

INTERTEK TESTING SERVS NA LTD  
Date: February 24, 2017  
P.O.: N/A

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## Environmental VOC Emissions


Test Summary	
Test Method	Standard Method Version 1.2 for CDPH 01350
Modeling Scenario	Private office, school classroom and single family residence


Test Results	
Modeling Scenario	Pass/Fail
Private Office	Pass
School Classroom	Pass
Single Family Residence	Pass

\*Note: The single family residence modeling scenario is not yet a requirement and is for informational purposes only.

Customer Information	
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Product Sample Information	
Manufacturer / Location	Hammerglass AB / Sweden
Product Name	Hammerglass 6 mm clear
Date of Manufacture	01/21/17
Date of Collection	01/27/17
Date of Shipment	01/30/17
Date Received by Lab	01/30/17
Date of Test Start and Duration	02/03/17; 14 days
As Received Sample Condition	Good Condition
Lab Sample ID	GRR1701301023-MLT

  
TAYLOR GEBBEN  
Project Engineer

  
AMANDA STUART  
Reviewer



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**DESCRIPTION OF SAMPLES:**

Part Description:	Hammerglass 6 mm clear
Material Submitted:	Four (4) Rigid polycarbonate, Silicon oxide coated glass

**WORK REQUESTED:**

Test Method:	CDPH Standard Method v1.2
Acceptance Criteria:	CDPH Standard Method v1.2, Table 4.1
Method Deviations:	Testing performed without deviation unless noted below. The conditioning temperature was above 25.0°C for 13 hours during the conditioning period.

**Test Summary:**

The emissions testing were performed according to “*Standard Method for the Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers Version 1.2*”. A photograph of the tested sample is included herein. The sample was attached to a stainless steel plate using strips of aluminized tape and placed in conditioning for 10 days with top surface exposed, before being placed in the test chamber. Air samples were collected prior to the sample being placed in the test chamber (0 hours) and at 24, 48 and 96 hours after placement in the test chamber. These times correspond to 264, 288, and 336 hours of total exposure. Samples analyzed for individual VOCs and TVOC were collected on multi-sorbent tubes containing Tenax TA 35/60 backed by Carbograph 5 TD 40/60. These VOC samples were analyzed by thermal desorption-gas chromatography/mass-spectroscopy, TD-GC/MS. TVOC was calculated through integration of the chromatogram from n-pentane through n-heptadecane using toluene as a surrogate. Individual VOCs were calculated using calibration curves based on pure standards unless otherwise noted. Samples analyzed for low molecular weight aldehydes were collected on cartridges treated with 2,4-di-nitrophenylhydrazine (DNPH). Low molecular weight aldehydes were analyzed using high performance liquid chromatography, HPLC.

**Table 1:** Conditioning and test timing.

Experiment Phase	Start Date	Duration
Conditioning	03 Feb 2017	10 days
Chamber Testing	13 Feb 2017	4 days

**Table 2:** Parameters of conditioning.

Parameter	Value	Units
Average Temperature (Average)	23.3 (22.7-25.8)	°C
Average Humidity (Average)	48.8 (43.2-52.5)	% RH

Note: Conditioning air is passed through both particulate and activated charcoal filtration to remove background VOCs.



**Table 3:** Sample and chamber conditions during test period.

Parameter	Symbol	Value	Units
Exposed Sample Surface Area	$A$	0.092	$\text{m}^2$
Chamber Volume	$V$	0.116	$\text{m}^3$
Chamber Loading Factor	$L$	0.80	$\text{m}^2 \text{m}^{-3}$
Inlet Air Flow Rate	$Q$	0.116	$\text{m}^3 \text{h}^{-1}$
Air Change Rate	$N_{ACH}$	1.00	$\text{h}^{-1}$
Area Specific Flow Rate	$q_A$	1.25	$\text{m h}^{-1}$
Testing Duration	$t$	96	$\text{h}$
Chamber Pressure (Range)	$P$	17.5 (14.2-20.6)	$\text{Pa}$
Average Temperature (Range)	$T$	23.0 (22.8-23.1)	$^{\circ}\text{C}$
Average Humidity (Range)	$\text{RH}$	50.0 (49.8-50.2)	% RH

