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International Standard



5630/4

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**Paper and board — Accelerated ageing —  
Part 4 : Dry heat treatment at 120 or 150 °C**

*Papier et carton — Vieillissement accéléré — Partie 4 : Traitement à la chaleur à 120 ou 150 °C*

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 5630/4 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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# Paper and board — Accelerated ageing — Part 4 : Dry heat treatment at 120 or 150 °C

## 0 Introduction

Exposure of paper or board to a hostile environment, such as some types of radiation, elevated temperature, or chemical attack over a period of hours, may provide information concerning the natural changes that may occur in the material over a period of years.<sup>[1, 2]</sup>

Hostile environments that have been used include exposure to dry heat, to heat and moisture, to visible and ultraviolet radiation, and to sulfur dioxide gas.

Properties compared before and after such exposure include mechanical, chemical and optical properties.

It has been determined that the degradation of cellulose is very sensitive to moisture.<sup>[3, 4]</sup> Comparison of accelerated ageing with natural ageing indicates that some moisture should be present in an accelerated ageing atmosphere.<sup>[5, 6]</sup> Dry accelerated ageing of cellulose is much less sensitive and probably does not rank papers in order of stability as accurately as moist accelerated ageing. It is much simpler to use and may be adequate for many purposes, but moist accelerated ageing should be used where the greatest correlation with natural ageing is needed.

ISO 5630 at present consists of the following parts :

Part 1 : Dry heat treatment.

Part 2 : Moist heat treatment at 90 °C and 25 % relative humidity.

Part 3 : Moist heat treatment at 80 °C and 65 % relative humidity.

Part 4 : Dry heat treatment at 120 or 150 °C.

## 1 Scope and field of application

This part of ISO 5630 specifies a procedure for heat treatment of paper and board in air at relatively high temperature and the general procedure for testing for heat-treated material. It is primarily intended for high purity papers such as are used for insulation in electrical equipment.

NOTE — Other standards of relevance to electrical papers are IEC Publications 216-1 and 2, IEC Publication 554-2 and IEC Publication 554-3-1.

This part of ISO 5630 does not contain any statement about the tests to be made on the paper. It is left to the parties concerned to determine which tests are appropriate for the type of paper being evaluated.

## 2 References

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

ISO 187, *Paper and board — Conditioning of samples.*

IEC Publication 216, *Guide for the determination of thermal endurance properties of electrical insulating materials*

— *Part 1 : General procedures for the determination of thermal endurance properties, temperature indices and thermal endurance profiles.*

— *Part 2 : List of materials and available tests.*

IEC Publication 554, *Specification for cellulosic papers for electrical purposes*

— *Part 2 : Methods of test.*

— *Part 3 : Specifications for individual materials — Sheet 1 : General purpose electrical paper.*

## 3 Principle

Heating of test pieces of paper or board in a closed oven either for 168 h at 120 °C (Procedure A) or for 24 h at 150 °C (Procedure B). Comparison of properties of the sample before and after this heat treatment.

NOTE — The two procedures are not necessarily equivalent, and in a specification for a particular paper the procedure to be used should be stated.

## 4 Apparatus

**4.1 Oven**, ventilated with a rate of air change of not less than 10 changes per hour, capable of maintaining an air temperature of  $120 \pm 2$  °C (Procedure A) or  $150 \pm 2$  °C (Procedure B), and so designed that, during the test, test pieces are not exposed to light nor to direct radiation from heating elements.

The design shall be such that the test pieces are uniformly exposed to the oven conditions. The test pieces shall be mounted so as to be at least 100 mm from the oven walls at any point to permit adequate circulation of air in all parts of the oven. Not more than 15 min shall be required to bring the oven back to working conditions after loading.

**4.2 Test equipment.** complying with the relevant International Standard, if any, or with another appropriate standard method.

**4.3 Desiccator,** or other preconditioner, maintained at 10 % to 35 % relative humidity.

## 5 Sampling

When possible, sampling shall be carried out in accordance with ISO 186.

## 6 Preparation of test pieces

For each property being evaluated (see clause 1), select and prepare two sets of test pieces in accordance with the relevant International Standard, if any, or another standard method, relevant to the required test.

Protect the test pieces from strong light.

Avoid handling the test pieces with bare hands and avoid undue exposure to the atmosphere of a chemical laboratory.

NOTE — It is convenient to cut the test pieces oversize and cut them to their correct size after ageing has been completed.

## 7 Procedure for heat treatment

Heat treatment shall be carried out in the dark.

Suspend one of the two sets of test pieces in the oven so that uncontaminated air at  $120 \pm 2$  °C (Procedure A) or  $150 \pm 2$  °C (Procedure B) can circulate around each test piece. Leave the test pieces in the oven for  $168 \pm 1$  h (Procedure A) or  $24 \text{ h} \pm 10$  min (Procedure B).

### NOTES

1 By agreement between the parties concerned, other ageing times may be used. If so, this shall be stated in the test report.

2 The oven should not contain more than one type of paper or board at any time, in order to prevent the possibility of contamination by distillation or sublimation products.

While this treatment is being carried out, keep the second set of test pieces in the dark.

## 8 Conditioning

**8.1** At least 2 h before completion of the heat treatment, place the untreated set of test pieces in a desiccator.

**8.2** On completion of the heat treatment, transfer both the treated and untreated sets of test pieces to the same conditioned atmosphere, regulated in accordance with ISO 187. Condition the test pieces for 24 h.

## 9 Procedure for testing

Test each set of test pieces for the properties previously determined to be appropriate for the type of paper or board being evaluated (see clause 1). Use the relevant International Standard, if any, or any other appropriate standard method.

## 10 Expression of results

Record the means and standard deviations of the test data for the unaged and aged test pieces.

The following are some of the ways in which the data may be presented :

- a) where the units of measurement allow, calculate the retention as a percentage of the property, based on the untreated value as 100 %;

NOTE — When the fold test is used as a measure of the extent of ageing, it is recommended that the percentage retention be calculated from the number of double folds (fold number) recorded before and after ageing, and not the folding endurance (logarithm to the base 10 of the fold number).

Retentions may also be plotted.

- b) a statistical test for significance of change in properties due to accelerated ageing should be made.

## 11 Test report

The test report shall contain the following information :

- a) a reference to this part of ISO 5630;
- b) reference to the International Standard, if any, or another standard method to which the testing procedure conformed.

The test report shall also include, as specified by the standard method to which the testing procedures conformed, the following particulars :

- c) all the indications necessary for complete identification of the sample;
- d) date and place of testing;
- e) the time and temperature of heat treatment;
- f) the mean value and standard deviation of the measured value of the appropriate property of the untreated material;
- g) the mean value and standard deviation of the measured value of the appropriate property of the treated material;
- h) any deviations from the relevant International Standard or other standards used, or any circumstances or influences which might have affected the test results.

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