eco-INSTITUT label

Testing manual: determination of indoor air emissions from construction products, furniture and furnishings

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Content

1 Preliminary remark

This manual regulates the standardised procedure for examining emissions from construction products, furniture and further products for indoor use in test chambers as part of the eco-INSTITUT-Label certification. The chamber testsare performed in the laboratory of eco-INSTITUT Germany GmbH, which is accredited in accordance with DIN EN ISO/IEC 17025.

The specifications for sampling can be found in the sampling instructions.

2 General test chamber conditions

The volatile organic compounds are measured in the test chamber in a manner that simulates practical conditions. Standardised test conditions are defined based on the type of test piece. All emission measurements are performed according to DIN EN 16516 incl. DIN EN ISO 16000-9, DIN ISO 16000-6 and DIN ISO 16000-3.

Test chamber conditions according to DIN EN ISO 16000-9:

Chamber volume:	product-specific
Temperature:	23°C ± 1°C
Relative humidity:	50 % ± 5 %
Air pressure:	normal
Air:	cleaned
Air exchange rate:	product-specific
Inflow velocity:	0.1 - 0.3 m/s
Loading:	product-specific
Air sampling:	3 (2) and 28 (7) days, or 4 and 24 hours (hard surface cleaners), if necessary 24 hours after test chamber loading

During the continuous test, air samples are taken from the test chamber after 3 (or 2 or 4 hours) and 28 (or 7 and 24 hours) days (and after 24 hours, if necessary, to determine the monomeric isocyanates). Premature termination of the test is possible if the results after 7 days meet half of the respective 28-day limit values and no significant increase in the concentration of individual substances can be observed compared to the measurement after 3 days.

3 Analytics

3.1 Volatile Organic Compounds

To determine the concentration of volatile organic compounds according to DIN ISO 16000-6 approx. 5 L of test chamber air are drawn into Tenax with a volume flow rate of 100 mL/min.

The substances adsorbed on Tenax are analysed after thermal desorption by means of gas chromatographic separation and mass spectrometric determination. Gas chromatographic separation is performed using a 60 m long, slightly polar capillary column.

More than 200 calibrated compounds are determined and quantified individually: volatile organic compounds (C6 - C16), semi-volatile organic compounds (C16 - C22) and – as far as possible with this method – also very volatile organic compounds (less than C6).

Uncalibrated substances are quantified as toluene equivalents and, where possible, identified by comparison with a spectra library.

The measured concentrations of the substances are corrected based on the recovery rate of the internal standard (toluene-d8). The limit of quantification for both calibrated and uncalibrated substances is 1 µg/m³.

To determine formaldehyde and other short-chain carbonyl compounds (C1 - C6) according to DIN ISO 16000-3 85 L or 100 L of test chamber air are drawn into DNPH (dinitrophenylhydrazine) with a volume flow rate of 660 mL/min or 800 mL/min.

The substances derivatised with DNPH are analysed by means of high-performance liquid chromatography (HPLC).

The limit of quantification is 2 µg per m³.

All substances for which a LCI value has been derived in the AgBB assessment scheme are calibrated in accordance with DIN ISO 16000-6 or DIN ISO 16000-3 and are quantified on a substance-specific basis.

3.2 Calculation of sums according to eco-INSTITUT Label

The following definitions apply to the calculation of sums and R-values, taking into account the AgBB assessment scheme.

TVOC according to eco-INSTITUT-Label	Sum of all calibrated VOC ≥ 1 µg/m³ (quantified substance-specific) and all not calibrated VOC ≥ 5 µg/m³ (as toluene equivalent)
TVOC without LCI according to eco-INSTITUT-Label	Sum of all calibrated VOCs without LCI ≥ 1 µg/m³ (quantified substance-specific) and all non-calibrated VOCs without LCI ≥ 5 µg/m³ (as toluene equivalent)
TSVOC with LCI according to eco-INSTITUT-Label	Sum of all SVOC with LCI ≥ 1 µg/m³ (quantified substance-specific)
TSVOC without LCI according to eco-INSTITUT-Label	Sum of all calibrated SVOC without LCI ≥ 1 µg/m³ (quantified substance-specific) and all non-calibrated SVOC without LCI ≥ 5 µg/m³ (as toluene equivalent)
R value according to eco-INSTITUT-Label	R-value for all substances ≥ 1 µg/m³ with LCI value, calculated according to the LCI list of the AgBB scheme

At the measurement time point 28 days (or 7 days or 24 hours) after the test chamber was loaded, SVOCs with a NIK value are evaluated together with TVOC.

