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Wood-based panels — Determination of formaldehyde release —

Part 3:
Gas analysis method

Panneaux à base de bois — Détermination du dégagement de formaldéhyde —
Partie 3: Méthode d'analyse de gaz

IMPORTANT — Please use this updated version dated 2023-03-30, and discard any previous version of this FDIS. Closing date has been modified to 2023-07-05.

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 89, *Wood based panels,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 112, *Wood based panels,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 12460-3:2020), which has been technically revised.

The main changes are as follows:

— laser spectroscopy introduced as a further analytical procedure;

— ready to use formaldehyde standards considered in 8.4.4.3.

A list of all parts in the ISO 12460 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.

Wood-based panels — Determination of formaldehyde release —

Part 3: Gas analysis method

1 Scope

This document specifies a procedure for determination of accelerated formaldehyde release from uncoated and coated wood-based panels using the gas analysis method. The procedure is also suitable for the testing of other materials (e.g. edge bands, floor coverings, foams, foils, laminated wood products, veneered wood products, coated wood products).

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 16979, *Wood-based panels — Determination of moisture content*

ISO 16999, *Wood-based panels — Sampling and cutting of test pieces*

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological 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

A test piece of known surface area is placed in a closed chamber in which the temperature, humidity, airflow, and pressure are controlled to defined values. Formaldehyde released from the test pieces mixes with the air in the chamber. This air is continually drawn from the chamber and passes through gas wash bottles, containing water, which absorbs the released formaldehyde. At the end of the test, the formaldehyde concentration is determined photometrically or fluorimetrically. The formaldehyde release is calculated from this concentration, the sampling time, and the exposed area of the test pieces and is expressed in milligrams per square meter and hour ($mg/m^2 \cdot h$).

5 Reagents

Reagents of recognized analytical purity and distilled or demineralised water (referred throughout the following text as distilled water) shall be used for the analysis.

5.1 4 ml acetylacetone solution are added to a 1 000 ml volumetric flask and made up to the mark with distilled water.

5.2 200 g ammonium acetate solution are dissolved with distilled water in a 1 000 ml volumetric flask and made up to the mark.

Optionally, a premixed reagent of acetylacetone and ammonium acetate as described in ISO 12460-4 can be used.

5.3 Formaldehyde solution, commercially available (concentration typically between 35 % mass fraction to 40 % mass fraction).

5.4 Standard iodine solution, $c(I_2)$ = 0,05 mol/l.

5.5 Standard sodium thiosulphate solution, $c(Na_2S_2O_3)$ = 0,1 mol/l.

5.6 Standard sodium hydroxide solution, c(NaOH) = 1 mol/l.

5.7 Standard sulphuric acid solution, $c(H_2SO_4)$ = 1 mol/l.

5.8 Starch solution, 1 % mass fraction.

6 Apparatus

6.1 Main composites of test apparatus (see Figure 1).

6.1.1 Dust or particle filter.

6.1.2 Formaldehyde filter (bottle filled with water, silicagel or other formaldehyde absorber).

6.1.3 Desiccator, 500 ml, containing silica gel.

6.1.4 Air pump.

6.1.5 Needle valve.

6.1.6 Equipment for measuring rate of air flow through apparatus.

NOTE Needle valve and equipment for measuring rate of air flow can be replaced by a mass flow controller.

6.1.7 Test chamber (diameter: 90 mm to 100 mm with a length which gives an internal volume of (4 000 ± 200) ml with double casing of stainless steel or glass.

