natureplus e.V.

Guideline 5010

Low Emission Building Products

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for the awardance of the eco-label

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Introduction

Building products emit volatile organic compounds and thus have a significant influence on indoor air quality. In the interest of preventive health protection, low-emission products should be used indoors as far as possible. In order to give consumers and manufacturers the confidence that preventive health protection and compliance with legal requirements are constantly guaranteed, the following aspects, classifications and regulations are taken into account when evaluating emissions from building products as part of natureplus certification:

- the principle of minimization
- preventive health protection / the precautionary principle
- the interior room standard values of the Federal Environment Agency
- the classification according to TRGS 905/907, DFG-MAK list, EU regulation 1272/2008 and IARC classification
- the German regulations for the evaluation of VOC emissions from building products, the so-called AgBB scheme, developed by the Committee for the Health Evaluation of Building Products with limit values for e.g. volatile organic compounds, SVOC and for LCI values

Volatile organic compounds are determined in accordance with the international standards

- EN 16516 [1] [2]
- EN ISO 16000-9, ISO 16000-6 and -3. [1] [2]

1 Threshold Limits

The following emission limit values are derived from the above-mentioned aspects and must be complied with by products intended for indoor use that have been awarded the natureplus Eco-Label:

Test Parameters	Threshold Limits
24h after loading the test chamber	
Monomeric Isocyanates (only if relevant input components have been employed)	≤ 0,001 mg/m³ (TDI, HDI) ≤ 0,002 mg/m³ (MDI)
3 days after loading the test chamber	
TVOC - Total Volatile Organic Compounds [1, 2] TVOC for insulation materials made of cellulose [3] TVOC for textile floor coverings [4]	≤ 3,0 mg/m³ ≤ 10,0 mg/m³ ≤ 0,25 mg/m³
VOC (incl. VVOC and SVOC) classified in: [7] Regulation (EC) No. 1272/2008: Categories Carc.1A & 1B, Muta. 1A & 1B, Repr. 1A; TRGS 905: K1A, K1B, M1A, M1B, R1A; IARC: Group 1 & 2A; DFG (MAK-List): Category III1, III2	≤ 0,001 mg/m³
Regulation (EC) No. 1272/2008: Repr. 1B; TRGS 905: R1B	≤ 0,01 mg/m³
Carbon disulphide (only applies to products with latex components > 1 %)	≤ 0,05 mg/m³
Nitrosamines (only applies to products with latex components > 1 %)	≤ 0,0001 mg/m³
Requirement value for odour	≤ 4 (average value)

Test Parameters	Threshold Limits
28 days after loading the test chamber[5]	
TVOC - Total Volatile Organic Compounds [1, 2] TVOC for textile floor coverings [4] TVOC for wood products [1, 6] TVOC for insulation materials made of cellulose [3]	≤ 0,3 mg/m³ ≤ 0,1 mg/m³ ≤ 1,0 mg/m³ ≤ 1,0 mg/m³
TSVOC - Total Semivolatile Organic Compounds TVOC for textile floor coverings [4]	≤ 0,1 mg/m³ ≤ 0,03 mg/m³
VOC (incl. VVOC and SVOC) classified in [7]: Regulation (EC) No. 1272/2008: Categories Carc.1A & 1B, Muta. 1A & 1B, Repr. 1A &. 1B; TRGS 905: K1A, K1B, M1A, M1B, R1A, R1B; IARC: Group 1 & 2A; DFG (MAK-List): Category III1, III2	≤ 0,001 mg/m³
VOC (Total) without LCI Values (Lowest Concentration of Interest) VOC (Total) without LCI Values for textile floor coverings [4]	≤ 0,1 mg/m³ ≤ 0,05 mg/m³
R-Value - Hazard index for the assessment of combinatorial effects of substances in an emitted mixture of substances of a building product	≤ 1 [8]
Requirement value for odour	≤ 3 (average value)
VOC (Individual amounts):	