3.3 Quality assurance

The accreditation covers the analytical determination of all volatile organic compounds including test chamber methods. In order to check the analysis system, a standard that has a composition based on the specifications of the DIN EN 16516 standard is analysed for each evaluation. The stability of the analytical systems is documented by means of control charts using a test standard. In interlaboratory tests, which are carried out at least once a year, the performance of the laboratory is checked by comparing the results of identical samples with those of other laboratories.

Before the test piece is introduced into the test chamber, a blank value control is carried out for any volatile organic compounds already present.

3.4 Monomeric Isocyanates

To measure the isocyanate concentrations, approx. 100-150 L of test chamber air with a volume flow rate of 0.5-1 L/min is taken from a collector impregnated with a derivatisation reagent. The derivatised isocyanates are desorbed by extraction of the collector with acetonitrile in an ultrasonic bath and then analysed by means of HPLC and UV detection. Llimit of determination is 1 µg/m³.

3.5 Ammonia

To measure the ammonia concentration, 100 L of test chamber air is drawn at a flow rate of 0.5 L/min onto silica gel tubes coated with sulfuric acid. The ammonia concentration is determined in accordance with DIN EN 16516 and ISO 7150-1. Limit of determination is 10 µg/m³.

3.6 N-Nitrosamines

To measure the nitrosamine concentration, 100 L of air with a volume flow rate of 800 mL/min is drawn through a Thermosorb-N tube. The concentration of N-nitrosamines is determined in accordance with DGUV Information 213-523 or DIN CEN/TS 17985. The adsorbed N-nitrosamines are analysed by means of gas chromatography after elution with a dichloromethane/methanol mixture using a TEA detector (Thermal Energy Analyser). Llimit of determination is 40 ng/m³.

3.7 Carbon disulphide

To determine the concentration of carbon disulphide according to DIN ISO 16000-6 approx. 5 L of test chamber air with a volume flow rate of 100 mL/min are drawn into Tenax (chilled sampling).

The carbon disulphide adsorbed on Tenax is analysed after thermal desorption by means of gas chromatographic separation and mass spectrometric determination and quantified substance-specifically. The determined recovery rate of carbon disulphide from the test chamber is taken into account (determination limit: 1 µg/m³).

4 Report writing

The test report contains the following information:

- manufacturer's details (place of production, date of production, sampler, sampling date, batch no.)
- description of the test specimen production

- test chamber conditions according to DIN EN ISO 16000-9
- if applicable, the blank value of the substrate material according to DIN ISO 16000-6 and DIN ISO 16000-3 (except glass and metal)
- test chamber air concentrations, substance specific emission rates, CMR classification according to Regulation (EC) No. 1272/2008, TRGS 905, IARC list and DFG (MAK list) LCI values and R values for calibrated compounds (with CAS numbers, substance-specific quantified) according to DIN ISO 16000-6 and DIN ISO 16000-3
- test chamber air concentrations and substance specific emission rates for non-calibrated compounds calculated as toluene equivalent according to DIN ISO 16000-6For each measurement point in time, a display of all sum values for which a target value is defined in accordance with the eco-INSTITUT label's testing criteria
- test chamber air concentrations and substance-specific emission rates of monomeric isocyanates, ammonia, nitrosamines, and carbon disulfide (if tested)

5 Test specimen preparation and product-specific test chamber conditions

The loading of the test chamber with the test specimen is oriented to the maximum possible installation scenario of the product to be certified and is based on the loading factors of DIN EN 16516:

Scenario	**Examples**	**Loading factor L**[1]	**Air exchange r**	**Specific air flow rate Q (n/L)**
Wall	Wall filler, wall panels, bricks, sealing sheets	1 m^2/m^3	0.5/h	0.5 $m^3/(m^2 \cdot h)$
Floor or ceiling	Parquet flooring, flooring adhesive, footfall sound insulation, floor filler, hard suface cleaners	0.4 m^2/m^3	0.5/h	1.25 $m^3/(m^2 \cdot h)$
Small areas	Door, window, kitchen worktop, masonry mortar	0.05 m^2/m^3	0.5/h	10 $m^3/(m^2 \cdot h)$
Very small areas / joints	Joint sealants	0.007 m^2/m^3	0.5/h	71.4 $m^3/(m^2 \cdot h)$
Case furniture	Surface coating agents for furniture	0.5 – 1 m^2/m^3	0.5/h - 2/h	1 $m^3/(m^2 \cdot h)$
Mattresses	Latex mattresses, cold foam mattresses	0.65 m^2/m^3 or 0.067 piece/m^3 (scenario: 2 in 30 m^3)	0.5/h	0.77 $m^3/(m^2 \cdot h)$
Sprung frame		0.067 piece/m^3	0.5/h	7.5 $m^3/(piece \cdot h)$

[1] If the load is different, the air exchange is adjusted so that the specific air flow rate specification is adhered to for the respective scenario.

