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VOC EMISSION TEST REPORT
EMICODE

2 June 2025

1 Sample Information

Sample name	Fortax 6500
Batch no.	250344032
Stated production date	03/02/2025
Product type	Joint sealant (GEV 5.1)
Sample reception	24/03/2025

2 Brief Evaluation of the Results

Regulation or protocol	Conclusion	Version of regulation or protocol
EMICODE	EC 1 PLUS	February 2025

Full details based on the testing and direct comparison with limit values are available in the following pages
Regarding pass/fail decision rule please see appendix

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Analytical Service Manager

Rasmus Verdier
Analytical Service Manager

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3 Applied Test Methods

3.1 General Test References

Regulation, protocol or standard	Version	Reporting limit VOC [µg/m³]	Calculation of TVOC	Combined uncertainty¤ [RSD(%)]
EN 16516	2017 + A1:2020	5	Toluene equivalents	22%
ISO 16000 -3 -6 -9 -11	2021-2024 depending on part	2	Toluene equivalents	22%
ASTM D5116-17	2017	-	-	-
EMICODE	February 2025	5	Toluene equivalents	22%

3.2 Specific Laboratory Sampling and Analyses

Procedure	External Method	Internal SOP	Quantification limit / sampling volume	Analytical principle	Uncertainty¤ [RSD(%)]
Sample preparation	ISO 16000-11:2024, EN 16516:2017+A1:2020, EMICODE:2022	71M549810	-	-	-
Emission chamber testing	ISO 16000-9:2024, EN 16516:2017+A1:2020	71M549811	-	Chamber and air control	-
Sampling of VOC	ISO 16000-6:2021, EN 16516:2017+A1:2020	71M549812	5 L	Tenax TA	-
Analysis of VOC	ISO 16000-6:2021, EN 16516:2017+A1:2020	71M542808B	1 µg/m³	ATD-GC/MS	10%
Sampling of aldehydes	ISO 16000-3:2022, EN 16516:2017+A1:2020	71M549812	35 L	DNPH	-
Analysis of aldehydes	ISO 16000-3:2022, EN 16516:2017+A1:2020	71M548400	3-6 µg/m³	HPLC-UV	10%

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4 Test Parameters, Sample Preparation and Deviations

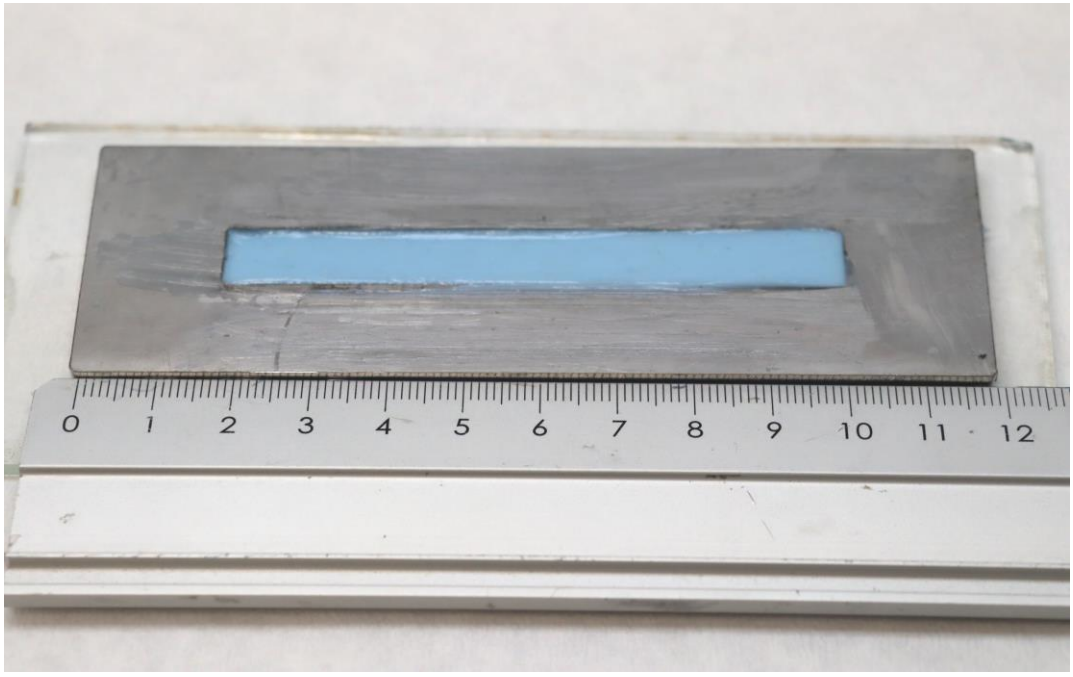
4.1 VOC Emission Chamber Test Parameters

