



# 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 <sub>(toluene)</sub> :	≤ 0.001 mg/m <sup>2</sup> h	0.345 mg/m <sup>2</sup> h	Pass
Formaldehyde:	0.8 µg/m <sup>2</sup> h	≤ 42.3 µg/m <sup>2</sup> h	Pass
Total aldehydes:	0.14 µmol/m <sup>2</sup> h	≤ 2.8 µmol/m <sup>2</sup> h	Pass
4-Phenylcyclohexene:	< 1 µg/m <sup>2</sup> h	≤ 4.5 µg/m <sup>2</sup> 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

**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 <sup>-1</sup> ± 0.05 h <sup>-1</sup>
Material load (L)	0.9 m <sup>2</sup> /m <sup>3</sup>
Area specific air flow rate (q)	1.0 m <sup>3</sup> /m <sup>2</sup> h

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

Sampling and analytical methods of air samples:

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

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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
<b>Aromatic hydrocarbons</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Aliphatic hydrocarbons</b>								
2-Methylpentane (3-Methylpentane)	3	3	3	0	1	1	1	0
<b>Cycloalkanes</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Terpenes</b>								
alpha-Pinene	2	1	2	67	2	2	2	0
<b>Alcohols</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Glycols/Glycol ethers</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Aldehydes</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Ketones</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Halocarbons</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Acids</b>	< 1	< 1	< 1	0	< 1	< 1	< 1	0
<b>Esters</b>								
Benzoic acid ester (Toluene)	10	10	10	0	< 1	< 1	< 1	0
<b>Other</b>								
Caprolactam	5	6	6	18	10	8	9	22
<b>TVOC (sum)</b>	20	20	20	0	13	11	12	17
<b>TVOC (toluene)</b>	< 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.