INTERNATIONAL STANDARD

**ISO 638**

Second edition
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# Paper, board and pulps — Determination of dry matter content — Oven-drying method

*Papiers, cartons et pâtes — Détermination de la teneur en matières sèches — Méthode par séchage à l'étuve*



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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 638 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*.

This second edition cancels and replaces the first edition (ISO 638:1978), which has been technically revised. The scope has been changed to cover also paper and board instead of only pulps.

## Introduction

Determination of dry matter content and moisture content are carried out for different purposes.

This International Standard should be used when the dry matter content is needed to calculate the results for chemical analysis or physical testing. An example of this is where the results of a chemical analysis for cadmium or manganese are required on the basis of the oven-dry mass of the sample.

ISO 287[1] should be used for the purpose of determining the average moisture content and the variation in moisture content (maximum and minimum values) of a lot. In the converting of paper and board, moisture content is important as it can have an effect on processes such as printing and copying. Moisture content can have an effect on curl and dimensional stability.

ISO 4119[2] should be used in laboratory procedures or is referred to in other International Standards in which the concentration of an aqueous pulp suspension requires determination.

# Paper, board and pulps — Determination of dry matter content — Oven-drying method

## 1 Scope

This International Standard specifies an oven-drying method for the determination of the dry matter in paper, board and pulp.

The procedure is applicable to paper, board and pulp which does not contain any appreciable quantities of materials other than water that are volatile at the temperature of 105 °C ± 2 °C. It is used, for example, in the case of pulp, paper and board samples taken for chemical and physical tests in the laboratory, when a concurrent determination of dry matter content is required.

This method is not applicable to the determination of the dry matter content of slush pulp or to the determination of the saleable mass of pulp lots.

NOTE ISO 287[1] specifies the determination of moisture of a lot of paper and board; ISO 4119[3] specifies the determination of stock concentration of pulps; ISO 801 (all parts)[2] specifies the determination of saleable mass in lots.



## 2 Normative references



The following referenced documents are indispensable for the application 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 186, *Paper and board — Sampling to determine average quality*

ISO 7213, *Pulps — Sampling for testing*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

**3.1**
**dry matter content**
⟨paper, board and pulps⟩ ratio of the mass of a test piece, after drying to constant mass at a temperature of 105 °C ± 2 °C under specified conditions, to its mass before drying

NOTE The dry matter content is usually expressed as a percentage mass fraction.

**3.2**
**constant mass**
⟨paper, board and pulps⟩ mass reached by a test piece after drying at a temperature of 105 °C ± 2 °C until the difference between two successive dryings and weighings, separated in time by at least half the initial drying period, does not exceed 0,1 % mass fraction of the test piece before drying

## 4 Principle

Test pieces taken from pulp, paper or board samples are weighed before and after drying to constant mass. From the mass of the test piece before and after drying, the dry matter content is calculated.

## 5 Apparatus

**5.1 Balance**, accurate to 1 mg, for weighing test pieces of 2 g and less; for larger test pieces, accurate to 0,05 % mass fraction of the original moisture-containing test piece.

**5.2 Containers**, water vapour-proof, with tightly fitting lids, and made from a material (e.g. glass or plastic) not affected by the conditions of test.

**5.3 Drying oven**, capable of maintaining the air temperature at 105 °C ± 2 °C, and suitably ventilated.

**5.4 Desiccator**.

## 6 Sampling

If it is necessary to take a sample, ensure that it is representative of the material being sampled and take special precautions to avoid any change in moisture content of the material that will be tested. Report the source of the sample and the sampling procedure used.

Sampling from a lot shall be in accordance with ISO 186 for paper and board or ISO 7213 for pulps.



## 7 Preparation of test pieces



Do not use bare hands to handle the test pieces. Handle the test pieces and weighing containers with clean, dry, rubber or polyethylene gloves or tools. For determination of dry matter content of pulp, paper or board samples as received, place each test piece as soon as obtained in a tared container and close it immediately.

From the sample, select test pieces of the required grammage which are representative of the sample. The test piece size depends on the grammage of the sample. The size can be varied from 1 g to 2 g for very low grammage samples (e.g. papers) up to 50 g for high grammage samples (e.g. pulps or boards).