Parameters	Value	Sample Conditions	Value
Chamber volume, V[L]	119	Date and time of unpacking and start of sample preparation	24/04/2025 - 08:39
Air change rate, n[h^{-1}]	0.5	Preconditioning period	-
Air Velocity [m/s]	0.1	Chamber test period	24/04/2025 - 22/05/2025
Area specific ventilation rate, q [m/h or $m^3/m^2/h$]	71	Analytical test period	24/04/2025 - 28/05/2025
Relative humidity of supply air, RH [%]	50 ± 3	Exposed sample area [m^2]	0.00083
Temperature of supply air, T [°C]	23 ± 1	Loading factor [m^2/m^3]	0.007
Background concentration of individual VOC's [µg/m^3]	< 2	Test scenario	Very small area
Background concentration of TVOC [µg/m^3]	< 20		

4.2 Preparation of the Test Specimen

The sample was applied onto a glass plate and drawn off over a model giving a 3 mm thick and uniform layer with a broadness of 10 mm.

4.3 Picture of Sample



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4.4 Deviations from Referenced Protocols and Regulations

No deviations from the referenced test methods were observed.

4.5 Air Samplings from the Test Chamber

Sampling media	Day (yyyy-mm-dd)	Time (hh:mm)	Volume [L]
3 Day, DNPH silicagel	2025-04-27	07:40 - 09:28	37
3 Day-Res, DNPH silicagel	2025-04-27	07:42 - 09:29	36
3 Day, Tenax TA	2025-04-27	07:43 - 08:41	5.1
3 Day-Res, Tenax TA	2025-04-27	08:41 - 09:29	2.1
28 Day, Tenax TA	2025-05-22	07:53 - 08:55	5.5
28 Day-Res, Tenax TA	2025-05-22	08:56 - 09:41	2.1
28 Day, DNPH silicagel	2025-05-22	07:51 - 09:40	35
28 Day-Res, DNPH silicagel	2025-05-22	07:52 - 09:41	36

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5 Results

5.1 VOC Emission Test Results after 3 Days

	CAS No.	Retention time [min]	ID-Cat	Specific Conc. [µg/m³]	Toluene eq. [µg/m³]	Specific SER [µg/(m²·h)]	R_D
VOC with NIK/LCI							
Isobutanol	78-83-1	2.24	1	8.1	< 5	580	0.0007
1-Butanol	71-36-3	2.53	1	50	15	3600	0.017
1,2-Propandiol (Propylene glycol) *	57-55-6	3.52	1	< 5	< 5	< 400	
Hexanal	66-25-1	4.88	1	< 5	< 5	< 400	
2-Ethyl-1-hexanol	104-76-7	9.01	1	53	38	3800	0.18
2-Ethylhexyl acetate	103-09-3	10.59	1	20	18	1400	0.057
Other saturated aliphatic hydrocarbons C9-C16 *		10.7-12.4	2	13	13	910	0.0021
VOC without NIK/LCI							
Not identified *		8.36	4	< 5	< 5	< 400	
Not identified *		9.09	4	6.0	6.0	430	
Sum of VOC without NIK/LCI				6.0	6.0	430	
VVOC compounds							
None determined							
TVVOC				< 5	< 5	< 400	
SVOC compounds							
None determined							
TSVOC				< 5	< 5	< 400	
Carcinogens							
Total carcinogens				< 1	< 1	< 80	
Aldehydes							
Formaldehyde	50-00-0		1	< 3		< 300	
Acetaldehyde	75-07-0		1	< 3		< 300	
Propionaldehyde	123-38-6		1	< 3		< 300	
Butyraldehyde	123-72-8		1	< 3		< 300	
Acrolein *	107-02-8		1	< 5		< 400	
2-Butenal *	123-73-9		1	< 5		< 400	
Glutaraldehyde *	111-30-8		1	< 3		< 300	
R-values							0.25