Scenario	Examples	Loading factor L[1]	Air exchange r	Specific air flow rate Q (n/L)
		component testing, piece-specific (scenario: 2 in 30 m³)		
Upholstered furniture / office chairs	Armchair, office chair	Whole-product testing: 1 - 20 m³; component : 250 L	0.5/h-2/h	4 m³/(piece·h) (ideal) or lower
Upholstery leather		0.33 - 0.66 m²/m³	0.5/h -1/h	1.5 m³/(m²·h)
Upholstery fabrics		0.33 - 0.66 m²/m³	0.5/h -1/h	1.5 m³/(m²·h)

If a product is not clearly classified into the above categories, it is classified in the closest realistic loading class, unless otherwise specified. If a product is processed on more than one surface (e.g. paints), the loading areas (e.g. ceilings and wall areas = 1.4 m²/m³ or ceilings, floor and wall areas = 1.8 m²/m³) are added together. Unless otherwise specified below, only the room-side surface is always considered and the reverse side sealed. Edges are sealed 100% or according to the specifications specified below.

5.1 Insulating materials from renewable and mineral raw materials

Panel-shaped insulating materials or insulating mats are cut to test piece size. The test piece is placed in the test chamber on a frame with open edges. All of the sides of the test piece are used to calculate the loading factor.

If insulation panels or mats of different thicknesses and/or weights are to be certified, a panel/mat of medium thickness/weight is used in each case.

Loose-fill and blow-in insulating materials are loosely scattered in a grid cube and arranged on the floor of the test chamber. 5 sides of the mesh cube are used to calculate the load. The material is compacted to such an extent that the injection density specified by the manufacturer for exposed coverage is achieved (unless clearly specified by the manufacturer, for cellulose fibres: 35 kg/m³, for injection wood fibres: 25 kg/m³). A test specimen preparation according to DE UZ 132 (status: October 2010) is possible.

The products are tested with a load of 0.4 m²/m³ for floor, ceiling and roof applications or 1.0 m²/m³ for walls. When used on several surfaces, the maximum load is 1.0 m²/m³.

Insulation adhesives are applied according to Chapter 5.7 and tested with a load of 0.4 or 1.0 m²/m³, depending on the intended use.

5.2 Levelling compounds

Fills that do not serve an insulating function are loosely poured into an aluminum mold and tested at the maximum layer thickness at which simple compaction without additional tools (e.g., by walking on it) is still intended.

5.3 Products in panel format

e.g. gypsum fibreboards, chipboards

The products are tested in accordance with DIN EN 717-1. The panels are cut to test piece size. The back is sealed. The ratio of the length of open (unsealed) edges U in relation to surface A is U/A = 1.5 m/m².

The products are tested with a load of 1.0 m²/m³ in the test chamber.

5.4 Products in plank format with tongue and groove connection

e.g. parquet flooring, panels

The planks are joined together and the test specimen is cut to the appropriate size so that the requirements of DIN EN ISO 16000-11, Section A.3.2, are met. In addition, a minimum joint ratio of specimen area to joint length of 2.5:1 must be selected in accordance with the DIBt Laboratory Handbook. (Note: For practical reasons, a ratio of sample area to joint length of 2:1 is often selected, resulting in a joint area of 2.5 m/m².) The edges and back are sealed 100%.

5.5 Elastic floor coverings in roll format

e.g. linoleum

The back is sealed. The ratio of the length of open (unsealed) edges U in relation to surface A must be U/A = 1.2 m/m² according to DIBt Laboratory Handbook.

5.6 Products in roll format without elastic floor coverings

e.g. textile floor coverings

The back is sealed. The edges remain open.

5.7 Paints, coatings and installation materials (except for clay products)

e.g. interior wall paints, parquet oil, adhesives, plasters, mortars, fillers

The products are prepared according to the Technical Data Sheet (TDS) of the manufacturer and applied to glass with the maximum application quantities and maximum thicknesses. The manufacturer's recommendations regarding the carrier material are only taken into account if glass is not suitable as a carrier due to wetting problems.