Total bicyclic Terpenes (without wood products) Total bicyclic Terpenes for wood products	≤ 0,2 mg/m³ ≤ 0,7 mg/m³
Total VOC (incl. VVOC and SVOC) classified in[11]: Regulation (EC) No. 1272/2008: Categories Carc. 2, Muta. 2, Repr. 2; TRGS 905: K2, M2, R2; IARC: Group 2B; DFG (MAK-List): Category III3	≤ 0,05 mg/m³
Total C9 – C14 Alkanes / Isoalkanes	≤ 0,2 mg/m³
Total C4 – C11 Aldehyde, acyclic, aliphatic (without wood products) Total C4 – C11 Aldehyde, acyclic, aliphatic (for wood products)	≤ 0,1 mg/m³ ≤ 0,2 mg/m³
Total C9 – C15 Alkylbenzenes	≤ 0,1 mg/m³
Total Cresols	≤ 0,005 mg/m³
Total Xylenes	≤ 0,1 mg/m³
VOC (Individual amounts):	
Styrene	≤ 0,01 mg/m³
Methylisothiazolinone (MIT)	≤ 0,001 mg/m³
Benzaldehyde	≤ 0,02 mg/m³
2-Ethyl-1-hexanol, Ethylene glycol monobutyl ether, 2-Hexoxyethanol, Methyl-isobutylketone (Threshold limits per individual substance)	≤ 0,1 mg/m³

2-Butoxyethyl acetate	≤ 0,2 mg/m³
Glycol ether with insufficient data available[9] (Threshold limits per individual substance):	0.005 ppm
Propane-1,2-diol (Propylene glycol)	≤ 0,06 mg/m³
2-Phenoxyethanol	≤ 0,03 mg/m³
Phenol	≤ 0,02 mg/m³
Acetic acid [1]	≤ 0,6 mg/m³
1-Butanol	≤ 0,7 mg/m³
2-Propylene glycol-1-ethyl ether	≤ 0,3 mg/m³
Benzyl alcohol	≤ 0,4 mg/m³
Ammoniac (only applies to products for which an ammoniac measurement must be conducted in accordance with the relevant award guideline, e.g. GL0209 Wood and Wood-Based Flooring for smoked products, also when using relevant input materials in cases of justified suspect)	≤ 0,1 mg/m³
Formaldehyde	≤ 0,03 mg/m³
Formaldehyde for mineral products	≤ 0,02 mg/m³

Formaldehyde for textile floor coverings [4]	≤ 0,010 mg/m³
Acetaldehyde	≤ 0,03 mg/m³
Acetaldehyde for mineral products	≤ 0,02 mg/m³
Acetaldehyde (only applies to textile floor coverings) [4]	≤ 0,02 mg/m³
Acetaldehyde for composite products made from biobased raw materials with mineral binders without direct contact with indoor air (Wood-concrete composite products, insulation fills, fibre-cement/ fibre-lime bricks, etc.)	≤ 0,10 mg/m³

Footnotes

1: For wood products (products of GL 0104, 0105, 0107, 0108, 0201, 0202, 0203, 0204, 0205, 0206, 0207, 0208, 0209, 0210, 0211, 0212, 0213, 1005, 1500, 1600, 2001) the concentration of acetic acid in the TVOC is not taken into account. The acetic acid is considered on a substance-by-substance basis.

2: applies to all products tested according to RL 5010 if no other requirements for TVOC are defined in the following.

3: For products falling within the scope of RL 0106 and 0107, an increased requirement value for TVOC incl. saturated aliphatic hydrocarbons C17-C22 applies if it can be assumed that these hydrocarbons are emitted from the printing inks of the recycled paper.

4: For textile floor coverings (award basis 1400), an increased requirement based on certification systems of buildings applies.

5: Premature termination of the test is possible if 50% of the respective 28-day limits are met after 7 days and no significant increase in concentration of individual substances can be detected compared to the measurement after 3 days.

6: Products following GL 0201, 0202, 0203, 0204, 0205, 0206, 0207, 0208, 0209, 0210, 0211, 0212, 0213, 1005, 1500, 1600, 2001.

7: Formaldehyde and, by analogy, acetaldehyde (classification: Carc. 1B) are excluded due to an assumed "practical threshold" below which a significant carcinogenic risk is no longer to be expected. For these substances, an individual substance consideration is carried out.

8: based on the AgBB scheme (values up to 1.49 are permissible), the natureplus target value is 1.0.

