REPORT

issued by an Accredited Testing Laboratory

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Testing

Winab Vikväggar AB
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Box 38
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Emission measurements after 28 days

(3 appendices)

Object

One sample of a partition wall was delivered to RISE by the customer.

Product name:	**Blockvägg 52dB, målad S 0500-N**
Production date:	week 20, 2019
Size of sample:	88 x 80 cm, thickness 8.7 cm, wrapped in plastic foil
Date of sampling:	week 21, 2019
Date of arrival to RISE:	2019-05-22
Date of analysis:	week 23 – 28, 2019

Assignment

Emission measurement according to ISO 16000-9:2006 (Indoor air – Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method), after 28 days regarding volatile organic compounds (VOC and VVOC/SVOC), carcinogenic substances (VOC-substances, EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), formaldehyde and acetaldehyde (ISO 16000-3:2011). Evaluation according to EN 16516:2017 (EU-LCI values).

Method

The test was started 2019-06-05 by unwrapping the test piece. The specimen was placed in a room with controlled climate conditions of 23 ± 2 °C and 50 ± 5 % RH. The test specimen was placed into the chamber three days prior to air samplings. Air samplings after 28 days of conditioning were carried out on 2019-07-04.

Test conditions in the chamber:

Chamber volume:	1.0 m^3
Temperature:	23 ± 0.5 °C
Relative humidity:	50 ± 5 % RH
Surface area of test specimen:	1.7 m^2
Air exchange rate:	1.0 h^{-1}
Area specific air flow rate:	0.59 m^3/m^2 h.
Air velocity at specimen surface:	0.1 – 0.3 m/s

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Tenax TA was used as adsorption medium for VOC. The tubes were thermally desorbed and analysed in accordance to RISE method 0601, similar to ISO 16000-6:2011 (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). This means an analysis in a gas chromatograph and detection with a flame ionisation detector (FID) and mass selective detector (MS). The capillary column used is coated with 5% phenyl/ 95 % methylpolysiloxane. The FID signals are used for compound quantification. The total volatile organic compounds (TVOC) means compounds eluting between and including n-hexane to hexadecane, having boiling points in the range of about 70-260 °C. Minimum duplicate air samples were taken and the results are mean values. Sampled volumes are 3 to 7 L.

Tenax TA was also used as adsorption medium for testing of volatile carcinogenic compounds according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B), (exclusive formaldehyde), 1 µg/m^3 and above.

The samplings of aldehydes were carried out with DNPH samplers. The samplers were analysed according to RISE method 2302, similar to ISO 16000-3:2011(Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds – Active sampling method). This means analysis on a liquid chromatograph with absorbance detector. Duplicate air samples were taken and the results are mean values. Sampled volumes were 60 to 110 L.

Results

The results relate only to the items tested.

The results in Table 1 are expressed as area specific emission rates and as concentrations in a reference room (according to EN 16516:2017). The reference room has a base area of 3 m x 4 m and a height of 2.5 m, with an air exchange rate of 0.5 h^{-1}. The wall area is 31.4 m^2, floor area is 12 m^2, small area, like a door, is 1.6 m^2 and very small area, like sealant, is 0.2 m^2. **Wall area** is used for the calculation of the concentrations.

Calculation of the concentration from the emission rate:

$$C = \frac{E_a \times A}{n \times V}$$

C = concentration of VOC in the reference room, in µg/m^3
E_a = area specific emission rate, in µg/m^{2}h
A = surface area of product in reference room, in m^2
n = air exchange rate, in changes per hour, here 0.5 h^{-1}
V = volume of the reference room, in m^3, here 30 m^3

