

Report No.: 244499203a2 001

Page 1 of 11

Client: Ahrend a.s.
Contact information: U Továren 770/1b 102 00 Praha 10 Czech Republic
Test item(s): Techo Fount original leg
Identification/
Model no(s): --
Product Dimensions: 1600*800*750
Plant Name: Suzhou Antriol sheet metal production Co., Ltd.
Condition at delivery: Test item complete and undamaged.
Sample receiving date: 2023-03-10
Test period: 2023-03-10 – 2023-03-21
Place of testing: Chemical laboratory Shanghai

Test specification:

ANSI/BIFMA M7.1-2011(R2016)
Standard Test Method for Determining VOC Emissions from Office Furniture
Systems, Components, and Seating

Test result:

PASS

Remark: All data refer to 244499203a1 001.

For on and behalf of
TÜV Rheinland (Shanghai) Ltd.



2023-03-23
Date

Eric Xu / Project Engineer
Name/ Position

Test report no.: 244499203a2 001

Page 2 of 11

1. Method and emission test chamber conditions

The emission test was performed in compliance with the test method defined in ANSI/BIFMA M7.1-2011(R2016) Standard "Test Method for Determining VOC Emissions from Office Furniture Systems, Components and Seating".

The evaluation of the test results is performed in accordance with requirements defined in ANSI/BIFMA X7.1-2011(R2016) Standard for Formaldehyde & TVOC Emissions of Low-emitting Office Furniture and Seating.

ANSI/BIFMA e3-2019 Furniture Sustainability Standard.

CDPH/ EHLB/ Standard Method Version 1.2 – California Specification 01350

Table 1 shows the different emitting parts of the sample, the dimensions of each part and the specimen dimension loaded into the chamber.

| Component | Material description | Surface area in the chamber (m ²) |
|---------------------------------|----------------------|---|
| Techo Fount original leg | Whole Product | 2.56 |

*The cut edges were sealed with non-emitting aluminum tape.

Table 2. Test chamber conditions

| Test Parameters | Test chamber conditions |
|---|-------------------------|
| Emission test chamber volume | 5 m ³ |
| Clean air supply air flow [Q _{chamber}] | 5 m ³ /h |
| Temperature | 23 ± 1°C |
| Humidity | 50 ± 5 % |
| Test specimen description | Entire sample |
| Test specimen amount [A _{chamber}] | 2.56 m ² |
| Test duration | 168 h |

Test report no.: 244499203a2 001

Page 3 of 11

2. VOC and aldehydes sampling conditions

VOC and aldehydes active sampling were performed in duplicate by pumping air through respective sorbent just before beginning of the test, then 72 ± 2 hours and 168 ± 2 hours after introduction of the test specimen in the emission test chamber. Sampling conditions are represented in Table 3.

Table 3. Sampling conditions

| Sampling conditions | VOC | Aldehydes (C ₁ -C ₆) |
|-------------------------|-------------------------|---|
| Number of sampled tubes | 2 | 2 |
| Sorbent type | Tenax TA | DNPH |
| Sampling duration | 50 min | 60 min |
| Sampling air flow rate | 75 mL.min ⁻¹ | 1.5 mL.min ⁻¹ |
| Sampled air volume | 4.0 L | 90L |

The chemical analysis was performed following internal test methods QMA 36.035.538 HKG and QMA 36.035.524HKG for the analysis of respectively aldehydes in DNPH cartridges by HPLC-UV and VOCs/TVOCs in Tenax tubes by TD-GC-MS. These internal tests methods are based on standards BS ISO 16000-3:2011 and ASTM D5116-10.

Test report no.: 244499203a2 001

Page 4 of 11

3. VOC test results

The Tenax tubes were analyzed and quantified as described in ANSI/BIFMA X7.1-2011(R2016) in order to obtain the chamber concentrations of total VOCs (TVOCs) and individual VOCs measured between n-C₆ and n-C₁₆

Table 4. Chamber concentrations [C_{chamber}] of VOCs between n-C₆ and n-C₁₆ measured by GC/MS

| Compound name | CAS no. | Chamber concentration at different sampling time (µg/m ³) | |
|----------------------------------|------------|---|-------|
| | | 72 h | 168 h |
| alpha-pinen | 80-56-8 | 8 | 7 |
| Dipropylene glycol monobutyl | 29911-28-2 | 54 | n.d. |
| 4-Phenylcyclohexene | 4994-16-5 | n.d. | n.d. |
| Total of all VOC (TVOC) (C6-C16) | -- | 63 | 7 |

Note: n.d. = not detected

The DNPH cartridges were analyzed by HPLC and quantified as described in BIFMA M7.1-2011(R2006) in order to obtain the chamber concentrations of formaldehyde and acetaldehyde.