9: cf. announcement of the Federal Environment Agency: guideline values for glycol ethers and glycol esters in indoor air, Bundesgesundheitsblatt, February 2013, Volume 56, Issue 2, pp 286-320.

10: If the odour score is less than 3, the requirement for the odour test is fulfilled and the test on day 28 is not required.

11: with the exception of acetaldehyde.

2 Test Method: Determination of Indoor Air Emissions

The following sections regulate the uniform procedure for the investigation of emissions from building products in test chambers.

The analyses are performed in laboratories which are accredited for both test chamber tests and the following analysis (Section 2.2) according to EN ISO/IEC 17025 and recognised by natureplus. [3]

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

The test must be started no later than 8 weeks after the product is cleared for trading.

In the intermediate period, the samples are stored in suitable packaging made of low-emission materials and under normal climatic room conditions.

2.1 General Parameters - Test Chamber

The volatile organic compounds are measured in the test chamber under conditions very close to actual practice. Depending on the type of test sample, standardized test conditions are defined.

All emission measurements are carried out according to

- EN 16516
  - incl. EN ISO 16000-9, DIN ISO 16000-6 and -3. [1] [2]

Test chamber loading according to EN ISO 16000-9:

Chamber volume	Product- specific (≥ 100 L)
Temperature	23°C ± 1°C
Relative humidity	50 % ± 5 %
Air pressure	Normal
Air	Purified
Air exchange rate	Product- specific
Air flow velocity	0.1 – 0.3 m/s
Loading	Product- specific
Air sampling	3 and 28 (7) days; where applicable 24 hours after loading the test chamber

During the continuous test, air samples are taken from the test chamber after 3 and 28 days (and after 24 hours if necessary for the determination of the monomeric isocyanates).

The test may be terminated prematurely if, after 7 days, 50 % of the respective 28-day limit values are complied with and no significant increase in the concentration of individual substances is observed compared with the measurement after 3 days.

Approx. 0.5 - 5 L test chamber air with a volume flow of 100 mL/min is drawn on Tenax and approx. 50 - 100 L with a volume flow of 0.8 - 1 L/min on DNPH (Dinitrophenylhydrazine).

For the measurement of the isocyanate concentrations approx. 100 -150 L of air with a volume flow of 0.5-1 L/min are taken with the aid of a collector impregnated with a derivatisation reagent.

2.2 Analysis

The substances adsorbed on Tenax are analysed after thermal desorption by means of gas chromatographic separation and mass spectrometric determination.

The gas chromatographic separation is carried out using a 30-60 m long, weakly polarised 5 % phenyl/95 % methyl polysiloxane capillary column.

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

As a minimum requirement, the analysis shall include the determination and quantification of all the individual substances listed in the LCI-list of the AgBB. These include volatile organic compounds (C6 - C16), low-volatility organic compounds (C16 - C22) and - as far as can be determined with this method - also highly volatile organic compounds (less than C6). Other individual substances may be analysed if required.

All other substances are - as far as possible - identified through comparison with a spectra library.

At least one internal standard (e.g. d8 toluene) is used to check the stability of the analytical system. In order to compensate for intensity fluctuations, quantification is performed by comparing the signal intensities with the signal of the internal standard.

Identification and quantification of the substances shall be carried out, as far as technically feasible, from a concentration (determination limit) of 1 µg per m3 test chamber air or 2 µg per m3 for DNPH-derivatised substances.

The derivatised isocyanates are desorbed by the extraction of the collector with acetonitrile in an ultrasonic bath and then analysed by HPLC and UV detection (determination limit: 1 µg/m³).

The ammonia concentration is determined using a method specified in DIN EN 16516 or a method equivalent to the specifications of DIN EN 16516.

Through inter-laboratory comparisons, carried out at regular intervals (at least every 1-2 years), the performance of the laboratory shall be verified by comparing results of identical samples with those of other laboratories.

The determination of odour behaviour is usually carried out in combination with the determination of volatile organic compounds in the test chamber; the sample preparation, test piece production and test chamber settings are therefore the same.

The sensory test is carried out by an odour panel of at least 5 testers. The evaluation is based on the 6-point scale in accordance with VDA 270:2018.