6.1.8 Heating equipment for air (e.g. copper coil inside the double casing).

6.1.9 Thermostat.

6.1.10 Magnetic valves.

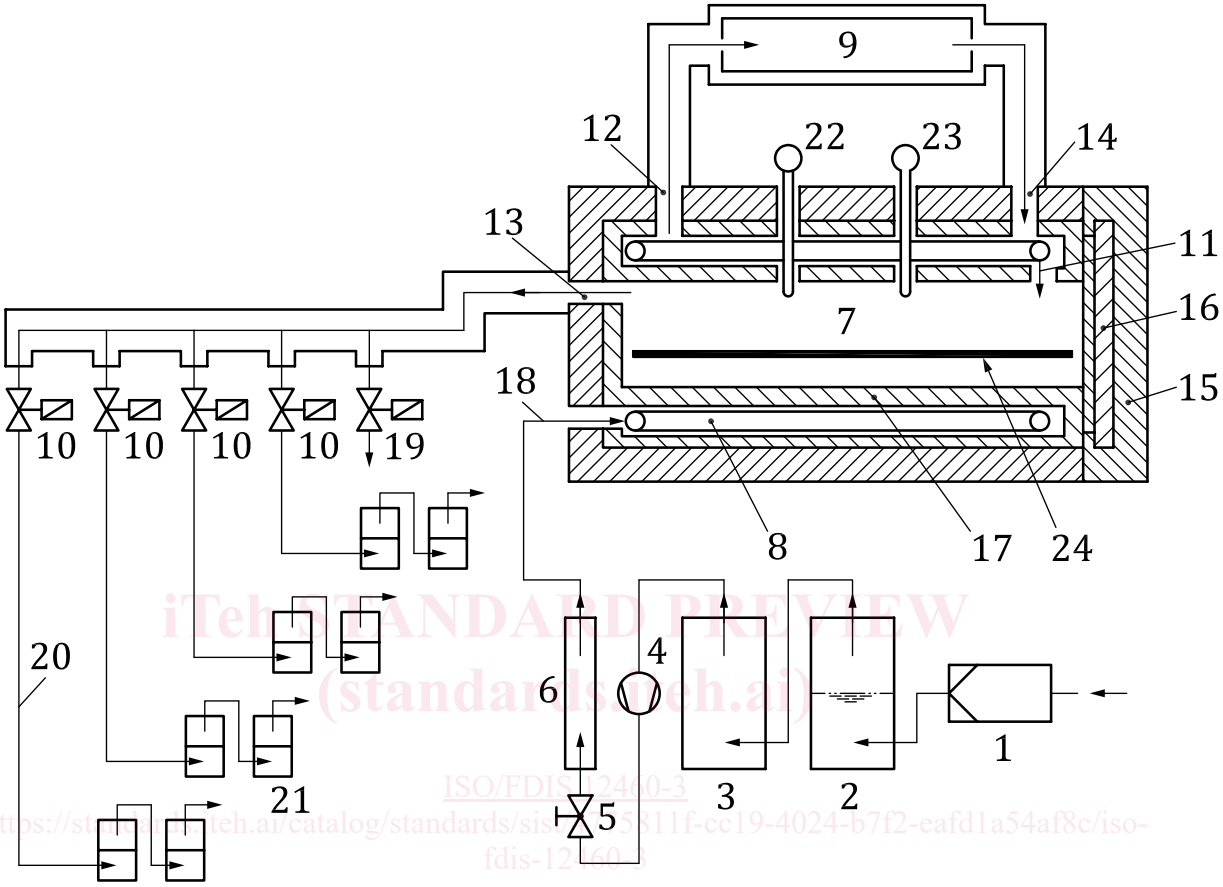
6.1.11 Pairs of gas wash bottles, 100 ml or optionally, pairs of gas wash bottles, 30 ml.

6.1.12 Pressure monitor.

6.1.13 Temperature monitor.

6.1.14 Test piece holder, constructed as a shelf with three rods made from stainless steel or another inert material.

NOTE The test apparatus described in Figure 1 is based on a waterborne heating system. A test apparatus with an electrical heating system can be used optionally.