**Table 4:** Test chamber background VOC concentrations in  $\mu\text{g m}^{-3}$ .

Compound	CAS No.	$C_{i0}$
Formaldehyde	50-00-0	1.0
TVOC	-	4.2

**Table 5:** Test chamber TVOC and formaldehyde concentrations in  $\mu\text{g m}^{-3}$ .

Compound	CAS No.	24 h	48 h	96 h
Formaldehyde	50-00-0	< 0.7	0.9	0.7
TVOC	-	20.9	13.3	9.2

**Table 6:** Test chamber TVOC and formaldehyde emission factors in  $\mu\text{g m}^{-2} \text{h}^{-1}$ .

Compound	CAS No.	24 h	48 h	96 h
Formaldehyde	50-00-0	BB*	BB*	BB*
TVOC	-	20.9	11.4	6.2

BB\* - Below Blank



Individual emitted VOCs identified above the lower limits of quantitation are listed in Table 7; VOCs which are listed on chemical of concern lists or have CRELs are indicated.

The measured chamber concentrations and corresponding emission factors of identified individual VOCs and TVOCs are listed in Table 8.

In Tables 6 and 8, emission factors were calculated using equation 3.1 in CDPH Standard Method V1.2:

$$EF_{Ai} = \frac{Q \times (C_{it} - C_{i0})}{A_c}$$

The inlet flow rate,  $Q$  ( $\text{m}^3 \text{h}^{-1}$ ), is the measured flow rate of air into the chamber. The chamber concentration,  $C_{it}$  ( $\mu\text{g m}^{-3}$ ), is the concentration of a target VOC<sub>i</sub>, formaldehyde and other carbonyl compounds measured at time  $t$ . The chamber background concentration,  $C_{i0}$  ( $\mu\text{g m}^{-3}$ ), is the corresponding concentration measured with the chamber operating without a test specimen. The exposed projected surface area of the test specimen in the chamber,  $A_c$  ( $\text{m}^2$ ), is determined from the measurements made at the time of specimen preparation.

**Table 7:** VOCs detected above lower limits of quantitation in air samples at 366 hours.

VOC	CAS No.	Surrogate <sup>1</sup>	CREL <sup>2</sup> ( $\mu\text{g m}^{-3}$ )	CARB TAC <sup>3</sup>	Prop 65 List <sup>4</sup>
Formaldehyde	50-00-0		9	Yes	Yes
Acetaldehyde	75-07-0		140	Yes	Yes
2-Ethylhexyl acrylate	103-11-7	Yes	N/A	No	No

<sup>1</sup>Indicates which non-listed VOCs were quantified using surrogate compounds, all other compounds were quantified using pure compounds.

<sup>2</sup>Chronic Reference Exposure Level (CREL) as defined by California Office of Environmental Health Hazard Assessment.

<sup>3</sup>Substance is listed on California Air Resource Board's (CARB) Toxic Air Contaminant (TAC) identification list.

<sup>4</sup>Substance known to the state of California to cause cancer or reproductive toxicity according to California's Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).

**Table 8:** Measured chamber concentrations and corresponding emission factors of identified individual VOCs and TVOC at 96 hours.