Table 1.
Emission results of **Blockvägg 52dB, målad S 0500-N** after 28 days

Volatile organic compounds	CAS number	Retention time (min)	ID[1]	Emission rate ($\mu g/m^2h$)	Concentration in reference room ($\mu g/m^3$)	LCI_i ($\mu g/m^3$)	R_i (c_i/LCI_i)
TVOC ($C_6 - C_{16}$)	--	6.9 – 39	B	160	330	--	--
Volatile Carcinogens [2]		6.9 – 39					
No substances detected	--	--	B	< 1	< 1	--	--
VOC with LCI [3]		6.9 – 39					
1-Propanol, 2-methyl-	78-83-1	7.4	A	13	27	11000	0.002
1-Butanol	71-36-3	8.2	A	130	270	3000	0.089
Pentanal	110-62-3	9.3	A	10	21	800	0.026
Hexanal	66-25-1	12.6	A	63	130	900	0.144
Acetic acid, butyl ester	123-86-4	12.9	A	5	10	4800	0.002
Hexanoic acid	142-62-1	18.6	A	24	49	2100	0.023
∑ VOC with LCI	--	--	A	240	510	--	--
VOC without LCI [4]		6.9 – 39					
Cyclopentasiloxane, decamethyl-	541-02-6	24.3	B	3	7	--	--
Cyclohexasiloxane, dodecamethyl-	540-97-6	30.0	B	11	22	--	--
Cycloheptasiloxane, tetradecamethyl-	107-50-6	34.9	B	6	12	--	--
Ethanone, 1,1'-(1,3-phenylene)bis-	6781-42-6	35.1	B	2	< 5	--	--
Probably: Ethanone, 1-[4-(1-hydroxy-1-methylethyl)phenyl]-	54549-72-3	36.1	B	2	< 5	--	--
∑ VOC without LCI	--	--	B	24	41	--	--
SVOC ($C_{16} - C_{22}$) [5]		39 - 52					
No substances detected	--	--	B	< 2	< 5	--	--
∑ SVOC	--	--	B	< 2	< 5	--	--
VVOC ($< C_6$) [6]		5.3 – 6.9					
Acetic acid	64-19-7	6.2	A	27	58	1200	0.048
Formaldehyde [7]	50-00-0	--	A	61	130	100	1.28
Acetaldehyde [7]	75-07-0	--	A	4	8	1 200	0.007
∑ VVOC	--	--	A	92	200	--	--
R = ∑ C_i / LCI_i [8]	--	--	--	--	--	--	1.6

[1)] ID: A = quantified compound specific, B = quantified as toluene-equivalent
[2)] Volatile carcinogens = VOCs according to EU Regulation No 1272/2008 Annex VI, cat 1A and 1B
[3)] VOC with LCI = identified VOC-compound with LCI-value according to EU-LCI, July 2018
[4)] VOC without LCI = VOC-compound without LCI-value or not identified.
[5)] SVOC = semi-volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)
[6)] VVOC = very volatile organic compounds, as defined in ISO 16000-6 (not part of accreditation)

[7)] VVOC-aldehydes measured with DNPH samplers (ISO 16000-3)
[8)] All VVOC, VOC, SVOC and carcinogens with LCI

Only VOC-compounds with an emission rate higher than 2 µg/m^{2}h are listed in Table 1, carcinogenic compounds ≥ 1 µg/m^{2}h. Only the compounds with a concentration in the reference room > 5 µg/m^3 are evaluated based on LCI (= lowest concentration of interest). TVOC expressed in µg/m^3 is the sum of all individual substances with concentrations ≥ 5 µg/m^3 (in toluene equivalents).

Quantification limit for TVOC is 10 µg/m^{2}h. Measurement uncertainty for VOC is 15 % (rel) and for formaldehyde 30 % (rel). Background of TVOC in the empty chamber was below 20 µg/m^3 and is subtracted.

See Appendix 1 for a gas chromatogram (FID spectra) and Appendix 2 for a photo of the test specimen. Appendix 3 is the sampling report received from the customer.

Summary of the test results

The test results are summarized in Table 2.

Table 2.
Summary of the emission results after 28 days of **Blockvägg 52dB, målad S 0500-N**

Compounds	**Emission rate** (µg/m^{2}h)	**Concentration in reference room** (wall area scenario) (µg/m^3)
TVOC	160	330
∑ Carcinogenic VOCs	< 1	< 1
∑ VOC with LCI	240	510
∑ VOC without LCI	24	41
∑ VVOC	92	200
Formaldehyde	61	130
∑ SVOC	< 2	< 5
R = ∑ C_i / LCI_i	1.6	

Evaluation of the test results

Byggvarubedömningen has criteria regarding Emissions to indoor environment. The emissions are to be measured according to a standard method such as ISO 16000-9 after 28 days regarding VOC and formaldehyde. The requirements for the *Recommended class* is that the requirements to one of the following systems are being met: Emicode EC1, Emicode EC1^{PLUS}, Blue Angel, M1 (RTS) or GUT. The requirements for the *Accepted class* is one of Emicode EC2, AgBB or M2 (RTS). The results of the tested sample are compared to M1/M2.

Decision rule: When comparing the measured results and requirement level, the average value of the measured results has been compared with the requirement level. No account is taken to the measurement uncertainty.