Key

1 dust or particle filter
2 formaldehyde filter
3 desiccator
4 air pump
5 needle valve
6 equipment for measurement of air flow
7 test chamber
8 heating coil
9 thermostat
10 magnetic valves
11 inlet of air (test chamber)
12 heating medium (outlet)
13 outlet of test air
14 heating medium (inlet)
15 insulation
16 test chamber door
17 double casing
18 inlet for air (heating coil)
19 magnetic valve for purging
20 connection tube
21 pairs of wash bottles
22 pressure monitor
23 temperature monitor
24 test piece holder

Figure 1 — Gas analysis test apparatus

6.2 Laboratory equipment

6.2.1 Ventilated oven, as described in ISO 16979 for determination of moisture content (if requested).

6.2.2 Spectrophotometer, with cells of 50 mm optical path length and capable of measuring absorbance at 412 nm.

6.2.3 Water bath, capable of maintaining a temperature of (60 ± 1) °C.

6.2.4 Water bath, capable of maintaining a temperature in the range of 20 °C to 25 °C.

6.2.5 Six volumetric flasks, 100 ml (calibrated at 20 °C).

6.2.6 Four volumetric flasks, 250 ml or optionally, four volumetric flasks, 100 ml (calibrated at 20 °C).

6.2.7 Two volumetric flasks, 1 000 ml (calibrated at 20 °C).

6.2.8 Volumetric pipettes (calibrated at 20 °C), 1 ml, 2 ml, 5 ml, 10 ml, 15 ml, 20 ml, 25 ml, 30 ml, 50 ml, 100 ml.

6.2.9 Six flasks, 50 ml (with stoppers).

6.2.10 Microburette.

6.2.11 Burette, 50 ml, graduated (calibrated at 20 °C).

6.2.12 Balance, capable of measuring to 0,00 1 g.

7 Sampling and preparation of test pieces

7.1 Preparation of test pieces

Three test pieces, each with the dimensions of (400 ± 1) mm × (50 ± 1) mm × board thickness, shall be prepared for the determination of formaldehyde release giving a total emitting surface area of 0,04 m^2.

If the sample available does not allow the preparation of test pieces of the specified dimension, then the combined emitting surface area of the test pieces(s) should be as close as possible to 0,04 m^2.

For testing layer glued materials (e.g. plywood, veneered particleboard), specimens shall be cut from the respective panel with the fibre direction of the faces perpendicular to the longitudinal axis of the specimen.

Each test piece has to be hermetically wrapped immediately after cutting and stored at ambient temperature.

Before testing, each test piece shall be stored hermetically wrapped at least one day at ambient temperature in order to improve the repeatability. For factory production control with hot test pieces, a valid correlation has to be established.

Test pieces shall be representative for the tested boards.

For testing, the test pieces shall be edge sealed with temperature resistant (i.e. ≥60 °C) self-adhesive aluminium tape or an alternative sealing method if equivalence has been demonstrated. The emitting (unsealed) surface area of the sealed test piece has to be measured and calculated in square metres (m^2).

For decor finish foils it is recommended to pre-condition the material as follows in order to take into account inhomogeneity as to improve precision: 7 days at (20 ± 2) °C and (65 ± 5) % relative humidity.

7.2 Selection of test pieces for factory production control

Sampling and cutting of the test pieces shall be performed in accordance with the principles of ISO 16999.

Test pieces are taken, uniformly distributed over the width of the (cooled) board, but excluding a 250 mm wide strip from the end of each board.

The formaldehyde determination should be carried out not more than 72 h after sampling.

7.3 Selection of test pieces for other purposes

The procedure of sampling, preparation of the test pieces, and conditioning (e.g. from boards already installed) shall be noted and described in the test report. The number and dimensions of the test pieces shall be as given in 7.1.

7.4 Preparation of test pieces in case of dispute

If this method is used in case of dispute, e.g. linked to disagreement about compliance and not otherwise agreed upon, the conditioning of the test pieces shall be carried out according to the following reference conditions.

The test pieces shall be conditioned to constant mass at a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

Constant mass is considered to have been reached when the results of two successive weighings, carried out at intervals of not less than 24 h, do not differ by more than 0,1 % of the mass of the test pieces. Alternative two weeks of conditioning can be used.

