



Test Report

Howe A/S

Product Emissions of a seating
in accordance with

ANSI/BIFMA M7.1-2007
40/4 Upholstery

October 2010

Client: **Howe A/S**
Mandal Alle 23
5500 Middelfart
Denmark

Date: 18 October 2010

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Introduction

On 7 September 2010 Eurofins Product Testing A/S received a seating sample named

40/4 Upholstery

Batch: 117901, Date of production: 31 August 2010

for emissions testing in accordance with ANSI/BIFMA M7.1-2007. The sample was clearly labelled, properly packaged and not damaged. Testing was carried out in the laboratories of Eurofins Product Testing A/S. Before starting the testing procedure on 17-09-2010 the sample had been stored unopened at room temperature.

The testing result of the 40/4 chair is also representative of the 40/4 Barstool, 40/4 Lounge and 40/4 Swivel according to information from the manufacturer.

1 Description of the Applied Testing Method

The applied method complies with the test method as defined in ANSI/BIFMA M7.1-2007 "American National Standard for Office Furnishing" with the limit values as defined in ANSI/BIFMA X7.1-2007. The internal method numbers are: 9810; 9811, 9812, 2802, 2803 , 8400.

1.1 Test Specimen

A seating sample was sent by the client to the laboratory of Eurofins Product Testing A/S in an airtight package. The package was opened and the test specimen was transferred into a test chamber immediately (internal method no.: 9810).

1.2 Test Chamber

The test chamber was consisting of stainless steel and had a volume of 0,119 m³. The air clean-up was realized in multiple steps. Before loading the chamber, a blank check of the empty chamber was performed. The operation parameters were 23 °C, 50 % relative air humidity (in the supply air) with an air exchange rate of 0.5 per hour. The loading of the test chamber was 1 test specimen per chamber (internal method 9811).

1.3 Sampling, Desorption, Analyses

1.3.1 VOC Emissions Testing after 3 and 7 Days

The emissions of organic compounds after 3 and after 7 days were tested by drawing air samples from the chamber outlet through Tenax TA tubes (main tube and backup tube) after 3 and after 7 days. Analyses were done by thermal desorption and gas chromatography / mass spectroscopy (internal methods no.: 9812 / 2808). All single substances were identified if the toluene equivalent in the Total Ion Chromatogram (TIC) exceeded 2 µg/m³. Quantification was done with the respective response factor and the TIC signal, or in case of overlapping peaks by calculating with fragment ions. All non-identified substances were quantified as toluene equivalent if giving more than 2 µg/m³. The uncertainty amounted to ± 20 % (RSD).

The results of the individual substances were calculated in three groups depending on their appearance in a gas chromatogram when analysing with a non-polar column (HP-1):

- Volatile organic compounds VOC: All substances appearing between these limits.
- Very volatile organic compounds VVOC: All substances appearing before n-hexane (n-C₆).
- Semi-volatile organic compounds SVOC: All substances appearing after n-hexadecane (n-C₁₆).

Calculation of the TVOC_{SumVOC} (Total Volatile Organic Compounds) was done by addition of the results of all individual substances between C₆ and C₁₆.

Calculation of the TVOC_{Toluene} (Total Volatile Organic Compounds) was done by addition of the results of all substances between C₆ and C₁₆ as toluene equivalent.

This test covered only substances that can be adsorbed on Tenax TA and that can be thermally desorbed. If other emissions occurred then these could not be monitored (or with limited reliability only).

1.3.2 Testing of Aldehydes after 3 and 7 Days

The presence of formaldehyde and acetaldehyde was tested by drawing air samples from the chamber outlet through DNPH-coated silicagel tubes after 3 and 7 days. Analysis was done by solvent desorption, HPLC and UV-/diode array detection (ISO 16000-3, internal methods no.: 9812 / 8400).

The absence of the aldehydes was stated if the specific wavelength UV detector response was lacking at the specific retention time in the chromatogram. Otherwise it was checked whether the detection limit was exceeded. In this case the identity was finally checked by comparing full scan sample UV spectra with full scan standard UV spectra. The uncertainty amounted to $\pm 20\%$ (RSD).

1.3.3 Deviation from the test method

The volume of test chamber was 119 l.

1.3.4 Accreditation

The testing methods described above have been accredited (EN ISO/IEC 17025:2005) by DANAK (no. 168). But some parameters are not yet covered by that accreditation. At present the accreditation does not cover the parameters marked with a note *. But the analysis was done for these parameters at the same level of quality as for the accredited parameters.

