eco-INSTITUT label

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

(Last updated: February 2022)

Content

1 Preliminary remark 1
2 General test chamber conditions 2
3 Analytics 3
4 Report writing 4
5 Test specimen production and product-specific test chamber conditions 4
5.1 Insulating materials from renewable and mineral raw materials 6
5.2 Products in panel format 6
5.3 Products in plank format with tongue and groove connection 6
5.4 Elastic floor coverings in roll format 6
5.5 Products in roll format without elastic floor coverings 7
5.6 Paints, coatings and installation materials 7
5.7 Joint sealants 7
5.8 Bricks 7
5.9 Doors 7
5.10 Partition walls 8
5.11 Windows 8
5.12 Cleaning products 8
5.13 Furniture, mattresses and sprung frames 8
5.14 Cover materials 8
6 Determination of the odour characteristics 9
7 References 10

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 analyses are performed in the laboratory of eco-INSTITUT Germany GmbH,

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

which is accredited both for the test chamber tests and for the subsequent analysis 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 -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 50% of the respective 28-day limit values are observed after 7 days and no significant increase in the concentration of individual substances can be observed compared to the measurement after 3 days. Approx. 5 L of test chamber air are drawn into Tenax with a volume flow rate of 100 mL/min and approx. 100 L into DNPH (dinitrophenylhydrazine) with a volume flow rate of 0.8-1 L/min. To measure the isocyanate concentrations, approx. 100-150 L of air with a volume flow rate of 0.5-1 L/min is taken from a collector impregnated with a derivatisation reagent. The ammonia concentration is determined by adsorption of the test chamber air in sulphuric acid solution. To measure the nitrosamine concentration, 200 L of air with a volume flow rate of 1.6 L/min is drawn through a sorbent tube. Carbon disulfide concentration is determined by chilled sampling on Tenax.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

3 Analytics

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 5% phenyl / 95% methyl polysiloxane capillary column.

The substances derivatised with DNPH to determine formaldehyde and other short-chain carbonyl compounds (C1 - C6) are analysed by means of high-performance liquid chromatography.

More than 200 compounds are determined and quantified individually, including the substances listed in the NIK list by the AgBB: 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).

All other substances are identified – as far as possible – by comparison with a spectra library.

These and unidentified substances are quantified by comparing their signal intensity with the signal of the internal standard (d8 toluene). The identification and quantification of the substances are carried out, as far as technically feasible, from a concentration (limit of determination) of 1 µg per m^3 test chamber air or 2 µg per m^3 for DNPH-derivatised substances.

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 (limit of determination: 1 $\mu g/m^3$).

The ammonia concentration is determined using UV/VIS spectroscopic determination of the indophenol concentration formed by the Berthelot reaction (limit of determination: 15 $\mu g/m^3$).

After elution, the adsorbed N-nitrosamines are analysed by means of gas chromatography with a dichloromethane/methanol mixture using a TEA detector (Thermal Energy Analyser) (limit of determination: 50 ng/m^3).

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 $\mu g/m^3$).

eco-INSTITUT Germany GmbH is accredited with flexible scope according to DIN EN ISO/IEC 17025. 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.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

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
- if applicable, the blank value of the substrate material (except glass and metal)
- substance-specific emission rates and test chamber air concentrations of substance-specific quantified identified compounds (with CAS numbers) and non-identified compounds calculated as toluene equivalent
- TVOC as the sum of the concentrations of substance-specific quantified identified compounds and non-identified compounds calculated as toluene equivalent (from 1 µg/m³, as far as technically feasible, decisive for the assessment)
- the TVOC calculated as toluene equivalent according to EN 16516 (informative)
- an evaluation part which evaluates the product-specific emission requirements (including totals). In the summation, all relevant determined substances (substance-specific calibrated VOC ≥ 1 µg/m³, as far as technically feasible, and non-calibrated VOC ≥ 1 µg/m³ as toluene equivalent) are considered. Substances below the determination limit are not taken into account.