VOC	CAS No.	Chamber Concentration ( $\mu\text{g m}^{-3}$ )	Emission Factor ( $\mu\text{g m}^{-2} \text{h}^{-1}$ )
Formaldehyde	50-00-0	0.7	BB*
Acetaldehyde	75-07-0	3.4	1.2
2-Ethylhexyl acrylate	103-11-7	2.1	2.6
TVOC	-	9.2	6.2

\*BB – Below Blank



### Exposure Scenario Modeling and Evaluation:

Estimated building concentrations for the private office, school classroom, and single-family residence scenarios were calculated using equation 3.2a of CDPH Standard Method V1.2:

$$C_{Bi} = \frac{EF_{Ai} \times A_B}{Q_B}$$

The area specific emission rate  $EF_A$  at 336 hours (14 days) total exposure time is multiplied by the ratio of the exposed surface area of the installed material in the building,  $A_B$  ( $m^2$ ), to the flow rate of outside ventilation air,  $Q_B$  ( $m^3 h^{-1}$ ).

The modeling parameters used for private office, school classroom, and single-family residence scenarios are listed in Tables 9.

The modeled concentrations of identified individual VOCs for private office, school classroom, and single-family residence scenarios are listed in Tables 10, 11, and 12, respectively. Whether the modeled concentrations meet the maximum allowable concentration requirements specified in Table 4.1 of CDPH Standard Method V1.2 are also indicated.

**Table 9:** Standard modeling parameters for windows.

Parameter	Symbol	Value	Units
Exposed Surface Area Installed in <i>Private Office</i>	$A_B$	1.49	$m^2$
Air flow rate of <i>Private Office</i>	$Q_B$	20.7	$m^3 h^{-1}$
Exposed Surface Area Installed in <i>Classroom</i>	$A_B$	4.46	$m^2$
Air flow rate of <i>Classroom</i>	$Q_B$	191	$m^3 h^{-1}$
Exposed Surface Area Installed in <i>Residence</i>	$A_B$	38	$m^2$
Air flow rate of <i>Residence</i>	$Q_B$	127	$m^3 h^{-1}$



**Table 10:** Projected concentrations of identified individual VOCs using private office scenario.

VOC	CAS No.	Projected Concentration ( $\mu\text{g m}^{-3}$ )	Concentration Limit ( $\mu\text{g m}^{-3}$ )	Disposition
Acetaldehyde	75-07-0	0.1	70*	Pass
2-Ethylhexyl acrylate	103-11-7	0.2	-	N/A

\* Concentration Limit specified in CDPH SM V1.2, Table 4.1

**Table 11:** Projected concentrations of identified individual VOCs using school classroom scenario.

VOC	CAS No.	Projected Concentration ( $\mu\text{g m}^{-3}$ )	Concentration Limit ( $\mu\text{g m}^{-3}$ )	Disposition
Acetaldehyde	75-07-0	0.03	70*	Pass
2-Ethylhexyl acrylate	103-11-7	0.1	-	N/A

\* Concentration Limit specified in CDPH SM V1.2, Table 4.1

**Table 12:** Projected concentrations of identified individual VOCs using single family residence scenario.

VOC	CAS No.	Projected Concentration ( $\mu\text{g m}^{-3}$ )	Concentration Limit ( $\mu\text{g m}^{-3}$ )	Disposition
Acetaldehyde	75-07-0	0.4	70*	Pass
2-Ethylhexyl acrylate	103-11-7	0.8	-	N/A

\* Concentration Limit specified in CDPH SM V1.2, Table 4.1



**Table 13:** Facilities and Equipment:

Instrumentation Used:	Markes TD-100 Thermal Desorption Agilent 7890B GC Agilent 5977A MS Agilent 1260 HPLC
Column Used:	Agilent HP-ULTRA2 (GC) Poroshell 120 EC-C18 (HPLC)

**Table 14:** HPLC Parameters.

Parameter	Value
Solvent A	Water
Solvent B	Acetonitrile
Solvent C	Tetrahydrofuran
Flow Rate	0.62 mL/min
Initial	56:30:14 A:B:C
Final	21:70:9 A:B:C
End Time	10.25 min
Detector wavelength	360 nm