Table 5. Chamber concentrations of Formaldehyde and Acetaldehyde by HPLC analysis

| Compound name | CAS no. | Chamber concentration at different sampling time (µg/m ³) | |
|-----------------|---------|---|-------|
| | | 72 h | 168 h |
| Formaldehyde | 50-00-0 | n.d. | n.d. |
| Acetaldehyde | 75-07-0 | n.d. | n.d. |
| Total aldehydes | -- | n.d. | n.d. |

Note: n.d. = not detected

Test report no.: 244499203a2 001

Page 5 of 11

The emission factor for each individual VOC and TVOC was calculated using equation 1, where the emission factors at 72h and 168h [E(t_i)] are equal to the product of the chamber air flow rate [Q_{chamber}] and the chamber concentration [C_{chamber}] at the different times, divided by the area [A_{chamber}] of product tested in the test chamber.

$$E(t_i) = \frac{Q_{chamber} \times C_{chamber}}{A_{chamber}} \quad \text{Equation 1}$$

Table 6. Calculated Specific Emission Factor for Identified VOCs, TVOC Formaldehyde and Acetaldehyde

| Compound name | CAS no. | Emission factor (µg/m ² h) | |
|----------------------------------|------------|---------------------------------------|-------|
| | | 72 h | 168 h |
| alpha-pinen | 80-56-8 | 15.63 | 13.67 |
| Dipropylene glycol monobutyl | 29911-28-2 | 105.47 | -- |
| 4-Phenylcyclohexene | 4994-16-5 | -- | -- |
| Total of all VOC (TVOC) (C6-C16) | -- | 123.05 | 13.67 |
| Formaldehyde | 50-00-0 | -- | -- |
| Acetaldehyde | 75-07-0 | -- | -- |
| Total aldehydes | -- | -- | -- |

The emission factor for each individual aldehydes was calculated using equation 2, where the emission factors at 72h and 168h [E(t_i)µmol] is equal to the emission factor for each individual aldehydes [E(t_i)] divided by the molecular weight (molar mass) [MW] of the respective compound.

$$(t_i)_{\mu mol} = E(t_i) / MW \quad \text{Equation 2}$$

Table 7. Calculated Specific Emission Factor Formaldehyde and Acetaldehyde

| Compound name | CAS no. | Emission factor (µmol/m ² h) | |
|-----------------|---------|---|-------|
| | | 72 h | 168 h |
| Formaldehyde | 50-00-0 | -- | -- |
| Acetaldehyde | 75-07-0 | -- | -- |
| Total aldehydes | -- | -- | -- |

Test report no.: 244499203a2 001

Page 6 of 11

Table 8. Calculation of emission factors at 336 hours based on the Power law Model Prediction of VOCs and TVOC

| Compound name | CAS no. | Power Law Model Coefficients for $E=at^{-b}$ | | Emission factor at 336th hours ($\mu\text{g}/\text{m}^2\text{h}$) |
|----------------------------------|------------|--|------|---|
| | | a | b | |
| alpha-pinen | 80-56-8 | 30.66 | 0.16 | 12.26 |
| Dipropylene glycol monobutyl | 29911-28-2 | -- | -- | -- |
| 4-Phenylcyclohexene | 4994-16-5 | -- | -- | -- |
| Total of all VOC (TVOC) (C6-C16) | -- | 8063637.75 | 2.59 | 2.27 |

Table 9. Calculation of emission factors at 336 hours based on the Power law Model Prediction of aldehydes

| Compound name | CAS no. | Power Law Model Coefficients for $E=at^{-b}$ | | Emission factor at 336th hours ($\mu\text{g}/\text{m}^2\text{h}$) |
|-----------------|---------|--|----|---|
| | | a | b | |
| Formaldehyde | 50-00-0 | -- | -- | -- |
| Acetaldehyde | 75-07-0 | -- | -- | -- |
| Total aldehydes | -- | -- | -- | -- |

Test report no.: 244499203a2 001

Page 7 of 11

4. Evaluation

Table 10. Evaluation according to the requirements of BIFMA X7.1-2011(R2016) for individual furniture components at 168

| Chemical/ Chemical Group | Emissions Limits Open Plan Workstation | Emissions Limits Private Office Workstation | Test Results At 168h | Evaluation |
|---|--|---|----------------------|------------|
| Formaldehyde ($\mu\text{g}/\text{m}^2\text{hr}$) | 42.3 | 85.1 | -- | Pass |
| TVOC ($\mu\text{g}/\text{m}^2\text{hr}$) | 345 | 694 | 13.67 | Pass |
| Total Aldehydes ($\mu\text{mol}/\text{m}^2\text{hr}$) | 2.8 | 5.7 | -- | Pass |
| 4-Phenylcyclohexene ($\mu\text{g}/\text{m}^2\text{hr}$) | 4.5 | 9.0 | -- | Pass |