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	CAS No.	Retention time [min]	ID-Cat	Specific Conc. [µg/m³]	Toluene eq. [µg/m³]	Specific SER [µg/(m²·h)]	R_D
TVOC				150	90	11000	

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5.2 VOC Emission Test Results after 28 Days

	CAS No.	Retention time [min]	ID-Cat	Specific Conc. [µg/m³]	Toluene eq. [µg/m³]	Specific SER [µg/(m²·h)]	R_D
VOC with NIK/LCI							
2-Ethyl-1-hexanol	104-76-7	9.04	1	7.6	5.5	540	0.025
2-Ethylhexyl acetate	103-09-3	10.63	1	< 5	< 5	< 400	
VOC without NIK/LCI							
Not identified *		9.13	4	< 5	< 5	< 400	
Sum of VOC without NIK/LCI				< 5	< 5	< 400	
VVOC compounds							
None determined							
TVVOC				< 5	< 5	< 400	
SVOC compounds							
None determined							
TSVOC				< 5	< 5	< 400	
Carcinogens							
Total carcinogens				< 1	< 1	< 80	
Aldehydes							
Formaldehyde	50-00-0		1	< 3		< 300	
Acetaldehyde	75-07-0		1	< 3		< 300	
Propionaldehyde	123-38-6		1	< 3		< 300	
Butyraldehyde	123-72-8		1	< 3		< 300	
Acrolein *	107-02-8		1	< 5		< 400	
2-Butenal *	123-73-9		1	< 5		< 400	
Glutaraldehyde *	111-30-8		1	< 3		< 300	
R-values							0.025
TVOC				7.6	5.5	540	

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6 Summary and Evaluation of the Results

6.1 Comparison with Limit Values of EMICODE

Parameters	Concentration µg/m³	EC 2 µg/m³	EC 1 µg/m³	EC 1 PLUS µg/m³
TVOC 3 days (EN 16516)	90	≤ 3000	≤ 1000	≤ 750
TVOC 28 days (EN 16516)	5.5	≤ 300	≤ 100	≤ 60
TSVOC 28 days (EN 16516)	< 5	≤ 100	≤ 50	≤ 40
Sum without NIK/LCI 28 days	< 5	> 40		≤ 40
R-value 28 days (dimensionless)	0.025	> 1	≤ 1	
Formaldehyde 3 days	< 3	≤ 50		
Acetaldehyde 3 days	< 3	≤ 50		
Sum Formaldehyde + Acetaldehyde [ppm] 3 days	< 0.005	≤ 0.05		
Formaldehyde 28 days	< 3	≤ 10		
Sum carcinogens 3 days	< 1	≤ 10		
Sum carcinogens 28 days	< 1	≤ 1		

