

VOC emission test

For wall coverings following CDPH/ EHLB/ Standard Method V1.1. California Specification 01350

1. Manufacturer, product and sample identification

Manufacturer Information

Product name:	Quick Install Wall Covering
Product commercial part no.:	n/a
Product item no.:	n/a
Product category:	Wall Covering
Manufacturer ID:	HKKZ20160508002
Date manufactured:	2016.05.08
Date collected:	2016.05.09
Date shipped:	Not provided

Sample/Specimen Information

Date received:	2016.05.16
Specimen ID (Lab tracking No.):	A000361135-001
Specimen preparation:	2 pieces of specimen of 1.18m by 0.13m were tested with back and sides sealed by aluminum foil.
Conditioning period start & duration:	2016.06.03, 10 days
Test period start & duration:	2016.06.14, 96 hours

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2. Test Methods and conditions

Method

Emission tests are performed following California Department of Public Health Services "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1 - California Specification 01350". The chamber test method is conducted following the guidance of ASTM Standard D 5116-06 and ISO 16000-9:2011.

Conditions

The sample was conditioned for 10 days in the same test chamber where the analysis was performed during 96h. The same conditions during conditioning and test were kept and are described in table 1.

Table 1. Chamber conditions during the 10 days conditioning and 96-h test period

Parameter	Symbol	Units	Value
Product exposed area (A_c)	A_c	m^2	0.31
Chamber volume (V_c) (0.25 $m^3/1m^3$)	V_c	m^3	1
Loading factor (L_c)	L_c	m^2/m^3	0.31
Air change rate (a_c)	a_c	h^{-1}	1.01
Inlet flow rate (Q)	Q	m^3/h	1.01
Area specific flow rate (q_A)	q_A	m/h	3.26
Temperature	T	$^{\circ}C$	23 ± 1
Relative humidity	RH	%	50 ± 5

VOC and aldehydes active sampling were performed in duplicate by pumping air through respective sorbent just before loading the chamber, then at 24h, 48h and 96 h after initiating the chamber test (without counting the previous 10 days conditioning). Sampling conditions are represented in table 2.

Table 2. 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	1.5 L/min
Sampled air volume	3.8 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.

3. Data Analysis Procedures

3.1 Emission Factors

Emission factors were calculated from chamber concentrations then by using the emission factors the estimated building concentrations were calculated.

Emission factor (EF) in $\mu\text{g}/\text{m}^2/\text{h}$ for a chemical substance in a chamber test is calculated using Equation 1:

$$EF = (Q (C - C_o)) / A_c \quad (1)$$

where C is the chamber concentration of the substance ($\mu\text{g}/\text{m}^3$) and C_o is the corresponding substrate or chamber blank concentration ($\mu\text{g}/\text{m}^3$). The other parameters are defined in Table 1.

3.2 Estimated Building Concentrations

Building concentrations can be calculated on a case-by-case basis using input parameters for the amount of installed product, the size of the space and the air change rate (or air flow rate) that are specific to the architectural project under consideration.

In order to evaluate and compare products for use in a wide range of building products, concentrations also can be calculated for selected building scenarios. Building concentrations are estimated based on the measured VOC emission factors, the amount of material to be installed in the building and flow rate of outside air used for ventilation. Steady state conditions with respect to emission rates and building ventilation shall be assumed in making the prediction. Additional assumptions are zero outdoor concentrations, perfect mixing within the building and no net losses of VOC from air due to other effects such as irreversible or net sorption on surfaces (i.e., net sink effects) and chemical reactions. The projected surface area of installed flooring and the building parameters to be used in the calculation of estimated VOC concentrations are established for a school classroom and an office and have been described in table 3.

