Lucerne University of Applied Sciences and Arts



Technik & Architektur Zentrum für Integrale Gebäudetechnik



Centre for Integrated Building Technology

Test Report Nr: HP-151554

Test	object:
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Aeris Air Purifier

Client:

Aeris Cleantec AG Stegackerstrasse 48 CH- 8409 Winterthur

Horw, 2016-10-15

Date:

Author:

Reviewer:

Andrii Zakovorotnyi, M.Sc. Academic Research Associate **Benoit Sicre**, PhD Academic Research Associate Senior

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Contents

1	Summary	3
2	Client	3
3	Description of order	3
4	Device identification, delivery date, testing date	4
5	Test procedure	5
6	Test results	8
7	Conclusions	9
8	Appendix 1: Photos	11
9	Appendix 2: Testing equipment	. 12
9.1	Particle counter	12
9.2	Particle dilutor	12
9.3	Temperature and humidity measurement	. 12
10	Appendix 3: Literature	12

1 Summary

The portable room air cleaner 'Aeris' was tested by the Centre for Integrated Building Technology at the Lucerne University of Applied Sciences and Arts – Engineering & Architecture. The aim of the tests was to measure:

- 100:1 recovery time with new filter
- 100:1 recovery time with electrostatic discharged filter

The recovery time indicates the time in which the device reduces the aerosol concentration to 1% from the initial level in a standardised test chamber (particle size fraction fraktion $\geq 0.5 \ \mu m$). The air circulation and air cleaning in the test room are performed solely by the tested air cleaner.

The results show that the average recovery times with new and discharged filters are the same and equal 18 min 10 seconds. It can also be said that the air in the test chamber was well mixed by air cleaner.

2 Client

Ordering party	Aeris Cleantec AG
	Stegackerstrasse 48
	CH- 8409 Winterthur

Contact person:

Mr. Constantin Overlack

3 Description of order

Aeris is the portable room air cleaner designed by the Aeris Cleantec AG Winterthur.

The Centre for Integrated Building Technology ZIG was contracted by Aeris Cleantec AG on Oct. 13th 2016 to carry out a particle measurement of its air cleaner device to determine the time needed to decrease the particle concentration in the air in ratio 100:1 with new and electrostatic discharged filters according to "Test Guideline for Portable Room Air Cleaners" of Hochschule Luzern[1].

4 Device identification, delivery date, testing date

Product description:

Supplier	Aeris Cleantec AG
Model (according supplier designation)	Aeris Air Purifier, aair
Serial No.:	Not available
Delivery date:	09.10.2016
Period of test:	from 12.10.2016 to 28.10.2016



5 Test procedure

Presently there exist no international standards for testing the particle removal rate of portable air cleaners. Therefore, the test was carried out according "Test Guideline for Portable Room Air Cleaners" published by Hochschule Luzern on 14.05.2012 [1].

The portable room air cleaner was placed in the standardised, not ventilated test chamber of ZIG opposite to the patient bed with a distance of 10 cm from the wall (s. *Fig. 2*). The chamber air conditions were kept unchanged during all tests at approx. 21°C and relative humidity of approx. 45 %. The concentration of particles of size larger or equal than 0.5 μ m was recorded in 3 places in series: on top of patient bed at height 1 m – measurement point M1, in the left corner near the patient bed at height 1.8 m – measurement point M2, in front of the entrance door at height 1 m –

measurement point M3 (s. *Fig.* 2). A test aerosol of type DEHS¹ was used. It has a maximum of particle size at 0.5 μ m. Prior to measurement the air in the test chamber was enriched with DEHS-particles to reach similar particle concentration (initial concentration of particle $\geq 0.5 \mu$ m was approx. $6 \cdot 10^6 P/ft^3$).

A circulation fan provides homogeneous distribution of particle load in the room before starting the test. During the test, the circulation fan was shut off.

The measurement was carried out according the specification of Aeris with the fan switched to the highest ventilation level (Display on speed 6). At this level the volume flow rate equals to $600 \text{ m}^3/\text{h}$ according to manufacturer's data. ⁽²⁾.

All doors were kept closed during the measurement.

After the measurements with the new filter were done, it was taken out of the Aeris and sent for discharging to Unifil AG Filtertechnik in Niederlenz, Switzerland. After obtaining the discharged filter back, it was plugged back in Aeris and the device was tested under the same conditions as the new filter.

¹ Di-2-Ethylhexyl-Sebacat: for more information s. http://www.topas-gmbh.de/dateien/prospekt/dehs_prspe.pdf ² This value was NOT measured as varified by ZIC



Fig. 2: Testing setup in the "isolation room" test chamber. The volume of the test chamber is approx. 35 m^3 .