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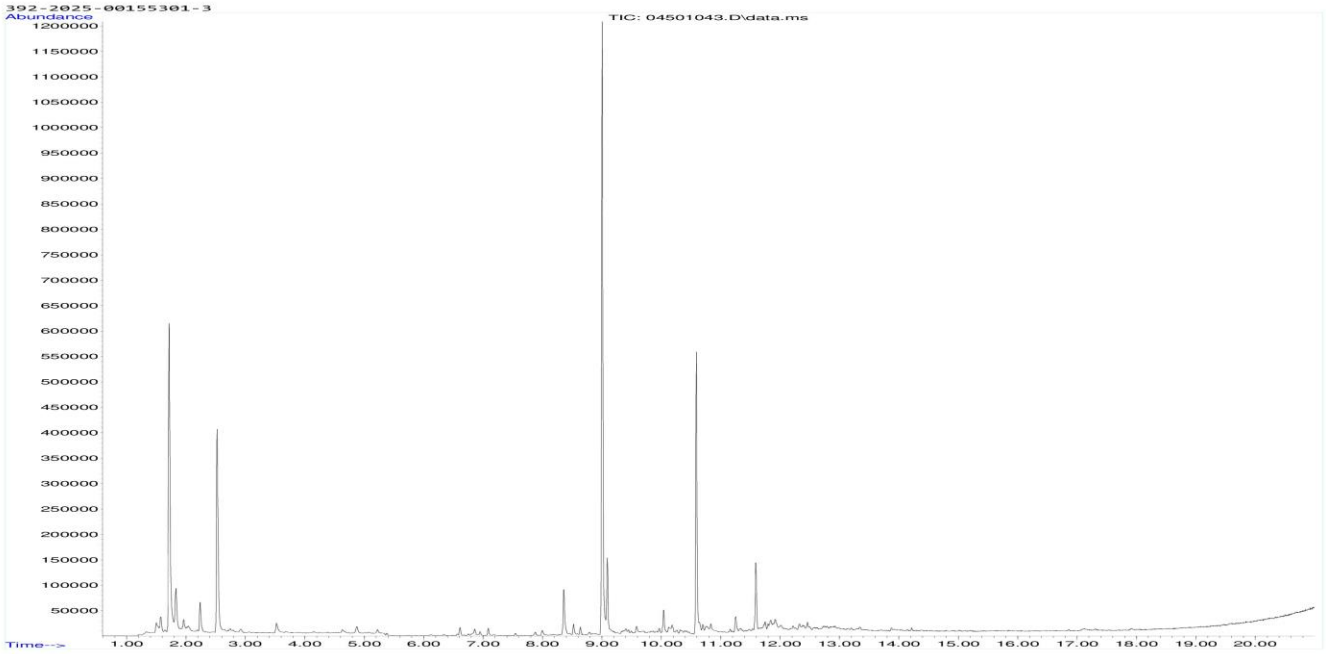
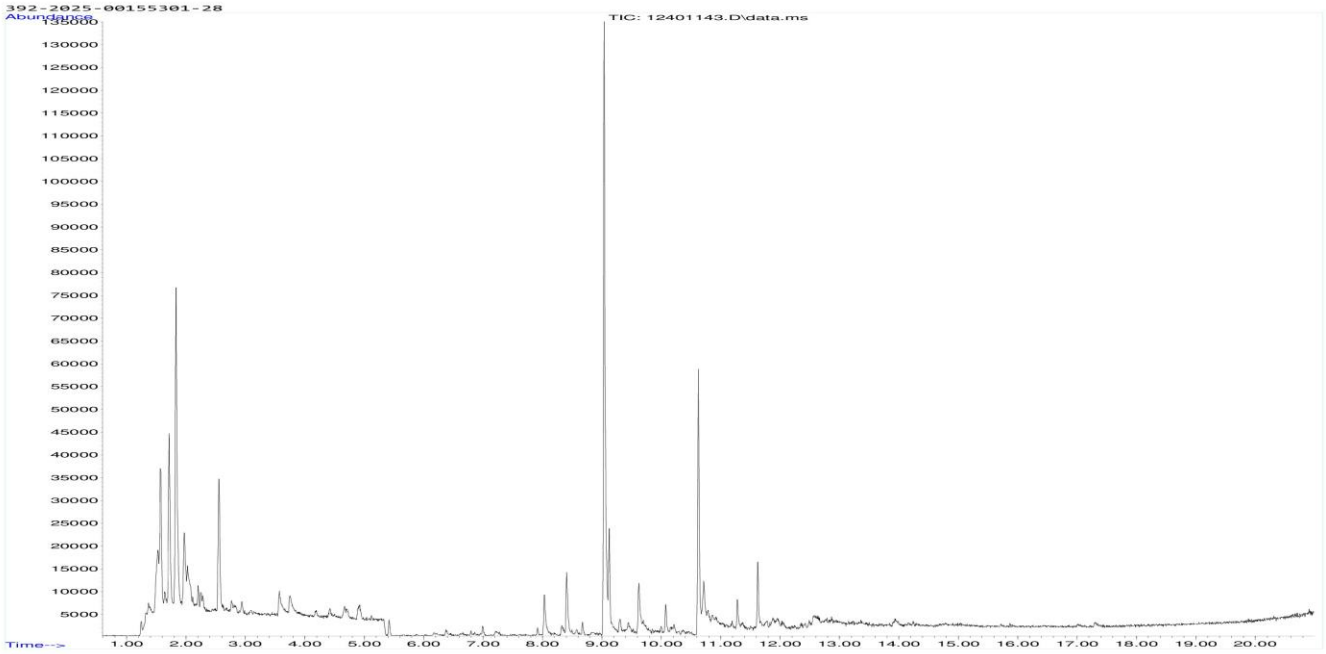
7 Appendices