Table 3. The projected surface area of installed flooring and the building parameters to be used in the calculation of estimated VOC concentrations

Scenario	Outdoor ventilation air (m^3/h)	Exposed wall surface area (m^2)	Area specific air flow rate (m/h)
Standard School Classroom	191	94.6	2.02
Private Office	20.7	33.4	0.62

The estimated building concentration, C_{Bi} ($\mu\text{g}/\text{m}^3$), of a target VOC is calculated using equation 2.

$$C_{Bi} = (EF \times A_B) / Q_B = EF / (Q_B / A_B) = EF / q_A \quad (2)$$

The area specific emission rate EF at 336 hours (14 days) total exposure time is divided by the area specific flow rate, q_A (m/h). The area specific flow rate, q_A , is calculated as the ratio of the flow rate of outside ventilation air, Q_B (m^3/h), to the exposed surface area of the installed material in the building, A_B (m^2).

4. Results

Table 4. 24h & 48h chamber conc. & emission factors

Parameter	CAS Number	Chamber concentration ($\mu\text{g}/\text{m}^3$)		Emission factor ($\mu\text{g}/\text{m}^2\text{h}$)	
		24h	48h	24h	48h
TVOC	--	154	126	502	411
Formaldehyde	50-00-0	6	n.d.	20	--

Table 5. 96-h chamber concentrations and emission factors of all target VOCs and most abundant - Only detected compounds have been listed.

Compound Name	CAS Number	Chamber concentration ($\mu\text{g}/\text{m}^3$)	Emission factor ($\mu\text{g}/\text{m}^2\text{h}$)	Remark ¹
Acetic acid	64-19-7	32	104	--
2-ethyl-1-hexanol	104-76-7	6	20	--
2-butoxyethanol	111-76-2	22	72	TAC
Benzaldehyde	100-52-7	6	20	--
1-hydroxycyclohexyl phenyl ketone	947-19-3	6	20	--
TMPDMIB (Texanol) 1	80525-37-7	17	55	--
TMPDMIB (Texanol) 2	80525-37-7	15	49	--
Acetonitrile	75-05-8	5	16	TAC
TVOC	--	112	365	--

¹ CRELs – Chronic Reference Exposure Levels: this substance has a CREL value.
Refer to <http://www.oehha.ca.gov/air/allrels.html>.

C – Safe Drinking Water and Toxic Enforcement Act of 1986: classified as known or probable human carcinogens and reproductive/ developmental toxins.
Refer to http://www.oehha.ca.gov/prop65/prop65_list/newlist.html.

TACs – Toxic Air Contaminants: classified as Hazardous Air Pollutants plus additional compounds.
Refer to <http://www.arb.ca.gov/toxics/id/taclist.htm>.

Table 6. Estimated concentrations for the different scenarios and evaluation of the requirements

Compound Name	CAS Number	Allowable Concentration ² ($\mu\text{g}/\text{m}^3$)	Standard class room estimated concentration ($\mu\text{g}/\text{m}^3$)	Private office estimated concentration ($\mu\text{g}/\text{m}^3$)	Pass/Fail
Acetic acid	64-19-7	--	52	168	--
2-ethyl-1-hexanol	104-76-7	--	10	32	--
2-butoxyethanol	111-76-2	--	35	116	--
Benzaldehyde	100-52-7	--	10	32	--
1-hydroxycyclohexyl phenyl ketone	947-19-3	--	10	32	--
TMPDMIB (Texanol) 1	80525-37-7	--	27	89	--
TMPDMIB (Texanol) 2	80525-37-7	--	24	79	--
Acetonitrile	75-05-8	--	8	26	--
TVOC	--	--	181	589	--

² Refer to <http://www.oehha.ca.gov/air/allrels.html>. All maximum allowable concentrations are one-half the corresponding CREL adopted by Cal/EPA OEHHA with the exception of formaldehyde.

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5. Conclusion

The indoor air quality emission criteria for the California Specification 01350 for the *Quick Install Wall Covering* have been met.

Hong Kong, 2016.06.23

TÜV Rheinland Hong Kong Ltd.

A handwritten signature in blue ink, appearing to read 'Miu'.

Miu Cheung
Project Chemist

A handwritten signature in blue ink, appearing to read 'Zhang'.

Liang Zhang
Project Manager

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6. Photo



Photo 1. Tested sample – Quick Install Wall Covering