

Wood-based panels — Determination of formaldehyde release —

Part 1: Formaldehyde emission by the chamber method

ICS 79.060.01

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National foreword

This Draft for Development is the English language version of ENV 717-1:1999.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because it is necessary to establish the correlation between each of the three types of apparatus (options) specified, and the reproducibility and repeatability of results using each of these types of equipment. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion into a European Standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its three-year life. The commencement of the review period will be notified by an announcement in *Update Standards*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European Standard, to extend the life of the prestandard or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee B/541, Wood-based panels, at 389 Chiswick High Road, London W4 4AL, giving the document reference and clause number and proposing, if possible, an appropriate revision of the text.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the BSI Standards Catalogue under the section entitled “International Standards Correspondence Index”, or by using the “Find” facility of the BSI Standards Electronic Catalogue.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the ENV title page, pages 2 to 30 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

Amd. No.	Date	Comments

This Draft for Development, having been prepared under the direction of the Sector Committee for Building and Civil Engineering, was published under the authority of the Standards Committee and comes into effect on 15 March 1999

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ICS

Descriptors: Wood products, wood-based panels, determination, emission, formaldehyde, analysis methods, enclosures

English version

Wood-based panels — Determination of formaldehyde release — Part 1: Formaldehyde emission by the chamber method

Panneaux à base de bois — Détermination du dégagement de formaldéhyde —
Part 1: Emission de formaldéhyde par la méthode à la chambre

Holzwerkstoffe — Bestimmung der Formaldehydabgabe —
Teil 1: Formaldehydabgabe nach der Prüfkammer-Methode

This European Prestandard (ENV) was approved by CEN on 15 November 1998 as a prospective standard for provisional application.

The period of validity of this ENV is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the ENV can be converted into a European Standard.

CEN members are required to announce the existence of this ENV in the same way as for an EN and to make the ENV available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the ENV) until the final decision about the possible conversion of the ENV into an EN is reached.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Prestandard has been prepared by Technical Committee CEN/TC 112 “*Wood-based panels*”, the secretariat of which is held by DIN.

This European Prestandard is one of a series which specifies methods for determining formaldehyde potential in or formaldehyde release from wood-based panels. The other standards of this series are:

EN 120, *Wood based panels — Determination of formaldehyde content — Extraction method called the perforator method*.

EN 717-2, *Wood-based panels — Determination of formaldehyde release — Part 2: Formaldehyde release by the gas analysis method*.

EN 717-3, *Wood-based panels — Determination of formaldehyde release — Part 3: Formaldehyde release by the flask method*.

This European Prestandard is based on CEN report CR213 “*Particleboards — Determination of Formaldehyde Emission under Specified Conditions*” and COST Project 613: Indoor Air Quality and its Impact on Man, Report No. 2: “*Formaldehyde emission from wood-based materials: Guideline for the determination of steady state concentrations in test chambers*”.

The status of an ENV instead of EN, has been proposed because in the test institutes which are generally working with only one or two types of test chambers (options), a large amount of knowledge indeed has been gained, but no convincing information exists on the reproducibility and repeatability of each of the options, and even less, information on the degree of mutual inter-correlation of results (see NOTE to the scope).

During the ENV period, a number of test institutes are prepared to participate in cooperation with the aim mentioned above, to acquire the necessary information, including solutions to some statistical questions, raised with regard to Annex C.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this European Prestandard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Prestandard specifies a chamber method with three options of test chambers for the determination of the formaldehyde emission from wood-based panels in terms of the steady-state concentration in a climate chamber under defined conditions, which relate to average conditions in real-life. This chamber method can also be applied to the estimation of formaldehyde concentrations under various conditions in practice, by the use of mathematical models.

NOTE During the ENV period, inter-laboratory tests will be carried out to determine the reproducibility and repeatability of this test method.

2 Normative references

This European Prestandard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Prestandard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies.

EN 326-1, *Wood-based panels — Sampling, cutting and inspection — Part 1: Sampling and cutting of test pieces and expression of test results.*

3 Definitions

For the purposes of this Prestandard the following definitions apply:

3.1

volume of the chamber

total air volume of the unloaded chamber, including recirculating ventilation ducts, expressed in cubic metres (m^3)

3.2

loading factor

ratio of the total surface area of the test piece, excluding the area of the edges, to the volume of the chamber, expressed in square metres per cubic metre (m^2/m^3)

3.3

air exchange rate

quotient of air volume passing through the chamber per hour (m^3/h) and the chamber volume (m^3)

3.4

air velocity

velocity of the air near the surface of test pieces in the chamber in metres per second (m/s)

3.5

steady-state

a steady-state (see clause 10) is reached when the formaldehyde emission of the wood-based panels is quasi constant under the test conditions, this means that the formaldehyde concentration in the chamber remains constant

NOTE In practice, a true steady-state is not achievable because formaldehyde is emitted irreversibly. This Prestandard defines a steady-state condition for the purpose of the test.

3.6

emission value

the steady-state formaldehyde concentration in the chamber, obtained under constant temperature, relative humidity, loading factor and air exchange rate, expressed by mass to volume in milligrams formaldehyde per cubic metre air (mg/m^3)

NOTE At 23 °C and 1 013 hPa, the following relationship exists for formaldehyde:

1 ppm (parts per million) = 1,24 mg/m^3

1 mg/m^3 = 0,81 ppm (parts per million)

4 Principle

Test pieces of known surface area, are placed in a chamber, in which the temperature, relative humidity, air velocity and exchange rate are controlled at defined values. Formaldehyde emitted from the test pieces mixes with the air in the chamber. The air in the chamber is sampled periodically. The formaldehyde concentration is determined by drawing air from the chamber through gas washing bottles containing water, which absorbs the formaldehyde. The formaldehyde concentration in the water is determined. The concentration of formaldehyde in the chamber atmosphere is calculated from the concentration in the water in the gas washing bottles and the volume of the sampled air. It is expressed in milligrams per cubic metre (mg/m^3). Sampling is periodically continued until the formaldehyde concentration in the chamber has reached a steady-state.

