INTERNATIONAL STANDARD

ISO 18134-3

Second edition
2023-06

Solid biofuels — Determination of moisture content —

Part 3: Moisture in general analysis sample

Biocombustibles solides — Dosage de la teneur en humidité —
Partie 3: Humidité de l'échantillon pour analyse générale

Reference number
ISO 18134-3:2023(E)

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Published in Switzerland

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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 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*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 335, *Solid biofuels*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 18134-3:2015), which has been technically revised.

The main changes are as follows:

— Clause 6: statement added warning against loss or gain of moisture during sample preparation;

— references updated;

— minor editorial corrections.

A list of all parts in the ISO 18134 series can be found on the ISO website.

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.

Solid biofuels — Determination of moisture content —

Part 3:
Moisture in general analysis sample

1 Scope

This document describes the method of determining the moisture content in the general analysis sample by drying in an oven. The method described in this document is applicable to all solid biofuels. The moisture content of solid biofuels (as received) is always reported based on the total mass of the test sample (wet basis).

Since biofuels in small particle size are very hygroscopic, their moisture content will change with humidity in the atmosphere and, therefore, the moisture of the general analysis sample is determined simultaneously with the determination of other properties being measured (e.g. calorific value, volatile matter, metals, etc.).

NOTE Biomass materials can contain small amounts of volatile organic compounds (VOC) which can evaporate when determining moisture content by oven drying (see References [1] and [2]). The release of such compounds is quite small relative to the overall moisture content as determined by this method and is disregarded in this document.

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 11722, *Solid mineral fuels — Hard coal — Determination of moisture in the general analysis test sample by drying in nitrogen*

ISO 14780, *Solid biofuels — Sample preparation*

ISO 16559, *Solid biofuels — Vocabulary*

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 of the general analysis sample is dried at a temperature of (105 ± 2) °C in air atmosphere until constant mass is achieved and the percentage moisture is calculated from the loss in mass of the test portion.

Automatic equipment such as gravimetric analysers can be used when the method is validated with biomass reference test samples of selected biomass type. Analysis with such equipment shall fulfil all the requirements given in Clause 7 regarding sample size, temperature, atmosphere and weighing accuracy.

The general analysis sample may be dried in an air atmosphere or a nitrogen atmosphere. If the sample material is susceptible to oxidation (at 105 °C), drying in nitrogen atmosphere is performed in accordance with ISO 11722. The used drying atmosphere should be reported in accordance with Clause 10.

5 Apparatus

5.1 Drying oven, capable of being controlled at a temperature within a range of (105 ± 2) °C and in which the air atmosphere changes between three and five times per hour.

The air velocity shall be such that the test portion particles are not dislodged out of their weighing dish.

The use of nitrogen atmosphere is detailed in ISO 11722.

It is important that drying ovens maintain a consistent temperature throughout the heated chamber. The temperature tolerance provided is intended for all locations within the oven.

5.2 Dishes, of non-corrodible and heat-resistant material and of such dimensions that they will hold the total test portion in a layer not exceeding 0,2 g of material per cm^2 and covered by a well-fitted lid. The surface of the trays shall be such that the possibility of adsorption or absorption is minimized (very clean and even surface).

5.3 Balance, capable of reading to the nearest 0,1 mg.

5.4 Desiccator with desiccant to minimize absorption by the test portion of moisture from the atmosphere.

6 Sample preparation

6.1 General

Test samples shall be obtained in accordance with ISO 18135 or ISO 21945 and the preparation of a general analysis sample shall be conducted in accordance with ISO 14780. The nominal top size of the general analysis sample shall be reduced to below 1 mm.

WARNING — Dried solid biofuels are hygroscopic. Precautions shall be taken to ensure that moisture is not lost during preparation of the test portion. Significant losses of moisture from the test portion will occur after a few minutes in room atmosphere.

Before commencing the determination, mix the general analysis sample in its container, preferably by mechanical means, to ensure a well-mixed sample.

6.2 Size of test portion

The test portion shall have a minimum mass of 1 g.

7 Procedure

Dry an empty weighing dish with its lid at (105 ± 2) °C until constant in mass and cool to room temperature in a desiccator (5.4).

NOTE Several dishes can be handled at the same time.

Weigh the weighing dish with its lid to the nearest 0,1 mg.

Add minimum 1 g of the general analysis sample into the weighing dish in an even layer and weigh the weighing dish with its lid plus the test portion to the nearest 0,1 mg.

Heat the uncovered dish and its lid with the test portion at (105 ± 2) °C in the drying oven until constant mass has been achieved. Constant mass is defined as a change not exceeding 1 mg in mass during a heating period of 60 min. The drying time required will depend on the particle size of the material, the rate of atmospheric change in the oven and the thickness of the layer of material. Allow for up to 3 h.

Replace the lid immediately upon removal from the oven. Transfer the dish and its contents to a desiccator. Let it cool in the desiccator to room temperature.

Remove the dish and its lid with the test portion from the desiccator and weigh to the nearest 0,1 mg. Since small particle size biofuels are very hygroscopic, it is important to weigh rapidly once the test portion is taken out of the desiccator.

The moisture content determination shall be conducted in duplicate.

8 Calculation

The moisture content of the general analysis sample on an as-determined (as analysed) basis, M_{ad}, is expressed as a mass fraction, shall be calculated in accordance with Formula (1):

$$M_{ad} = \frac{(m_2 - m_3)}{(m_2 - m_1)} \times 100 \quad (1)$$

where

m_1 is the mass in grams of the empty dish plus lid;

m_2 is the mass in grams of the dish plus lid plus test portion before drying;

m_3 is the mass in grams of the dish plus lid plus test portion after drying.

The result shall be calculated to two decimal places and the mean value of both determinations shall be rounded to the nearest 0,1 % for reporting.

The test result may be converted to different basis as described in ISO 16993[3].

9 Performance characteristics

9.1 Repeatability

The result of duplicate determinations carried out in the same laboratory, by the same operator, with the same apparatus on representative portions weighed out at the same time from the analysis sample shall not differ by more than 0,2 % absolute.

9.2 Reproducibility

Since the humidity of the atmosphere and other factors in different laboratories can vary, it is not practical to quote a value regarding reproducibility.

10 Test report

The test report shall include at least the following information:

a) identification of the laboratory performing the test;

b) date of the test;

c) identification of the product (or sample) tested;

d) a reference to this document, i.e. ISO 18134-3:2023;

e) results of the test on a wet basis (alternatively, results of the test, including the basis in which they are expressed, as indicated in Clause 8);

f) any unusual features noted during the determination which could have affected the result;

g) any deviation from this document or operations regarded as optional.