The examiners must not suffer from anosmia and should be familiar with the assessment scale.

An odour sample is taken from the test chamber by collecting an air sample in a suitable sampling bag (Nalophan or equivalent) in sufficient quantity for the test. The air sample is offered to the testers within 6 hours via a funnel at an Airprobe (inflow velocity at the funnel of 0.6-1 litre/s).

Alternatively, the odor test can be carried out directly at the test chamber outlet via a funnel, provided that the flow velocity here is also 0.6-1.0 L/s.

The average of the individual test scores is calculated and used as the result. If the individual scores of the examiners are more than two odour scores apart, the examination must be repeated.

2.3 Reporting

The test report shall contain at least the following information:

- Manufacturer's details (production location, production date, sample-taker, sampling date, batch number, and if applicable, including the sampling form)
- A description of the production of the test sample
- Test chamber conditions
- the blank value of the carrier material (except glass and metal)
- substance-specific emission rates and test chamber air concentrations of substance-specific quantified and identified compounds (with CAS numbers) and non-identified compounds calculated as a toluene equivalent
- the TVOC as the sum of the concentrations of substance-specific, quantified, identified compounds and unidentified compounds calculated as a toluene equivalent (from 1 µg/m³, if technically feasible)
- the TVOC calculated as a toluene equivalent according to EN 16516
- a rating section, which evaluates the product-specific natureplus emission requirements (including totals). All relevant specific substances (from 1 µg/m³, as far as technically feasible) are taken into account in the summation. Substances below the determination limits are disregarded.
- an evaluation section that contains and evaluates the natureplus requirements for odour behaviour.

2.4 Production of the Test Sample and Test Chamber Conditions

The loading of the test chamber with the test piece is based on the maximum possible installation scenario of the product to be certified and on the loading factors of EN 16516[1]:

Scenario	Examples	Loading factor L [11] (in m²/m³)	Air exchange n [11](in 1/h)	Specific air flow rate q (n/L, in m³/(m²·h)
Wall	Wall panels, Masonry	1	0.5	0.5
Floor or ceiling	Parquet, Floor covering adhesive, Footfall insulation, Floor levelling compounds	0.4	0.5	1.25
Small areas	Door, Window, Kitchen worktop, Mortar	0.05	0.5	10
Very small areas / joints	Joint sealants	0.007	0.5	71.4
Furniture	Surface coating substances for furniture	0.5	0.5	1

If a product is not clearly classified in 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 considered and the rear is sealed.

Edges are either sealed to 100 % or according to the specifications specified below.

2.4.1 Insulation Materials from Renewable an Mineral Raw Materials (GL0100, GL0400)

Board/Sheet format 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 sides of the test piece are used to calculate the load.

If insulation boards or mats of different thickness and/or weight are to be certified, a board/mat of medium thickness/weight is used.

Bulk-fill and blow-in insulating materials are loosely scattered in a net cube and arranged on the floor of the test chamber.

Five sides of the net cube are used to calculate the load.

The material shall be compacted to such an extent that the bulk injection density specified by the manufacturer for exposed inflation is achieved (unless clearly specified by the manufacturer, the following shall apply: 35 kg/m³ for cellulose fibres and 25 kg/m³ for wood fibres).

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 or according to their intended use.

When used on several surfaces, the maximum load is 1.0 m²/m³.

Insulation adhesives are applied according to Section 2.4.6 and tested with a load of 0.4 or 1.0 m²/m³, depending on the intended use.

2.4.2 Products in Board/Sheet Format (GL1000, GL0200 except Floor Coverings, e.g. Gypsum Fibreboards, Chip- and Particle Boards)

The sheets/boards are to be cut to the appropriate sample size. The rear side is to be sealed.

The ratio of the longer, open (non-sealed) edges U in relation to the surface A is U/A = 1.5 m/m². [4]

The products are tested in the test chamber with a loading factor of 1.0 m²/m³, in so far that in accordance with the normal usage of the product a lower loading factor cannot be derived.

2.4.3 Products in Plank Format with Tongue and Groove Joints (GL0209, e.g. Parquet, Panels)

The planks are to be pressed together and cut to the required sampling size in such a manner that the sample has a joint proportion of 2.5 m/m².