Table 11. Evaluation of individual VOCs at 336 hours according to ANSI/BIFMA e3-2019, Credit 7.6.2

| Compound name | CAS no. | Open Plan Maximum Allowable Emission Factor ($\mu\text{g}/\text{m}^2\text{h}$) | Private Office Maximum Allowable Emission Factor ($\mu\text{g}/\text{m}^2\text{h}$) | Calculated emission factor at 336h ($\mu\text{g}/\text{m}^2\text{h}$) | Evaluation |
|----------------------------------|------------|--|---|---|------------|
| alpha-pinen | 80-56-8 | -- | -- | 12.26 | Pass |
| Dipropylene glycol monobutyl | 29911-28-2 | -- | -- | -- | Pass |
| 4-Phenylcyclohexene | 4994-16-5 | -- | -- | -- | Pass |
| Total of all VOC (TVOC) (C6-C16) | -- | -- | -- | 2.27 | Pass |
| Formaldehyde | 50-00-0 | 11 | 23 | -- | Pass |
| Acetaldehyde | 75-07-0 | 48 | 97 | -- | Pass |
| Total aldehydes | -- | -- | -- | -- | Pass |

Test report no.: 244499203a2 001

Page 8 of 11

Table 12. Evaluation of individual VOCs at 336 hours according to CDPH/ EHLB Standard Method V1.2

| Substance | CAS no. | Emission factor at 336 hours ($\mu\text{g}/\text{m}^2\cdot\text{h}$) | Allowable Concentration ($\mu\text{g}/\text{m}^3$) | Open-plan workstation estimated concentration ($\mu\text{g}/\text{m}^3$) | Evaluation |
|----------------------------------|------------|--|--|--|------------|
| alpha-pinen | 80-56-8 | 12.26 | -- | 17.76 | Pass |
| Dipropylene glycol monobutyl | 29911-28-2 | -- | -- | -- | Pass |
| 4-Phenylcyclohexene | 4994-16-5 | -- | -- | -- | Pass |
| Total of all VOC (TVOC) (C6-C16) | -- | 2.27 | -- | 3.28 | Pass |
| Formaldehyde | 50-00-0 | -- | 9 | -- | Pass |
| Acetaldehyde | 75-07-0 | -- | 70 | -- | Pass |
| Total aldehydes | -- | -- | -- | -- | Pass |

Table 13. Evaluation of formaldehyde at 336 hours according to ANSI/BIFMA e3-2019, Credit 7.6.3 – individual furniture components maximum emission factor

| Compound name | CAS no. | Open-plan workstation Emission Factor ($\mu\text{g}/\text{m}^2\cdot\text{h}$) | Private Office workstation Emission Factor ($\mu\text{g}/\text{m}^2\cdot\text{h}$) | Calculated emission factor at 336h ($\mu\text{g}/\text{m}^2\cdot\text{h}$) | Evaluation |
|---------------|---------|---|--|--|------------|
| Formaldehyde | 50-00-0 | 6.2 | 12.5 | -- | Pass |

Test report no.: 244499203a2 001

Page 9 of 11

Chain of Custody

 TÜV Rheinland Hong Kong Ltd
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 Page 1 of 2

VOC EMISSION TESTING APPLICATION FORM AND CHAIN OF CUSTODY
揮發性及有機化合物釋放測試申請表

 Please fill out one form per sample and return it to us. Thanks.
 請為每份測試樣品填寫一份申請表, 然後將填妥的申請表回傳到我司。謝謝。

| |
|--------------------------------|
| Internal use only / TÜV 萊茵內部使用 |
| Order No: 150246475 |
| Reviewed by (date): |

Please ship sample to/ 請把樣品寄送到:

 萊茵技術(上海)有限公司 TÜV Rheinland (Shanghai) Co.,Ltd
 上海市靜安區廣中西路 777 弄 153 - 165 號萊茵大廈三期 1 樓倉庫 (200072)
 1 F warehouse, Shanghai TÜV building Phase III, No.153, 165, Lane 777,West
 Guangzhong Road,Jing'an District, Shanghai 200072
 Attn: Allie Tan (Sample Use)
 Contact Number: +86 21 6108 1021