7.1 Chromatogram of VOC Emissions after 3 Days



7.2 Chromatogram of VOC Emissions after 28 Days



Please consider the different scales.

7.3 How to Understand the Results

7.3.1 Acronyms Used in the Report

<	Means less than
>	Means bigger than
*	Not a part of our accreditation
¤	Please see section regarding uncertainty in the Appendices
§	Deviation from method. Please see deviation section
a	The method is not optimal for very volatile compounds. For these substances smaller results and a higher measurement uncertainty cannot be ruled out
b	The component originates from the substrate and is thus removed
c	The results have been corrected by the emission from the substrate
d	Very polar organic compounds are not suitable for reliable quantification using Tenax TA adsorbent and HP-5ms GC column. A high degree of uncertainty must be expected
e	The component may be overestimated due to contribution from the system
SER	Specific Emission Rate

7.3.2 Explanation of ID Category

Categories of Identity:

1: Identified by comparison with a mass spectrum obtained from library and supported by other information and quantified through specific calibration.

2: Identified by comparison with a mass spectrum obtained from library and supported by other information. Quantified as toluene equivalent.

3: Identified with a lower match by comparison with a mass spectrum obtained from a library. Quantified as toluene equivalent.

4: Not identified, quantified as toluene equivalent.

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7.4 Applied LCI and NIK Values

7.4.1 LCI/NIK Values for Compounds found after 3 Day Measurements

Compound	CAS No.	AgBB 2024 NIK [µg/m³]
Isobutanol	78-83-1	11000
1-Butanol	71-36-3	3000
1,2-Propandiol (Propylene glycol) *	57-55-6	2100
Hexanal	66-25-1	900
2-Ethyl-1-hexanol	104-76-7	300
2-Ethylhexyl acetate	103-09-3	350
Other saturated aliphatic hydrocarbons C9-C16 *		6000

7.4.2 LCI/NIK Values for Compounds found after 28 Day Measurements

Compound	CAS No.	AgBB 2024 NIK [µg/m³]
2-Ethyl-1-hexanol	104-76-7	300
2-Ethylhexyl acetate	103-09-3	350

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7.5 Description of VOC Emission Test

7.5.1 Test Chamber

The test chamber is made of stainless steel. A multi-step air clean-up is performed before loading the chamber, and a blank check of the empty chamber is performed.
The chamber operation parameters are as described in the test method section. (EN 16516, ISO 16000-9, internal method no.: 71M549811).
The recovery rates in the climate test chamber have been investigated using toluene and n-dodecane. The mean recovery rates of toluene and n-dodecane were concluded to be between 95 % and 100 % depending on the chamber size. These values comply with the criteria of a minimum mean recovery rate of 80 % stated in the 16000-9 test method.
Air sampling from the test chamber is carried out in a clean test chamber room at ambient air pressure and 23 ± 1 °C.