In general, the minimum order quantity and preconditioning time is specified according to EN 16402. In the case of multi-layer structures, the shortest intermediate drying times according to the manufacturer's TDS are taken into account. The specimen must be placed in the preconditioning chamber immediately after application of the final layer. Floor coatings are preconditioned in accordance with the manufacturer's specifications (e.g. in accordance with the specifications for the desired readiness for walking on or readiness for covering[2]). The maximum preconditioning time must not exceed the product-specific specification of EN 16402 of 3 days. Plasters and mortars are applied to glass with a minimum thicknessof 3 mm.

As far as technically feasible, adhesives are applied according to DIBt Laboratory Handbook with a toothed

[2] When specifying readiness for walking and covering, the preconditioning time is based on the specification for readiness for covering.

trowel TKB B 1 up to a quantity of 500 g/m², with TKB B3 for a quantity of 500 to 1,100 g/m², and with a toothed trowel TKB B 12 over 1,100 g/m². After completion of the test piece, it is preconditioned for 72 hours.

For adhesive strips that come with a protective liner, the protective liner is not taken into account in laboratory testing.

Screed and screed mortar are tested with a layer thickness of 12 mm without preconditioning.

5.8 Clay products

clay mortar, plaster, and filler

Clay paints are tested in accordance with Section 5.7. Clay mortars, plasters, and fillers are prepared according to the manufacturer's technical data sheet and applied to glass at maximum load, application rates, and thicknesses, provided that the applied layer does not exceed a thickness of 15 mm and the minimum application rate does not fall below the value specified in EN 16402. Masonry mortar, thin-bed mortar, joint mortar, and joint filler are tested at a loading rate of 0.4 m²/m³ and a layer thickness of 3 mm. If multi-layer systems are not strictly specified by the manufacturer, a single-layer application is performed. In the case of mandatory multi-layer systems, the shortest intermediate drying times specified in the manufacturer's technical data sheet (TDB) are taken into account. Immediately after application of the final layer, the test specimen must be placed in a 0.1 m³ test chamber for preconditioning. This chamber is operated at an air exchange rate of 4 h^{-1}. Preconditioning lasts 3 days for products with a layer thickness < 10 mm and 7 days for products with a layer thickness ≥ 10 mm. The high air exchange rate, which deviates from DIN EN ISO 16516, as well as the specified drying times, are due to the specific drying mechanisms of clay products and prevent mold growth. The specifications comply with the relevant recommendations of leading product manufacturers.

5.9 Joint sealants

Joint sealants are applied to a 10 mm wide and 3 mm deep aluminium mould, smoothed and transferred directly into the test chamber. Pre-conditioning does not take place.

5.10 Bricks

The edges and, if necessary, the back are sealed.

5.11 Doors

The stop side of the door (and frame) is considered. If the ratios of the materials used for the door structure are correctly represented, door leaves can be tested in test chambers ≤ 1 m³. In the case of inhomogeneous structures or if the frames are included in the certification, a test chamber ≥ 1 m³ must be selected. The back and cut edges of the door leaf are sealed. The rebate remains open. The surface of the side under consideration must be selected so that a load of 0.05 m²/m³ results. The frame is either additionally placed in the test chamber (≥ 1 m³) or tested separately (with separate certification). The loading must always be selected according to length, whereby the scenario of one frame in 30 m³ is taken as a basis (480 cm frame per door corresponds to a length-specific loading of 16 cm/m³). Only the part of the frame that is exposed on the hinge side when the door leaf is closed is considered. The seal is also regarded as an emission-relevant surface. All other surfaces and open cut edges must be sealed.

5.12 Partition walls

The products are tested with a load of 1 m^2/m^3. The surfaces on both sides are to be included when calculating the emission area. Cut edges are sealed.

5.13 Windows

Preferably, the whole product is placed with a load of 0.05 m^2/m^3 in a test chamber.

5.14 Cleaning products

The cleaning solution is applied to glass according to the manufacturer's instructions, but at least with 30 g/m^2.

5.15 Furniture, mattresses and sprung frames

Furniture, mattresses and sprung frames can be evaluated using whole-body, component or individual component tests.

- Whole-product testing: The complete product is placed in a test chamber.
- Component testing: Components of the product are removed and tested together in a test chamber in relation to the proportion in the product (e.g. mattress core incl. cover or parts of the sprung frames).
- Individual component testing: Individual components of the product are tested separately in different test chambers (e.g. different furniture fronts).

