INTERNATIONAL STANDARD

ISO 8226-2

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Paper and board — Measurement of hygroexpansivity —

Part 2:
Hygroexpansivity up to a maximum relative humidity of 86 %

Papiers et cartons — Détermination de la dilatation à l'humidité — Partie 2: Dilatation à l'humidité jusqu'à une humidité relative maximale de 86 %

Reference number
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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.

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.

International Standard ISO 8226-2 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps.*

ISO 8226 consists of the following parts, under the general title *Paper and board — Measurement of hygroexpansivity*:

— *Part 1: Hygroexpansivity up to a maximum relative humidity of 68 %*

— *Part 2: Hygroexpansivity up to a maximum relative humidity of 86 %*

Annex A of this part of ISO 8226 is for information only.

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Introduction

The measurement of dimensional changes in paper and board with changes in the ambient humidity is necessary for accurate control of printing and similar processes. The change in length, or hygroexpansivity, is due to stress relaxation of the paper fibres and swelling or contraction of the fibres by absorption or desorption of water. The proportion of the two mechanisms effective to produce hygroexpansivity depends upon the upper limit of relative humidity of the environment.

For the purpose of this part of ISO 8226 an upper limit of relative humidity of 86 % is imposed to accommodate the effects of stress relaxation on the hygroexpansivity.

ISO 8226-1 describes a method for the measurement of hygroexpansivity at 68 %.

The relationship between hygroexpansivity and relative humidity above approximately 68 % is non-linear, partly due to the effects of stress relaxation of the test piece above this humidity. A two-point measurement of hygroexpansivity can be used with humidities greater than 68 %, but no attempt should be made to interpolate or correct measurements in the range 33 % r.h. to 84 % r.h. to other relative humidity ranges, by simple arithmetical procedures.

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Paper and board — Measurement of hygroexpansivity —

Part 2:
Hygroexpansivity up to a maximum relative humidity of 86 %

1 Scope

This part of ISO 8226 specifies a method for the determination of the hygroexpansivity of paper and board when subjected to a change in the relative humidity with which it is in equilibrium from (33 ± 2) % to (84 ± 2) %.

The purpose of this part of ISO 8226 is to cover applications of paper and board intended to be used in high humidity conditions, e.g. as found in tropical countries. It may also be useful in determining the effect of excessive moisture to which paper may be subjected for short periods during some printing processes, e.g. offset printing.

This method is applicable to paper and board generally. It is not, however, suitable for crêpe papers and corrugated fibreboard.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8226. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8226 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 186:1985, *Paper and board — Sampling to determine average quality.*

ISO 187:1990, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples.*

ISO 8226-1:1985, *Paper and board — Measurement of hygroexpansivity — Part 1: Hygroexpansivity up to a maximum relative humidity of 68 %.*

3 Definition

For the purposes of this part of ISO 8226, the following definition applies.

hygroexpansivity: The increase in length relative to the initial length that occurs when the relative humidity with which the test piece of paper or board is in equilibrium is raised from a specified lower relative humidity to a specified higher relative humidity.

NOTE 1 A contraction of the test piece is regarded as negative hygroexpansivity.

4 Principle

To ensure that all test pieces being tested are brought to the initial relative humidity, from an immediate similar moisture level, this method includes a preliminary conditioning step, at a very low relative humidity.

Preliminary conditioning of test pieces at a specified temperature (preferably 23 °C ± 1 °C), under zero load and a relative humidity of (22 ± 3) % and then at relative humidities of (33 ± 2) % and (84 ± 2) %. Measurement of the change in length between the latter two relative humidities under a load appropriate to the grammage of the test pieces.

5 Apparatus

5.1 Cabinet, with air circulation, capable of being maintained at one of the temperatures specified in ISO 187, preferably 23 °C ± 1 °C. It shall be possible to attain uniform relative humidities of (22 ± 3) %, (33 ± 2) %, (50 ± 5) % and (84 ± 2) % within the whole cabinet and within a short time, for example, 30 min.

Any method which will provide the specified relative humidities within the tolerances indicated may be used, for example, the saturated salt solutions given in annex A.

5.2 Clamps, or other means for suspending the test pieces vertically in the cabinet (5.1) and provided with some means of ensuring the unloaded test pieces are free from tension.

5.3 Loading weights, for application to the test pieces during measurement (see table 1).

Table 1 — Test loads

Test piece grammage, ϱ_A g/m²	Total load (including clamps) N/m	Equivalent mass g/15 mm
$\varrho_A \leqslant 125$	15 ± 1	23 ± 1,5
$125 < \varrho_A \leqslant 200$	30 ± 1	46 ± 1,5
$200 < \varrho_A \leqslant 275$	50 ± 1	76 ± 1,5
$275 < \varrho_A$	80 ± 1	122 ± 1,5

5.4 Means for measuring the relative humidity of the air in the cabinet (5.1) with a precision of ± 1 % (maximum error of reading) and an accuracy of ± 2 % (maximum departure from true relative humidity).

5.5 Means for measuring the temperature in the cabinet (5.1).

5.6 Device for measuring the increase in length of the test pieces to the nearest 0,01 mm. This device may be mechanical or electronic.

6 Sampling and preparation of test pieces

6.1 Where possible, sample in accordance with ISO 186.

6.2 From undamaged specimens free from watermarks, folds and wrinkles, cut five test pieces in the machine direction and/or five in the cross direction as required. Each test piece shall be at least 20 mm longer than the nominal free span between the clamps, and the minimum free span shall be 100 mm. The width of the test piece shall be at least 15 mm. For the determination of hygroexpansivity in the machine direction or in the cross direction, cut the test pieces with the longer side parallel to the relevant direction.

7 Procedure

7.1 Initial length (l_0)

Set the clamps (5.2) inside the cabinet (5.1) to a span of at least 100 mm (known to within 1 mm). Clamp, then condition the unloaded test pieces for at least 30 min at the selected temperature (see 5.1) and at a relative humidity of (50 ± 5) %. Gently apply the appropriate load in accordance with table 1 and note the readings on the length-measuring devices (5.6) to the nearest 0,01 mm. Record this length as l_0.

7.2 Preliminary conditioning of test pieces

Condition the unloaded test pieces for at least 30 min at a relative humidity of (22 ± 3) %. Gently apply the appropriate load in accordance with table 1 and note the readings on the length-measuring devices. Remove the load and repeat the conditioning and measurement until the length under load changes by no more than 0,02 % between measurements.

NOTE 2 These readings are not used in the calculation.

7.3 Measurement of hygroexpansivity

Change the conditioning atmosphere to one of (33 ± 2) %, and record the relative humidity value obtained. Condition the unloaded test pieces for at least 30 min at a relative humidity of (33 ± 2) %. Gently apply the appropriate load in accordance with table 1 and note the readings on the length-measuring devices. Remove the load and repeat the conditioning and measurement until the length under load changes by no more than 0,01 mm. Record these to the nearest 0,01 mm (l_{33}).

Condition the test pieces in the same way for a minimum of 18 h in an atmosphere having a relative humidity of (84 ± 2) %. Note the relative humidity value obtained. Record the new readings (l_{84}) of the test pieces to the nearest 0,01 mm.

NOTE 3 Shorter conditioning times at a relative humidity of 84 % may be used by agreement, but this fact should be noted in the test report.