7.5.2 Expression of the Test Results

All test results are calculated as specific emission rate, and as extrapolated air concentration in the European Reference Room (EN 16516, AgBB, EMICODE, M1 and Indoor Air Comfort).

7.5.3 Testing of Carcinogenic VOCs

The emission of carcinogens (EU Categories C1A and C1B, as per European law) is tested by drawing sample air from the test chamber outlet through Tenax TA tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by ATD-GC/MS (automated thermal desorption coupled with gas chromatography and mass spectroscopy using 30 m HP-5 (slightly polar) column with 0.25 mm ID and 0.25 µm film, Agilent) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All identified carcinogenic VOCs are listed; if a carcinogenic VOC is not listed then it has not been detected. Quantification is performed using the TIC signal and authentic response factors, or the relative response factors relative to toluene for the individual compounds.

This test only covers substances that can be adsorbed on Tenax TA and can be thermally desorbed. If other emissions occur, then these substances cannot be detected (or with limited reliability only).

7.5.4 Testing of VOC, SVOC and VVOC

The emissions of volatile organic compounds are tested by drawing sample air from the test chamber outlet through Tenax TA tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by ATD-GC/MS using HP-5 column (30 m, 0.25mm ID, 0.25µm film) (EN 16516, ISO 16000-6, internal methods no.: 71M549812 / 71M542808B).

All single substances that are listed with a LCI/NIK value in the latest publications (hereafter referred to as target compounds) are identified if present. All other appearing VOCs are identified as far as possible. Quantification of target compounds is done using the TIC signal and authentic response factors, or the relative response factors relative to toluene. For certain compound groups, which differ significantly in chemistry from toluene, quantification is performed relative to a representative member of the group for more accurate and precise results. This can include quantification of for example glycols and acids. In addition to that, all results are also expressed in toluene equivalents. All non-target compounds, as well as all non-identified substances, are quantified in toluene equivalents.

The results of the individual substances are calculated in three groups depending on their retention time when analyzing using a non-polar column (HP-1):

- Volatile Organic Compounds (VOC) are defined as: All substances eluting between and including n-hexane (n-C6) and n-hexadecane (n-C16)

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- Semi-Volatile Organic Compounds (SVOC) are defined as: All substances eluting after n-hexadecane (n-C16) and before and including n-docosane (n-C22)
- Very Volatile Organic Compounds (VVOC) are defined as: All substances eluting before n-hexane (n-C6).

Total Volatile Organic Compounds (TVOC) is calculated by summation of all individual VOCs with a concentration ≥ 5 µg/m³. The TVOC can be expressed either in toluene equivalents as defined in EN 16516 and similar to ISO 16000-6, or as the sum of concentrations using specific or relative response factors. In the case of summation of concentrations using authentic or relative response factors, the toluene equivalent is applied to all non-target and non-identified VOCs before summing up. Compounds regarded as VOC in line with the above definition but elute before n-C6 or after n-C16 on the HP-5 column are treated as VOC, and are thus added to the TVOC.

Total Semi-Volatile Organic Compounds (TSVOC) is calculated by the summation of all individual SVOCs expressed in toluene equivalents with a concentration ≥ 5 µg/m³, as defined in EN 16516. VOCs that are regarded as VOC in line with the above definition, but elute after n-C16 in this test, are not added to the TSVOC.

Total Very Volatile Organic Compounds (TVVOC) is calculated by the summation of all individual VVOCs with a concentration ≥ 5 µg/m³ and expressed in toluene equivalents. VOCs that are regarded as VOC in line with the above definition, but elute before n-C6 in this test, are not added to the TVVOC.

