shock exposure of the bulk material for several reasons. A shock leads to a certain volume reduction, which accounts for compaction effects occurring during the production chain. These compaction effects are mainly due to the fact that the fuel is usually transported and/or stored in containers or silos that are much larger than the measuring container as chosen for the described method. Thus, in practice, the higher mass load leads to an increased load pressure and to settling of the material. Vibrations during transportation can further increase this effect.

A procedure which applies a controlled shock to the sample was thus believed to reflect the practically prevailing bulk density in a better way than a method without shock. This is particularly true when the mass of a delivered fuel has to be estimated from the volume load of a transporting vehicle, which is a common procedure in many countries. Furthermore, in practice, the falling height of the bulk material during filling or unloading operations is greater than the falling height of the particles selected for the test. This will result in a respectively higher compaction due to the increased kinetic energy of the particles falling.

For a rough estimation on how susceptible the different solid biofuels are towards the shock exposure, some research data are given in Annex A. The data shows a compaction effect between 6 % and 18 % for different biomass fuels.

The determination of the bulk density of coarse bulk material with a larger particle size requires a larger container. Due to the size of the container, the compaction by shock exposure is omitted. The influence of container size and omitting the compaction should be taken into account when evaluating the results.

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Solid biofuels — Determination of bulk density

1 Scope

This document specifies a method for determining the bulk density of solid biofuels using a standardized measuring container. This method is applicable to all pourable solid biofuels with a nominal top size of maximum 63 mm while the maximum particle length is 200 mm. For fuels with a nominal top size larger than 63 mm, a different method is described.

Bulk density is not an absolute value; therefore, conditions for its determination have to be standardized in order to gain comparative measuring results.

NOTE Bulk density of solid biofuels is subject to variation due to several factors such as vibration, shock, pressure, biodegradation, drying, and wetting. Measured bulk density can therefore deviate from actual conditions during transportation, storage, or transhipment.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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*

ISO 16559, *Solid biofuels — Vocabulary*

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

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

ISO 18135, *Solid Biofuels — Sampling*

ISO 21945, *Solid biofuels — Simplified sampling method for small scale applications*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle

The test portion is filled into a container of a given size and shape, in most cases it is then compacted by defined shock exposure and weighed afterwards. The bulk density is calculated from the net weight per volume and reported with the determined moisture content.

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