Fig. 3: Testing setup in the "isolation room"



6 Test results

Note: the test aerosol used is DEHS, an organic component that can evaporate by itself and so does not damage or obstruct or foul the tested products. DEHS as an aerosol can vanish slowly with time from the air of the testing chamber, resulting from evaporation, recombination in bigger droplets, from sedimentation on the floor, etc. One should keep this in mind while evaluating the particle counting results. For the evaluation of the particle removal rate, some preliminary measurements at rest³ have shown that an observation interval of **14 hours** is a reasonable compromise to this respect, which is much higher than the obtained recovery time of the device.

The results are shown on table below and supplied with graphs on Fig. 4 and Fig.5.

The theoretical recovery time was calculated according to the formula in Chapter 8, Annex. 2 of ISO 14644-3:2006 [2]. It equals to 17 minutes and results from the ventilation flow: $600 \text{ m}^3/\text{h}$ in the test chamber of 35 m³ of net volume (ventilation rate LW = $600/35 = 17.14 \text{ h}^{-1}$). Compared to the theoretical minimum possible time the tested device displays an increase in cleaning time of about 10%.

The results also showed that the current volume flow rate of the device provides good mixing of the air volume inside the chamber (due to the fact that all measured points lie on one straight line).

No.	Criterion	PAC clas	ses / guide	e value	Values determined		Domonka		
		Α	В	С					Kemarks
P.1	New filter				100:1 recovery	Mea	asuring p	oint	The most
	100:1 recovery				time at				unfavourable value
	time	$t_{0.01}\!\le 20$	$t_{0.01}\!\leq 30$	$t_{0.01}\!\le\!40$	highest fan stage	M1	M2	M3	is for point M3
		minutes	minutes	minutes	(600 m ³ /h)				equals to 1,008 %
					100:1 recovery	10 10	10 10	10 10	of initial
					time [min] t _{0.01}	18:10	18:10	18:10	concentration
P.2	Discharged				100:1 recovery	Measuring point		The most	
	filter				time at				unfavourable value
	100:1 recovery	t < 20	t < 20	t < 10	highest fan stage	M1	M2	M3	is for point M1
	time if the	$t_{0.01} \ge 20$	$t_{0.01} \ge 50$	$t_{0.01} \le 40$	(600 m ³ /h)				equals to 1,06 % of
	filter unit used	minutes	minutes	minutes	100:1 recovery	10.10	10.10	10.10	initial
	has been				time [min] t _{0.01}	18:10	18:10	18:10	concentration
	discharged								
Hen	ce, the PAC comp	olies with PA	C	(The mos	t unfavourable value	s for P.1,	P.2 and	P.3 are re	presentative values
class	:	for the rating.)							

PAC: Portable Air Cleaner

³ Reference measurement with air cleaner shut off



Fig. 4: 100:1 recovery time for New Filter



Fig. 5: 100:1 recovery time for Discharged Filter

7 Conclusions

A portable air cleaner was tested upon particle removal in a test chamber according "Test Guideline for Portable Room Air Cleaners" published by Centre for Integrated Building Technology on 14.05.2012.

Using a DEHS aerosol, particle removal rate of above 99.0% have been observed for particle size fraction of 5 μ m and above after 18 minutes and 10 seconds of operation.

These results are valid for both new and discharged filters.

The results also showed that the current volume flow rate of the device provides good mixing of the air volume inside the chamber.

Note: it was not part of the order to determine the sound emission level or the room air velocity of the tested unit while running in the test chamber. So it has not been possible to carry out a classification of the device according chap. 10 of [1] yet.

The test results described above are only valid for the tested unit.

The electronically recorded data will be stored for a period of 3 years. The test report and all the related documents will be kept 10 years. During this time the customer is entitled to look into these documents. Copies will be charged separately.

8 Appendix 1: Photos



9 Appendix 2: Testing equipment

9.1 Particle counter

The particle counter was used to monitor the particle object and measuring the number of particles at the measurement points.

Manufacturer	Met One
Туре	Model 3413
Range	$0.3 - 10.0 \ \mu m$
Air suction flow	28.3 L/min
Log. Nr.	1.11 HP 040

9.2 Particle dilutor

The dilutor was used to reduce the particle concentration in the air inlet of particle counter to insure that it works in permeable range.

Manufacturer	Topas GmbH
Туре	Dil 550
Dilution factor	100
Air suction flow	28.3 L/min
Log. Nr.	1.11 HP 050

9.3 Temperature and humidity measurement

The combi temperature and humidity measuring device was used to monitor temperature and humidity of air in the test chamber.

Manufacturer	Rotronic
Туре	HygroPalm 3.1a
Range	0100% rh, -50+200 °C
Accuracy	±1.5% rh, ±0.3K (0.5°F)
Log. Nr.	1.09 HP 088

10 Appendix 3: Literature

- [1] Hochschule Luzern: Test Guideline for Portable Room Air Cleaners; Lucerne University of Applied Sciences and Arts; Lucerne; 2012
- ISO 14644-3:2006: Reinräume und zugehörige Reinraumbereiche Prüfverfahren. (in English: Cleanrooms and associated controlled environments - Part 3: Test methods); Beuth Verlag; Berlin; 2006