This test only covers substances which can be adsorbed on Tenax TA and can be thermally desorbed. If emissions of substances outside these specifications occur then these substances cannot be detected (or with limited reliability only).

7.5.5 Calculation of R Values with LCI Lists

The concentrations of detected compounds ≥ 5 µg/m³ are divided by their respective LCI/NIK value (if defined in the given publication). The sum of the quotients gives the R value, which can be mathematically expressed:

$$R = \sum_{i}^{n} \left({}^{c_i}/_{NIK_i} + \ldots + {}^{c_n}/_{NIK_n} \right)$$

This R value is calculated, depending on the purpose of this test, for the European LCI list, for the German LCI/NIK list (R_D), and/or for the Belgian LCI list (R_B).

All VOCs without published LCI/NIK value and concentration ≥ 5 µg/m³ are summed up as sum of VOCs without LCI/NIK if required by the standard or protocol.

7.5.6 Testing of Aldehydes

The presence of aldehydes is tested by drawing air samples from the test chamber outlet through DNPH-coated silicagel tubes after the specified duration of storage in the ventilated test chamber. Analysis is performed by solvent desorption and subsequently by HPLC and UV-/diode array detection.

The absence of formaldehyde and other aldehydes is stated if UV detector response at the specific wavelength is lacking at the specific retention time in the chromatogram. Otherwise it is checked whether the reporting limit is exceeded. In this case the identity is finally checked by comparing full scan sample UV spectra with full scan standard UV spectra.

Conversions of specific aldehydes from µg/m³ to ppm are done by the ideal gas law using a temperature of 23 degree Celsius and standard atmospheric pressure.

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7.6 Quality Assurance

Before loading the test chamber, a blank check of the empty chamber is performed and compliance with background concentrations in accordance with EN 16516 / ISO 16000-9 is determined.

Air sampling at the chamber outlet and subsequent analysis is performed in duplicate. Relative humidity, temperature and air change rate in the chambers is logged every 5 minutes and checked daily. A double determination is performed on random samples at a regular interval and results are registered in a control chart to ensure the uncertainty and reproducibility of the method.

The stability of the analytical system is checked by a general function test of device and column, and by use of control charts for monitoring the response of individual substances prior to each analytical sequence.

7.7 Accreditation

The testing methods described above are accredited online with EN ISO/IEC 17025 by DANAK (no. 522). This accreditation is valid worldwide due to mutual approvals of the national accreditation bodies (ILAC/IAF, see also www.eurofins.com/galten.aspx#accreditation).

Eurofins Product Testing Denmark A/S is notified body for the construction products regulation (EU) No 305/2011 with number NB 2657 under system 3.

Not all parameters are covered by this accreditation. The accreditation does not cover parameters marked with an asterisk (*), however analysis of these parameters is conducted at the same level of quality as for the accredited parameters.

7.8 Uncertainty of the Test Method

The relative standard deviation of the overall analysis is 22%. The expanded uncertainty Um equals 2 x RSD. For further information please visit www.eurofins.dk/product-testing/uncertainty/.

7.9 Decision Rules

Eurofins Product Testing A/S, declare statement of conformity based on the “Binary Statement for Simple Acceptance Rule” described in ILAC’s “Guidelines on decision Rules and Statements of Conformity” ILAC-G8:09/2019.

This means that results above the detection limit are always reported with two significant digits. Results are evaluated with the same number of significant digits as the corresponding limit values, and conformity is based on results being less than or equal to limit values.

For limit values with more than two significant digits, the third digit will be used to confirm whether a result is below or equal to the limit value. It will always be indicated in the evaluation table if this expanded evaluation is performed.

For further information, please visit www.eurofins.dk/product-testing/om-os/beslutningsregler/

7.10 Version History

Report date	Report number	Modification
02/06/2025	392-2025-00155301_G_EN	Current version

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