The examination of furniture is to be carried out in an open state.

The surfaces on both sides and the narrow surfaces (without surfaces subsequently sealed as a result of test specimen cuts) are to be included when calculating the emission area.

5.16 Cover materials

Textiles are tested with a load of 0.65 m^2/m^3, unless they are brought into the chamber as part of the testing of the complete product. The surface of only one side ist o be included when calculating the emission area.

5.17 Kitchen worktops

Kitchen worktops are tested with a load of 0.1 m^2/m^3, whereby the underside remains open and is taken into account in the load. The top side falls into the “small areas” category. Cut edges are sealed.

6 Determination of the odour characteristics

The determination of odour characteristics as part of eco-INSTITUT label certification is conducted in combination with the determination of volatile organic compounds in the test chamber. Test specimen manufacture, sample preparation and the setting of product-specific test chamber conditions thus take place in accordance with the measurement of volatile organic compounds in the test chamber according to DIN EN ISO 16000-9. The determination of odour characteristics in the test chamber can also be carried out analogously without the measurement of volatile organic compounds.

The measurement times for the odour test are based on the measurement times for determining volatile organic compounds. The first measurement time is 3 days for construction products and furniture, 2 days for mattresses and for cleaning products 4 hours after loading in the test chamber.

The odour panel consists of at least five investigators. Participating investigators must not suffer from anosmia and must be familiar with the 6-point scale in accordance with VDA 270. If the individual assessment of the grades differs by more than two grades, a repeat measurement with at least 7 investigators should be conducted.

An odour sample is taken from the test chamber by collecting an air sample of at least 20 litres in a Nalophan sampling bag. Alternatively, an odour test can be performed directly at the test chamber outlet using a funnel if the air flow volume at the funnel outlet is 0.6 - 1 L/s.

If the air sample is collected in a Nalophan sampling bag, this air is then offered to the investigators within 6 hours at the Airprobe via a funnel. The inflow velocity at the funnel outlet must also be 0.6 - 1 L/s.

The odour assessment takes place in accordance with the 6-point scale according to VDA 270.

The required value for the odour is a mean of 4 for the first measurement time. The required value for the second measurement time a maximum of 28 days (or 7 days for mattresses or 24 hours for cleaning products) after loading in the test chamber is a mean of 3.

If the required value of 3 is already fulfilled at the first measurement time, no further measurement times are required. If the mean at the first measurement time has a grade >4, the requirement for odour characteristics is not fulfilled.

A grade (mean) of 3-4 at the first measurement time leads to a repeat of the odour test for the last measurement time after a maximum of 28 days (or 7 days for mattresses or 24 hours for cleaning products).

If the mean is ≤ 3 at the last measurement time, the requirement for odour characteristics is considered fulfilled.

The requirement for odour characteristics is considered not fulfilled, however, if the grading at this time continues to have a mean of > 3.

The table shows an overview of the decision-making criteria:

Measurement time	Required value (mean)	Grade (mean)	Requirement fulfilled?	Further procedure
1	4	3	yes	No further measurement required
1	4	> 4	no	No further measurement required
1	4	3-4	yes	Further measurement time required
2	3	≤ 3	yes	-
2	3	> 3	yo	-

7 References

[1] AgBB – Evaluation procedure for VOC emissions from building products

[2] DIBt laboratory handbook, “Prüf- und Messverfahren für die gesundheitliche Bewertung von Bauprodukten“

[3] DIN EN 16402, Paints and varnishes - Assessment of emissions of substances from coatings into indoor air - Sampling, conditioning and testing

[4] DIN EN 16516, Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air

[5] DIN EN 717-1, Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method

[6] DIN ISO 16000-3, Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds in indoor and test chamber air - Active sampling method

[7] DIN ISO 16000-6, Indoor air - Part 6: Determination of organic compounds (VVOC, VOC, SVOC) in indoor and test chamber air by active sampling on sorbent tubes, thermal desorption and gas chromatography using MS or MS FID

[8] DIN EN ISO 16000-9, Indoor air - Part 9: Determination of the emission of volatile organic compounds from samples of building products and furnishing - Emission test chamber method

[9] DIN EN ISO 16000-11, Indoor air - Part 11: Determination of the emission of volatile organic compounds from samples of building products and furnishing - Sampling, storage of samples and preparation of test specimens

[10] VDA 270, Determination of the odour characteristics

The current version of the cited references as of the date of publication of this document applies.