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Solid biofuels — Determination of bulk density

Biocombustibles solides — Détermination de la masse volumique apparente

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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.

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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.