Contamination of test pieces from other sources of formaldehyde during conditioning shall be avoided.

8 Procedure

8.1 Number of determinations

Determination shall always be made in duplicate using two different test pieces prepared according to 7.1. A third determination shall be carried out

— if the average emission value of the two determinations is >1,0 mg/m^{2}h and the two replicates deviate more than 20 % of the average value, or

— if the average emission value of the determinations is ≤1,0 mg/m^{2}h and the two replicates deviate more than 0,2 mg/m^{2}h from the average value.

For factory production control, a single determination can be sufficient.

8.2 Determination of moisture content

Moisture content shall be determined in accordance with ISO 16979 using a separate sample (see 7.1).

8.3 Determination of formaldehyde release

8.3.1 General

The determination of formaldehyde release can be done by using different procedures, which are described as standard procedure (see 8.3.2), to improve the sensitivity (see 8.3.3 and 8.3.4) and to simplify the procedure (see 8.3.5).

Seal the edges of the test pieces in accordance with 7.1.

Close chamber (6.1.7) and preheat it to (60 ± 0,5) °C.

For each test hour connect a pair of wash bottles (see 6.1.11), each bottle containing between 8 ml to 40 ml absorber solution, in series to the outlet of each magnetic valve (see 6.1.10) using flexible tubing by using four different options to improve the sensitivity of the analytical procedure and simplify the test method (8.3.2 to 8.3.5). The flexible tube shall be isolated in case of using the procedure of 8.3.3 or 8.3.5 in order to avoid condensation which requires the rinsing of the tube.

The absorber volume is chosen to maintain an overpressure of (1 100 ± 100) Pa in the test chamber. The pressure in the test chamber is monitored during the entire test period (see 6.1.12).

Place a test piece in the preheated test chamber. After closing the test chamber and starting the test, the test piece is uniformly exposed to practically formaldehyde free, heated air (60 ± 0,5) °C with a relative humidity of ≤3 %. Immediately set the airflow into the chamber to (60 ± 3) l/h using the needle valve (6.1.5) and the air volume meter (6.1.6). This air is led into one of a series of pairs of gas wash bottles via a magnetic valve (6.1.10).

Instead of leading dry and clean air through gas wash bottles, dry and clean compressed air may be used optionally.

As the formaldehyde released from the test piece shall be determined at hourly intervals (up to 3 h or 4 h from starting the test), a new series of gas wash bottles has to be connected and analysed every hour according to the analytical procedures given in 8.3.2 to 8.3.5. This exchange should be automatic.

For uncoated and coated particleboards and MDF with a thickness of at least 6 mm the test period may be reduced to 3 h. For all other material, a test period of 4 h is required. Tests can be carried out for 3 h provided that there is no significant difference with the results obtained after 4 h.

An overview of the 4 options for the determination of formaldehyde release is given in Table 1.

Table 1 — Options for the analytical procedure

Option	Volume of wash bottle ml	Number of wash bottles connected to gas analysis apparatus	Number of wash bottles used for analysis	Type of absorber	Volume of absorber solution filled in wash bottles ml	Procedure for analysis	Volume of solution resp. volumetric flask after rinsing ml
1	100	2	2	distilled water	20 to 40	transfer and rinsing to defined volume of volumetric flask	250
2	30	2	2	distilled water	8 to 10	transfer and rinsing to defined volume of volumetric flask	100
3	100	2	2	distilled water	30[c]	10 ml distilled water used for analysis (8.4.3)	not applicable

[a] Mixed reagent: 10 ml distilled water/10 ml acetylacetone solution/10 ml ammonium acetate solution.

[b] 2nd wash bottle can be filled with water for pressure adjustment only.

[c] Other volumes may be used but the exact volume has to be determined and recorded for further calculation.

[d] Provided equivalence of test results was shown for each individual type of wood-based panel.