Table 3.
The test results of **Blockvägg 52dB, målad S 0500-N** compared to the relevant requirements in M1 and M2

Compounds	**Requirement M1** (mg/m^2h)	**Requirement M2** (mg/m^2h)	**Test Results** (mg/m^2h)	**Pass / Fail**
TVOC	< 0.2	< 0.4	**0.17** [9]	**PASS M1**
Formaldehyde	< 0.05	< 0.125	**0.061**	**PASS M2**
CMR 1A+1B	< 0.001	< 0.001	**< 0.001**	**PASS M1**
Single VOC ($\mu g/m^3$)	≤ EU-LCI	≤ EU-LCI	≤ EU-LCI [10]	**PASS M1**
Ammonia	< 0.03	< 0.06	not measured	--
Odour	≥ 0.0	≥ 0.0	not measured	--

[9)] According to M1 and M2 acetic acid should be included in the TVOC. Acetic acid expressed as toluene equivalent is 11 $\mu g/m^2h$. TVOC is here 11 + 160 = 170 $\mu g/m^2h$.

[10)] The test result of formaldehyde is 130 $\mu g/m^3$ (EU-LCI is 100 $\mu g/m^3$). Formaldehyde has a separate requirement in emission rate that the product meets, which is interpreted to be sufficient.

The test results are in compliance with all the tested requirements of M2 and meet the requirements for the *Accepted class*.

RISE Research Institutes of Sweden AB
Chemistry and Materials - Chemistry

Performed by

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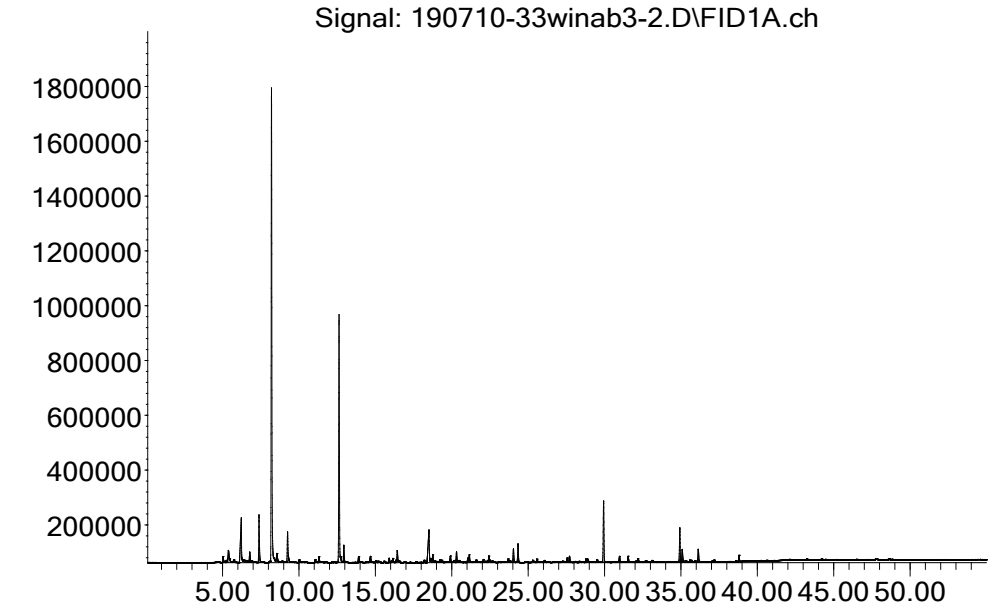
Appendices

1. Gas Chromatogram
2. Photo of the test specimen
3. Sampling report

Appendix 1

Gas chromatogram

Blockvägg 52dB, målad S 0500-N, after 28 days:



TVOC between C_6 and C_{16}, means compounds eluting between 6.9 and 39 minutes.

Appendix 2

Photo of the test specimen

Appendix 3

Sampling Report

Sampler (Name, Company, contact info): Winab Vikväggar AB Box 38 178 21 Ekerö Maria Söderberg maria.soderberg@winab.se +46 8 520 051 35	**Manufacturer of the product** (Company, address): Winab Vikväggar AB Box 38 178 21 Ekerö Maria Söderberg maria.soderberg@winab.se +46 8 520 051 35
Name of product: Blockvägg 52dB, målad S 0500-N	**Type of product:** Rumsavdelare Blockvägg / partition wall
Manufacturing Date: V20-2019	**Batch No:**
Date of sampling: V21-2019	**Amount/size of material sampled:** 1 **Packing material:** EUR-pallet, plastic and particle board
Sample is taken from: Production line X Stock / Storage ☐ Miscellaneous ☐ -where, specify:	**How was the product stored before sampling?** Normal storage at freight department in factory
If a sub-sample was collected from a larger material amount, describe how the sub-sample was taken: Sample is manufactured especially for testing as the normal product is much larger to fit from floor to ceiling. Each product is manufactured especially to each order as height and width is unique to each order.	
Observations and remarks:	
Confirmation I hereby confirm that the sample was selected, taken and packed in accordance with the instructions.	
Date:	**Signature:**