Cut or tear the test piece into a suitable size, taking into account the method of test for which the dry matter content is to be determined. In handling the test piece, special precautions shall be taken to avoid any change in moisture content. Test pieces which have been kept in water-vapour proof containers shall be quickly cut and weighed to minimize any variation in moisture content.

Prepare at least duplicate test pieces for each sample.

## 8 Procedure

Carry out all weighings according to the accuracy required of the balance (5.1). Weigh a test piece in the closed, previously dried and weighed container (5.2). After weighing, open the container and place it with test piece and lid in the oven (5.3) and heat at 105 °C ± 2 °C for a sufficiently long period until constant mass is reached.

The initial drying period shall be $\geqslant$ 30 min for material of grammage $\leqslant$ 200 g/m$^2$ and $\geqslant$ 60 min for grammage $>$ 200 g/m$^2$. The initial drying period, even for highly moist samples, should not be more than 16 h. The test piece is considered to have reached constant mass when the difference between two consecutive weighings is not more than 0,1 % mass fraction of the test piece before drying. The drying period between two consecutive weighings shall be at least one-half of the minimum initial drying time. During these periods do not put any new test pieces in the oven.

After drying, fit the lid on to the container and allow the test piece to cool in the desiccator (5.4). After cooling, equalize the air pressures outside and inside the container by quickly half-opening and reclosing the lid. Weigh the container and its contents.

Carry out two determinations or as many as are stated in the method of test for which the dry matter content is to be determined. The results of the parallel determinations should not deviate by more than 0,5 % mass fraction from their mean.

NOTE This International Standard is a reference method for determination of dry matter content based on oven dryness at 105 °C. Other drying techniques (e.g. microwave and infrared drying) are available on the market, but results from those techniques do not accord with this International Standard.

## 9 Expression of results

### 9.1 Calculation

Calculate the dry matter content, $w_{dm}$ , expressed as a percentage mass fraction, according to Equation (1):

$$w_{dm} = \frac{m_1}{m_0} \times 100 \quad (1)$$

where

$m_0$ is the mass, in grams, of the test piece before drying;

$m_1$ is the mass, in grams, of the test piece after drying to constant mass.



Calculate the mean dry matter content of the determinations, $\overline{w}_{dm}$ , and express the result to the first decimal place.



Moisture content can be calculated as described in Annex A.

## 10 Precision

### 10.1 Repeatability

Different kinds of pulp, paper and board samples were tested in 11 different laboratories according to this International Standard. The pooled repeatability was determined and the results are shown in Table 1.

**Table 1 — Repeatability for determination of dry matter content**

| Sample | Dry matter content<br>% | Coefficient of variation<br>% |
|---|---|---|
| Bleached kraft pulp | 94,6 | 0,08 |
| Unbleached kraft pulp | 94,5 | 0,14 |
| Copy paper | 96,1 | 0,06 |
| Uncoated paper | 95,9 | 0,10 |
| Carton board 1 | 94,0 | 0,08 |
| Carton board 2 | 93,8 | 0,15 |

### 10.2 Reproducibility

Different kinds of pulp, paper and board samples were tested in 11 different laboratories according to this International Standard. The results are shown in Table 2.

**Table 2 — Reproducibility for determination of dry matter content**

| Sample | Dry matter content<br>% | Coefficient of variation<br>% |
|---|---|---|
| Bleached kraft pulp | 94,6 | 0,27 |
| Unbleached kraft pulp | 94,5 | 0,32 |
| Copy paper | 96,1 | 0,23 |
| Uncoated paper | 95,9 | 0,38 |
| Carton board 1 | 94,0 | 0,36 |
| Carton board 2 | 93,8 | 0,34 |

## 11 Test report

The test report shall contain at least the following information:



a) reference to this International Standard;

b) the date and place of testing;



c) all information for the complete identification of the sample;

d) the results, expressed as a percentage mass fraction;

e) any optional points observed in the course of the test;

f) any deviations from this International Standard.

# Annex A
(informative)

## Calculation of the moisture content

Calculate the moisture content, $w_{H_2O}$, expressed as a percentage mass fraction, according to Equation (A.1):

$$w_{H_2O} = \frac{m_0 - m_1}{m_0} \times 100 \qquad \text{(A.1)}$$

where

$m_0$ is the mass, in grams, of the test piece before drying;

$m_1$ is the mass, in grams, of the test piece after drying to constant mass.

Calculate the mean moisture content of the determinations and express the result to the first decimal place.