1.3.5 Calculation of results

Calculation of emission factors after 14 days:

The emission factor after 14 days was calculated by using equation 8, 9, 10 as given in ANSI/BIFMA M7.1-2007:

$$E_{14} = a \cdot 336^{-b}$$

with E_{14} = Emission factor after 14 days ($t=336$ hours) and with

$$b = \frac{\ln E(t_1) - \ln E(t_2)}{\ln t_2 - \ln t_1}$$

$$a = E(t_1) \cdot t_1^b = E(t_2) \cdot t_2^b$$

with $t_1 = 72$ hours (3 days) and $t_2 = 168$ hours (7 days).

Calculation of model room air concentrations after 14 days (chairs):

Model room concentrations were calculated by following formula:

$$C = \frac{A \cdot E}{Q}$$

with:

- C model room concentration, $\mu\text{g}/\text{m}^3$
- A number of seats = 1
- E Unit specific emission factor, $\mu\text{g}/(\text{unit} \cdot \text{h})$
- Q Ventilation rate, chair: $24.8 \text{ m}^3/\text{h}$

2 Results

2.1 Emission factors

40/4 Upholstery	CAS No.	Retention time min	ID-Cat.	Chamber air concentration, $\mu\text{g}/\text{m}^3$		Emission factor, $\mu\text{g}/(\text{unit}^*\text{h})$			b	a
				3 days	7 days	3 days	7 days	14 days #		
TVOC _{SumVOC} (C ₆ -C ₁₆)				290	430	29	43	59	-0.465	4.0
TVOC _{Toluene} (C ₆ -C ₁₆)				180	230	18	23	28	-0.289	5.2
Single VOC Substance:										
Acetic acid	64-19-7	2.28	1	95	140	5.7	8.3	11	-0.46	0.8
Volatile Aldehydes measured with DNPH-Method (see 1.3.2)										
Formaldehyde	50-00-0	-	1	<100	<100	< 10	< 10	< 10	-	-
Acetaldehyde	75-07-0	-	1	<100	<100	< 10	< 10	< 10	-	-

n.d. Not detected

< Means less than

* Not a part of our accreditation, see 1.3.4.

Calculated value, see 1.3.5

2.2 Concentration after 14 days (chair)

40/4 Upholstery	CAS No.	Retention time min	ID-Cat.	Emission factor $\mu\text{g}/(\text{unit}^*\text{h})$	Office air concentration $\mu\text{g}/\text{m}^3$	Limit value LEED CI 2.1 /1/4 CREL $\mu\text{g}/\text{m}^3$
TVOC _{SumVOC} (C ₆ -C ₁₆)				59	2.4	-
TVOC _{Toluene} (C ₆ -C ₁₆)				28	1.1	250
Single VOC Substance:						
4-Phenylcyclohexene	4994-16-5	-	1	< 3	< 0.2	3.25
Acetic acid	64-19-7	2,28	1	11	0.5	-
Volatile Aldehydes						
Formaldehyde	50-00-0	-	1	< 10	< 1	30 (25 ppb)
Acetaldehyde	75-07-0	-	1	< 10	< 1	-
Total Aldehydes (other)	-	-	-	< 30	< 2	50 ppb

n.d. Not detected

< Means less than

* Not a part of our accreditation, see 1.3.4.

** Calculated as average of the two samplings because of constant emissions ($-0.25 < b < 0.25$)

Categories of identity:

The results are only valid for the tested sample(s).

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- 1 = definitely identified, specifically calibrated
- 2 = identified by comparison with a mass spectrum obtained from a library, identity supported by other information, calibrated as toluene equivalent
- 3 = identified by comparison with a mass spectrum obtained from a library, calibrated as toluene equivalent
- 4 = not identified, calibrated as toluene equivalent

Compounds marked with "not identified" are compounds not listed on the CREL list.

3 Interpretation of the results

The results of 40/4 Upholstery can be summarised as follows:

- The Total VOC was **below** the classification threshold of 0.25 mg/m³.
- The 4-Phenylcyclohexene concentration was **below** the classification threshold of 0.00325 mg/m³.
- The formaldehyde concentration was **below** the classification threshold of 25 ppb.
- The total aldehyde concentration was **below** the classification threshold of 50 ppb.

The tested product 40/4 Upholstery complies with the requirements ANSI/BIFMA M7.1-2007 and the limit values given in ANSI/BIFMA X7.1-2007 for seating.

The model room concentrations were **below** the respective 1/4 CREL values.

Appendix 1: Photo of the sample