The edges and rear side are to be sealed to 100 %- The emissions from the edges are determined through the joints. [5]

2.4.4 Elastic Floor Coverings in Roll Format (GL1201, e.g. Linoleum)

The rear side is to be sealed.

The ratio of the longer, open (non-sealed) edges U in relation to the surface A is U/A = 1.2 m/m². [5]

2.4.5 Products in Roll Format except Elastic Floor Coverings (GL1400, e.g. Textile Floor Coverings)

The rear side is to be sealed. The edges remain open. [5]

3.4.6 Paints, Coatings and Adhesive Materials (GL0600, GL0700, GL0800, GL0900, e.g. Interior Wall Paints, Parquet Oil, Adhesives, Plasters, Mortar)

The products are to be prepared in accordance with the manufacturer's technical data sheet and applied to a sheet of glass using the maximum application amount and to the maximum permitted depth.

The manufacturer's recommendations relating to the carrier material will only be taken into account if glass is found to be unsuitable as a bearer substrate due to wetting problems. [6]

The minimum application amount is specified in EN 16402.

In the case of multi-layer applications the shortest intermediate drying times, according to the manufacturer's data sheet, will be used.

The sample must be placed in the pre-conditioning chamber immediately after the application of the final coat.

Pre-conditioning is to be carried out in accordance with the manufacturer's instructions (e.g. according to the instructions for readiness for foot-traffic or laying).

The maximum pre-conditioning period must not exceed the product-specific stipulations of EN 16402. [6]

Wall paints for interior use must always be pre-conditioned for 3 days in accordance with EN 16402. [6]

Adhesives must be applied , if technically possible, with an application amount of up to 500 g/m² using a notched trowel TKB B 1. If the application amount is between 500 and 1.100 g/m² a notched trowel TKB B3 is to be used and over 1.100 g/m² a notched trowel TKB B 12.

After preparation of the test sample is completed, it must be pre-conditioned for 72 hours. [5]

Plasters and mortar are to be prepared in accordance with the manufacturer's technical data sheet and applied to a sheet of glass using the maximum application depth.

The minimum application depth is 3 mm. The loading factor is based upon the manufacturer's recommendations in accordance with a normal usage of the product.

2.4.7 Masonry Elements (GL1100)

The edges and, if applicable, the rear side are to be sealed.

2.4.8 Interior Doors (GL1601)

Cut edges are to be sealed.

The frame/casement (proportionate to the length, scenario: 1 frame in 30 m³) is also either loaded into the test chamber (≥ 1 m³) or tested separately (in the case of a separate certification).

3 Literature references

[1] EN 16516, Construction products - Assessment of release of dangerous substances - Determination of emissions into indoor air; German version:

(Bauprodukte – Bewertung der Freisetzung von gefährlichen Stoffen – Bestimmung von Emissionen in die Innenraumluft)

[2] EN ISO 16000-3, -6, und -9, Indoor Air, Part 3,6,9 (Innenraumluftverunreinigungen)

[3] EN ISO/IEC 17025, General Requirements for the competence of testing and calibration laboratories; German Version: (Allgemeine Anforderungen an die Kompetenz von Prüf- und Kalibrierlaboratorien)

[4] EN 717-1, Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method; German Version: (Holzwerkstoffe — Bestimmung der Formaldehydabgabe — Teil 1: Formaldehydabgabe nach der Prüfkammer-Methode)

[5] German Institute for Building Technology (DIBt) Laboratory Handbook, Test and measurement procedures for the health-related evaluation of Building products, Issued: 13.02.2015; German version: DIBt -Laborhandbuch, Prüf- und Messverfahren für die gesundheitliche Bewertung von Bauprodukten, Stand: 13.02.2015

[6] EN 16402, Paints and varnishes - Assessment of emissions of substances from coatings into indoor air - Sampling, conditioning and testing; EN 16402:2013. German version: (Beschichtungsstoffe - Bestimmung der Emissionen regulierter gefährlicher Stoffe von Beschichtungen in die Innenraumluft - Probenahme, Probenvorbereitung und Prüfung EN 16402:2014-02).