Please fill in by computer - send with sample, and per email/ 請使用電腦填寫 - 並連同樣品 及 透過電郵交回

| Client/ 客戶 | Report To Be Sent To/ 報告送到 | Invoice To Be Sent To/ 發票送到 | Copy of Report To Be Sent To/ 報告副本送到 |
|-----------------------|--|--------------------------------|---|
| Company/ 公司 | Ahrend a.s. | | |
| Contact Person/ 聯絡人 | Felix.Huang | | |
| E-mail/ 電子郵件 | Felix.huang@royalahrend.cn | | |
| Address/ 地址 | U Tovären 770/1b 102 00 Praha 10 Czech Republic | | |
| Postcode/ Town/ 郵編/ 鎮 | | | |
| Country/ 國家 | Holland | | |
| Telephone No./ 電話號碼 | | | |
| Fax No./ 傳真號碼 | | | |
| Your reference/ 您的參考 | | | |

| Test Method(s) Ordered: | | | |
|---|--|--------------------------------------|--------------------------|
| 1. AgBB/DiBt | | 7. LGA Tested Safety & Contamination | |
| 7 days <input type="checkbox"/> | 28 days <input type="checkbox"/> | VOC/ 揮發性及有機化合物 | <input type="checkbox"/> |
| With aldehydes <input type="checkbox"/> | Without aldehydes <input type="checkbox"/> | Formaldehyde/ 甲醛 | <input type="checkbox"/> |
| 2. French mandatory VOC label | <input type="checkbox"/> | Odour/ 氣味 | <input type="checkbox"/> |
| (including 4 regulated CMR) | | 8. Formaldehyde/ 甲醛: | |
| 3. CDPH Section 01350 | <input type="checkbox"/> | EN 717-1 | <input type="checkbox"/> |
| 4. FloorScore | <input type="checkbox"/> | ISO 16000-3 (DNPH) | <input type="checkbox"/> |
| 5. ANSI/BIFMA M7.1-2011 | <input checked="" type="checkbox"/> | ASTM D6007 | <input type="checkbox"/> |
| 6. Indoor Advantage | <input checked="" type="checkbox"/> | ASTM D5116 | <input type="checkbox"/> |
| Indoor Advantage Gold | <input checked="" type="checkbox"/> | 9. VOC emission/ 揮發性及有機化合物釋放 | |
| | | ISO 16000-6,9 | <input type="checkbox"/> |
| | | ASTM D5116 | <input type="checkbox"/> |

| Further Information – Please Fill In Only If Necessary | | |
|--|---|---|
| Type of Chamber: | Length of Testing: | Reporting of Results: |
| Mid-scale <input type="checkbox"/> | 24h <input type="checkbox"/> 72h <input type="checkbox"/> 168h <input type="checkbox"/> 336h <input type="checkbox"/> | Emission Factors only <input type="checkbox"/> |
| Small-scale <input type="checkbox"/> | Other: | room concentrations modeling <input type="checkbox"/> |
| Other test/information: | | |
| Report format: | PDF <input checked="" type="checkbox"/> | Printed <input type="checkbox"/> Printed & PDF <input type="checkbox"/> |

| | | |
|--|---|--|
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Test report no.: 244499203a2 001

Page 10 of 11

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 Page 2 of 2

VOC EMISSION TESTING APPLICATION FORM AND CHAIN OF CUSTODY
揮發性及有機化合物釋放測試申請表

 Please fill out one form per sample and return it to us. Thanks.
 請為每份測試樣品填寫一份申請表，然後將填妥的申請表回傳到我司。謝謝。

| |
|--------------------------------|
| Internal use only / TÜV 萊茵內部使用 |
| Order No: 150246475 |
| Reviewed by (date): |

| | | | |
|--|--|-------------------------------|--------------|
| Product Commercial Name: | Techo Fount original leg | Product Commercial Part No.: | |
| Product Dimensions: (Height × Width × Thickness) | 1600*800*750 | Product Item No.: | |
| Manufacturer Sample Tracking ID: | | Date Manufactured: | 2023-2-22 |
| Product Category and Use: | Office use | Sample Construction Material: | Metal · wood |
| Plant Name and Location: | Suzhou Antriel sheet metal production Co., Ltd. No.135 West Yanshan Road, Chengxiang Town, Taicang City Jiangsu China | Collection Location In Plant: | Taicang City |
| Date and Time of Collection: | | Sample Collected By: | |
| Storage of Sample After Sampling: | | Packing Material: | |
| Packed and Shipped by: | Antriel | Shipping Date: | 2023-3-7 |
| Carrier: | | Airbill Number: | |

| LABORATORY USE ONLY | | | |
|------------------------|----------------|-----------------------|----------------|
| Received By: | From Yan | Received Date: | 2023. 3. 10 |
| Conditions of Package: | Apparent Good. | Conditions of Sample: | Apparent Good |
| Received By: | / | Signature: | From Yan |
| Company: | TRSH | Laboratory: | chemical Labop |
| Sample Number: | A003430886 | Report Number: | 244499203a2 |


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Test report no.: **244499203a2 001**

Page 11 of 11

5. Photos



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