NOTE 1 The chamber method can also be used for the testing of formaldehyde emitting products other than wood-based panels.

NOTE 2 The influences of temperature, relative humidity, loading factor and air exchange rate on the formaldehyde concentration in the chamber atmosphere can be described by the Andersen formula. An interrelation between the structure of the test pieces, especially of their surfaces and the air velocity is also apparent but cannot be exactly described by a formula.

5 Reagents

5.1 General

Reagents and water of recognised analytical purity shall be used for the analysis.

5.2 Acetylacetone solution

4 ml acetylacetone are added to a 1 000 ml volumetric flask and made up to the mark with water.

5.3 Ammonium acetate solution

200 g ammonium acetate are dissolved in water in a 1 000 ml volumetric flask and made up to the mark.

NOTE Commercially prepared solutions may be used.

6 Apparatus

6.1 Test chamber

6.1.1 General

This Prestandard applies to different test chambers for formaldehyde emission testing which are described in Annex A.

General specifications and requirements which apply to all types of test chambers included in this Prestandard are given in 6.1.2 to 6.1.8.

6.1.2 Test chamber materials

Materials used for the inner walls and ducts of test chambers shall have a smooth surface, which, prior to testing, can be effectively cleaned with water. The surface shall be as inert and non-absorptive as possible to formaldehyde.

NOTE Proven materials are stainless steel or aluminium (sandblasted or polished), glass and some types of plastics (PVC, PMMA).

6.1.3 Air-tightness of the chamber

The test chamber shall be air-tight in order to avoid uncontrolled air exchange.

The criteria of air-tightness are given in 8.2.2.

6.1.4 Air circulation in the test chamber

The test chamber shall contain facilities (such as fan systems) capable of maintaining:

- intensive air mixing in the chamber;
- an air velocity of 0,1 m/s to 0,3 m/s at the surface of the test pieces (see 8.2.5).

6.1.5 Air exchange facilities

The test chamber shall contain air inlet and/or outlet facilities capable of regulating the air flow and thus the rate of air exchange (replacement of chamber air by clean, conditioned air) with an error limit of 5 % at an air exchange rate of 1/h.

Precautions shall be taken to ensure that the clean air inlet and the air circulation system are adequately placed to ensure sufficient mixing and that ambient air cannot enter into the air outlet, even during sampling.

6.1.6 *Clean air supply of the test chamber*

Equipment capable of providing clean air with a maximum formaldehyde content of 0,006 mg/m³ (0,005 ppm).

6.1.7 *Temperature and relative humidity regulating systems*

Equipment capable of maintaining the temperature and the relative humidity in the test chamber within the following limits:

- Temperature: $(23 \pm 0,5) ^\circ\text{C}$
- Relative humidity: $(45 \pm 3) \%$

6.1.8 *Equipment for monitoring of test conditions*

Measuring equipment and recording facilities capable of continuous or frequent monitoring of the specified test conditions with an error limit as follows:

- Temperature: 0,1 $^\circ\text{C}$
- Relative humidity: 1 %
- Air exchange rate: 3 %
- Air velocity: 0,05 m/s

6.2 *Air sampling system*

6.2.1 *General*

Figure 1 shows the principle of a sampling system for the determination of the formaldehyde concentration in the chamber air. The sampling tube shall be placed either in the air outlet, or inside the chamber, close to the air outlet.

NOTE Other sampling systems may be used, provided it can be shown that they give equivalent results.

6.2.2 *Equipment*

The air sampling system consists of the following components which are given in Figure 1. The numbers in brackets refer to the numbers in Figure 1:

6.2.2.1 *Sampling tube (1)*

6.2.2.2 *Two 100 ml gas washing bottles, containing water, for absorption and subsequent determination of formaldehyde (2)*

6.2.2.3 *Silica absorber for drying the air (3)*

6.2.2.4 *Gas flow valve (4)*

6.2.2.5 *Gas sampling pump (5)*

6.2.2.6 *Gas flow meter (6)*

6.2.2.7 *Gas meter (including a thermometer) for measuring the volume of air (7)*

6.2.2.8 *Air pressure meter (8)*

6.3 *Equipment for chemical analysis*

6.3.1 *Spectrophotometer*, suitable for use with cells with a path-length of at least 50 mm and capable of measuring absorbance at 412 nm

6.3.2 *Water bath*, capable of maintaining a temperature of $(40 \pm 1) ^\circ\text{C}$

6.3.3 *Six volumetric flasks*, 100 ml (calibrated at 20 $^\circ\text{C}$)

6.3.4 *Two volumetric flasks*, 1 000 ml (calibrated at 20 $^\circ\text{C}$)

6.3.5 *Bulb pipettes*, 5 ml, 10 ml, 15 ml, 20 ml, 25 ml, 50 ml, and 100 ml (calibrated at 20 $^\circ\text{C}$)

6.3.6 *Microburette*

6.3.7 *Six flasks*, 50 ml, with stoppers

6.3.8 *Balance*, scale interval 0,001 g

6.4 *Equipment for verification of air exchange rate*

6.4.1 *Compressed-gas cylinder with tracer-gas*

6.4.2 *Detector for continuous monitoring of tracer-gas*

6.4.3 *Recorder*

NOTE Dinitrogen monoxide (N₂O) with infrared (IR) detection has proved to be suitable.