5 Test specimen production and product-specific test chamber conditions

The loading of the test chamber with the test piece 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:[1]

Scenario	Examples	Loading factor L[1]	Air exchange n[1]	Specific air flow rate Q (n/L)
Wall	Wall filler, wall panels, bricks	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 $m^3/(m^2 \cdot h)$

[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.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

Scenario	Examples	Loading factor L[1]	Air exchange n[1]	Specific air flow rate Q (n/L)
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 – 1/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 component testing, piece-specific (scenario: 2 in 30 m^3)	0.5/h	7.5 m^3/(piece·h)
Upholstered furniture / office chairs	Armchair, office chair	Whole-product testing: 1 - 20 m^3; component : 250 L	0.5/h-2/h	4 m^3/(piece·h) (ideal) or lower
Upholstery leather		0.33 - 0.66 m^2/m^3	0.5/h -1/h	1.5 $m^3/(m^2 \cdot h)$
Upholstery fabrics		0.33 - 0.66 m^2/m^3	0.5/h -1/h	1.5 $m^3/(m^2 \cdot h)$

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 m^2/m^3 or ceilings, floor and wall areas = 1.8 m^2/m^3) 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.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

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/m^3, for injection wood fibres: 25 kg/m^3). A test according to the awarding criteria for the Blue Angel UZ 132 (status: October 2010) is recognised.

The products are tested with a load of 0.4 m^2/m^3 for floor, ceiling and roof applications or 1.0 m^2/m^3 for walls. When used on several surfaces, the maximum load is 1.0 m^2/m^3.

Insulation adhesives are applied according to Chapter 5.6 and tested with a load of 0.4 or 1.0 m^2/m^3, depending on the intended use.

5.2 Products in panel format

(e.g. gypsum fibreboards, chipboards)

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/m^2.[2]

The products are tested with a load of 1.0 m^2/m^3 in the test chamber.

5.3 Products in plank format with tongue and groove connection

(e.g. parquet flooring, panels)

The planks are joined together and the test piece is cut out in a suitable size so that a joint of 2.5 m/m^2 is formed.[3] Edges and back are 100% sealed. Edge emissions are captured by the joints.

5.4 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/m^2.[3]

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

5.5 Products in roll format without elastic floor coverings

(e.g. textile floor coverings)

The back is sealed. The edges remain open.

5.6 Paints, coatings and installation materials

(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.

The minimum order quantity is specified according to EN 16402.[4] 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. Preconditioning is carried out 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). The maximum preconditioning time must not exceed the product-specific specification of EN 16402.

Wall paints for interior use are always preconditioned for 3 days in accordance with EN 16402.

As far as technically feasible, adhesives are applied with a toothed trowel TKB B 1 up to a quantity of 500 g/m^2, with TKB B3 for a quantity of 500 to 1,100 g/m^2, and with a toothed trowel TKB B 12 over 1,100 g/m^2. After completion of the test piece, it is preconditioned for 72 hours. [3]

Plasters and mortars are prepared according to the TDS of the manufacturer and applied to glass with the maximum thickness. The minimum application thickness is 3 mm.

5.7 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.

5.8 Bricks

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

5.9 Doors

Cut edges are sealed. The frame is either additionally (proportionate to length, scenario: 1 frame in 30 m^3) inserted into the test chamber ($\geq$ 1 m^3) (with sealed cut edges) or tested separately (with separate certification).

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

5.10 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.

5.11 Windows

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

5.12 Cleaning products

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

5.13 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.

5.14 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.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

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. 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 270:2018. 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 270:2018.

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.

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH

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

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

[3] DIBt laboratory handbook, "Prüf- und Messverfahren für die gesundheitliche Bewertung von Bauprodukten", last updated: 13 February 2015

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

[5] VDA 270, Determination of the odour characteristics

eco-INSTITUT Germany GmbH / Schanzenstrasse 6-20 / Carlswerk 1.19 / D-51063 Köln / Germany / Tel. +49 221.931245-0
Fax +49 221.931245-33 / eco-institut.de / eco-institut-label.de / Geschäftsführer: Dr. Frank Kuebart, Daniel Tigges
HRB 17917 / USt-ID: DE 122653308 / Volksbank Rhein-Erft-Köln eG, IBAN: DE60370623651701900010, BIC: GENODED1FHH