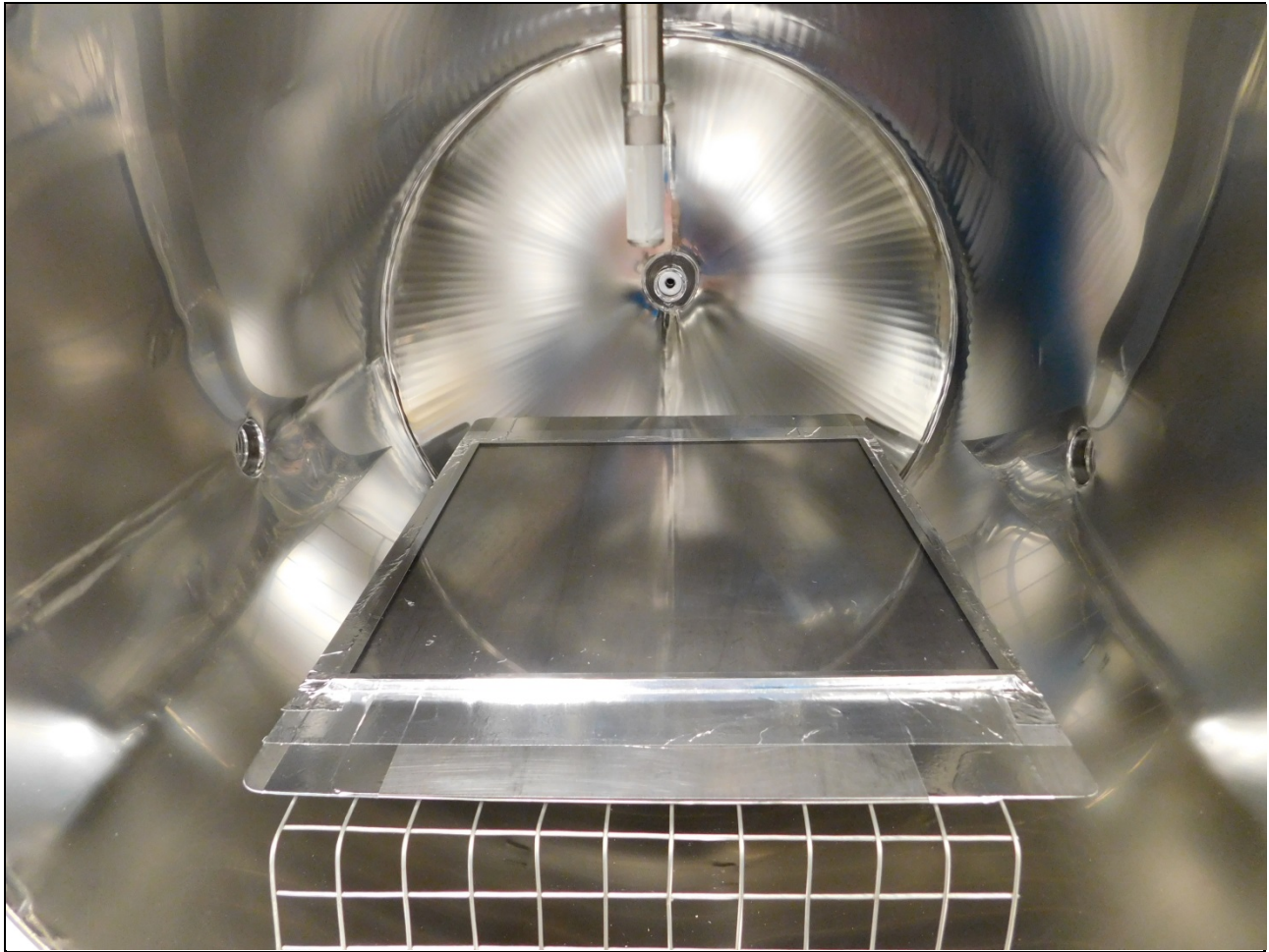
**Table 15:** TD-GC/MS Parameters.

