



Test Report

Report No.: 809785T1-AB

Assignor: GRID System Aps
Smedevangen 2
3540 Lyngø

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Hbk/nmlh
Order no.: 809785
No. of appendices: 3

Material: Article name: Basic Module, PA6, 30 % glass. Article number: G.NX

Sampling: The test material was sampled by the assignor and received in cardboard at the Danish Technological Institute 2018-06-07.

Method: ANSI/BIFMA M7.1-2011 (R2016) – Standard test method for determining VOC emissions from office furniture systems, components and seating.

Period: The chamber testing was carried out from 2018-06-11 to 2018-06-18.
The analysis of air samples was carried out from 2018-06-19 to 2018-07-02.

Result: The VOC emissions for the tested sample after 168 hours (7 days) in the chamber were:

	<u>Emission factor (E)</u>	<u>Maximum E Furniture Components*</u>	<u>Evaluation</u>
TVOC _(toluene) :	≤ 0.001 mg/m ² h	0.345 mg/m ² h	Pass
Formaldehyde:	0.8 µg/m ² h	≤ 42.3 µg/m ² h	Pass
Total aldehydes:	0.14 µmol/m ² h	≤ 2.8 µmol/m ² h	Pass
4-Phenylcyclohexene:	< 1 µg/m ² h	≤ 4.5 µg/m ² h	Pass

Results in detail are shown in Appendices 2 and 3.

*ANSI/BIFMA ANSI/BIFMA X7.1-2011 – Standard for formaldehyde and TVOC emissions of low-emitting office furniture and seating. Table A1.2: Individual furniture Components Maximum Emission Factors at 168 hours.

Storage: The test material will be destroyed after the issue of this test report.

Terms: The testing is only valid for the tested specimen. The test report may only be extracted, if the laboratory has approved the extract.

Date/place: 2018-07-13, Danish Technological Institute, Wood and Biomaterials, Taastrup

Estelle Haastrop Klindt
Tel. direct: +45 72 20 11 60
E-mail: hbk@teknologisk.dk

Natanya Majbritt Louise Hansen
Ph. direct: +45 72 20 11 60
E-mail: nmlh@teknologisk.dk

Signature: Test responsible

Co-signatory



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Material identification

Sample information given by assignor:

Product: PA6, 30 % glass

Product name: Basic Module

Article number: G.NX

Production date: 25/5 (2018-05-25)

Sampling date: 29/5 (2018-05-29) – GRID Warehouse, Smedevangen 2, 3540 Lyngø

Sampled by: Søren Ahlfors

Sample handling:

Prior to testing the wrapped samples were stored at the test laboratory at 20-25 °C.

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Emission testing

The test material was unwrapped and placed in the chamber.

Photo of test material in the chamber:



Climate chamber	113 L Polished stainless steel
Temperature	23°C ± 1°C
Relative humidity	50% RH ± 5% RH
Air velocity at the surface of the specimen	0.1 – 0.3 m/s
Air change rate (n)	0.9 h ⁻¹ ± 0.05 h ⁻¹
Material load (L)	0.9 m ² /m ³
Area specific air flow rate (q)	1.0 m ³ /m ² h

The test material was tested in the emission chamber without prior conditioning.

Sampling and analytical methods of air samples:

	Method	Absorbent	Sampling volume	Quantification/Analysis method	Detection limit
VOC and Carcinogens	ISO 16000-6	Tenax TA	4 L	TDS-GC/MS Calibrated with pure reference standards	1 µg/m ³
Formaldehyde and carbonyls	ISO 16000-3	DNPH coated silica gel	60 L	HPLC-DAD Calibrated with pure reference standards	1 µg/m ³

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Emission of volatile organic compounds

The applied test conditions result in an area specific air flow rate of $q = 1.0 \text{ m}^3/\text{m}^2\text{h}$. Thus, the measured concentrations (C) in $\mu\text{g}/\text{m}^3$ of volatile compounds are equal to the surface area specific emission rate i.e. emission factor (E) in $\mu\text{g}/\text{m}^2\text{h}$. The emission factor approach is applied for measurement and evaluation of individual furniture components.

Results from the VOC analysis appears from Table 1.
Method: ISO 16000-6: 2011. Indoor air – Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS/FID.

Analysis of the air sampled on Tenax was performed at the Wilhelm Klauditz Institut (WKI) under DAkKS accreditation number D-PL-11140-05-02. Report no. MAIC-2018-2752.

Table 1: Concentrations of volatile organic compounds (VOCs) between n-C6 and n-C16 measured by GC-MS ($\mu\text{g}/\text{m}^2\text{h}$)*

Chemical class/compound name	72 hrs (3 days)				168 hrs (7 days)			
	#1	#2	Mean	% diff	#1	#2	Mean	% diff
Aromatic hydrocarbons	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Aliphatic hydrocarbons								
2-Methylpentane (3-Methylpentane)	3	3	3	0	1	1	1	0
Cycloalkanes	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Terpenes								
alpha-Pinene	2	1	2	67	2	2	2	0
Alcohols	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Glycols/Glycol ethers	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Aldehydes	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Ketones	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Halocarbons	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Acids	< 1	< 1	< 1	0	< 1	< 1	< 1	0
Esters								
Benzoic acid ester (Toluene)	10	10	10	0	< 1	< 1	< 1	0
Other								
Caprolactam	5	6	6	18	10	8	9	22
TVOC (sum)	20	20	20	0	13	11	12	17
TVOC (toluene)	< 1	< 1	< 1	0	< 1	< 1	< 1	0

* Single substances/volatile compounds were quantified with pure reference standards, and in some cases the substances shown in subscript were used for the quantification.

< 1 Not detected ($< 1 \mu\text{g}/\text{m}^3$)

Measured concentrations just above limit of quantification (LOQ) of $1 \mu\text{g}/\text{m}^2\text{h}$ will result in higher standard deviation from mean value.

Definitions according to ISO 16000-6:

VOC (C6-C16): Volatile organic compounds, between hexane (C6) and hexadecane (C16)

VVOC (<C6): Very volatile organic compounds, eluting before hexane, not included in TVOC

SVOC (>C16): Semi-volatile organic compounds, eluting after hexadecane, not included in TVOC

TVOC: Total volatile organic compounds is the sum of all VOCs eluting between C6 and C16, quantified as toluene equivalents.

Emission of volatile organic compounds

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Results from aldehyde analysis are shown in Table 2.

Method: ISO 16000-3: 2011. Indoor Air – Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method.

Analysis of the air sampled on DNPH was performed at the Danish Technological Institute under DANAK accreditation number 90. Report no. 818967.

Table 2: ISO 16000-3 Lower aldehydes by HPLC analysis ($\mu\text{g}/\text{m}^2\text{h}$)*

Compound name	72 hrs (3 days)				168 hrs (7 days)			
	#1	#2	Mean	% diff	#1	#2	Mean	% diff
Formaldehyde	0.88	0.92	0.90	4	0.83	0.83	0.83	0
Acetaldehyde	4.0	4.1	4.1	2	4.0	3.8	3.9	5
Propanal	1.1	1.1	1.1	0	1	1	1.0	0
Butanal	0.50	0	0.25	200	0.74	0.75	0.75	1
Acrolein	-	-	-	-	-	-	-	-

*Limit of detection (LOD) is 0.5 $\mu\text{g}/\text{m}^3$ (formaldehyde, acetaldehyde, butanal), 0.8 $\mu\text{g}/\text{m}^3$ (propanal) and 3.3 $\mu\text{g}/\text{m}^3$ (acrolein).

Measured concentrations just above limit of quantification (LOQ) will result in higher standard deviation from mean value.