Parameter	Value
Thermal Desorption	
Tube Desorb Temperature	285 °C
Trap Temperature	-10 °C
Trap Desorb Temperature	310 °C
Gas Chromatograph	
Initial Temperature	30 °C
Initial Time	5 min
Ramp Rate 1	5 °C/min
Temperature 2	100 °C
Ramp Rate 2	10 °C/min
Final Temperature	300 °C
Final Temperature Hold	5 min

All data, including but not limited to raw instrument files, calibration fits, and quality control checks used to generate the test results are available to the client upon request.






Photo Documentation



**Figure 1:** Photograph of sample as tested in environmental testing chamber.



# Chain of Custody

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<b>Manufacturer Information (if different from customer)</b> Company: Hamnerglass AB City/State/Country: 269 71 Forslöv, Sweden Contact Name/Title: Bengt Nilsson Phone Number/E-mail Address: +46 733 540029 bengt.nilsson@hamnerglass.se		
<b>Sample Details</b> Product Commercial Name*: Hamnerglass Product Commercial Part No. (if not part of the name)*: 6 mm Clear Manufacturer Sample Tracking ID: 20170180_22462 Date Manufactured*: 21 January 2017 Product Category & Use*: Rigid polycarbonate, Silicon oxide coated Sample Construction Material*: Rigid polycarbonate, Silicon oxide coated Plant Name & Location*: Hamnerglass AB, Akagårdsvägen, 269 71 Forslöv, Sweden Collection Location within Plant: Production Date & Time Collected*: 27 January 2017, 10:30 Number of Sample Pieces*: 4 Sample Collected by*: David Bigland Phone/Fax Numbers*: +44 1308 857 778 E-mail Address*: david.bigland@intertek.com		
<b>Shipping Details*</b> Packed & Shipped By: David Bigland and Hamnerglass AB Shipping Date: 30 January 2017 Carrier/Airbill Number:		
<b>Sample Handling</b> Relinquished By: Bengt Nilsson Received By: David Bigland	Printed Name*   Taylor Odebrecht 27 January 2017	Signature* Date* Company*
<b>Chain of Custody for VOC Emission Test</b> A Separate COC must be completed for EACH product/material sample. Intertek's Terms & Conditions are included in this workbook. By submitting samples, customer acknowledges and accepts these terms & conditions unless a prior written contract is in effect. Intertek Quotation Number: 71795 Purchase Order (enter company & number): TBA, Re: Kyle Koke and Luke Kong Project number: G102735294		
<b>Requested Test (automatically filled from Furniture VOC Test Selections)</b> Test to be performed: <input checked="" type="checkbox"/> VOC Emission Type of furniture product: <input checked="" type="checkbox"/> Table Target chemicals and chemical groups: <input checked="" type="checkbox"/> Formaldehyde Modeling scenario: <input checked="" type="checkbox"/> Steady state Test schedule (for screening tests only): <input checked="" type="checkbox"/> 1 hour Test results applications: <input checked="" type="checkbox"/> Compliance		
<b>Customer Institutions for Sample Prep, Test Type, Schedule, etc. (filled from next worksheet)</b> Samples provided for testing to CAL 01350 315 mm x 315 mm x 6 mm, 4 pcs Instructions before testing: Remove the masking foil from both sides of the specimen		
<b>Customer Request for Certification Program</b> Are you pursuing Intertek's ETL Environmental VOC Certification: <input checked="" type="checkbox"/> Yes Are you pursuing Intertek's ETL Environmental VOC Certification: <input checked="" type="checkbox"/> Yes Are you pursuing SCS's Indoor Advantage™ Certification: <input checked="" type="checkbox"/> Yes Are you pursuing SCS's Indoor Advantage™ Gold Certification: <input checked="" type="checkbox"/> Yes Are you pursuing SCS's FloorScore® Certification: <input checked="" type="checkbox"/> Yes		
<b>Customer Authorizes Laboratory to Submit Copies of Test Report to:</b> Contact/E-mail Address: bengt.nilsson@hamnerglass.se Organization: Hamnerglass AB Contact/E-mail Address:		
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