Performance Test
On a Portable Room Air Cleaner

Elson Hava Froumann N90

TEST REPORT ECA 200902-RL1

Mainleus, October 22nd, 2020

According ECARF Criteria for allergy-friendly Air Purifiers (November 2016)

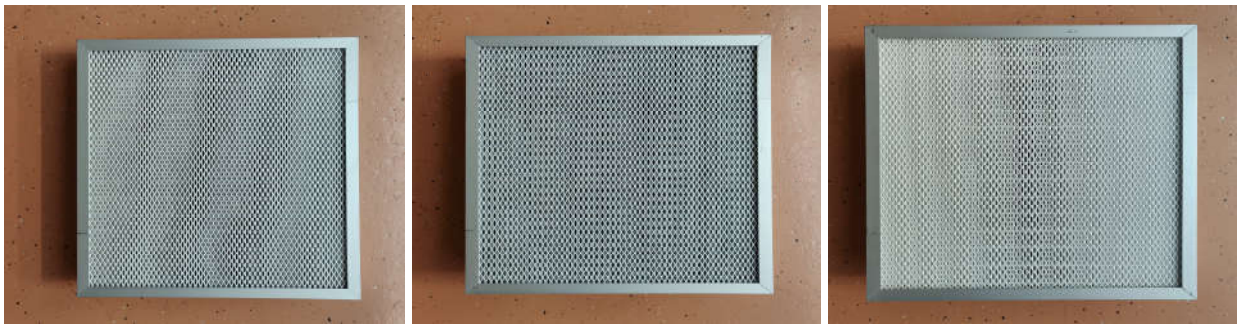
initiated by:

ECARF Institute GmbH

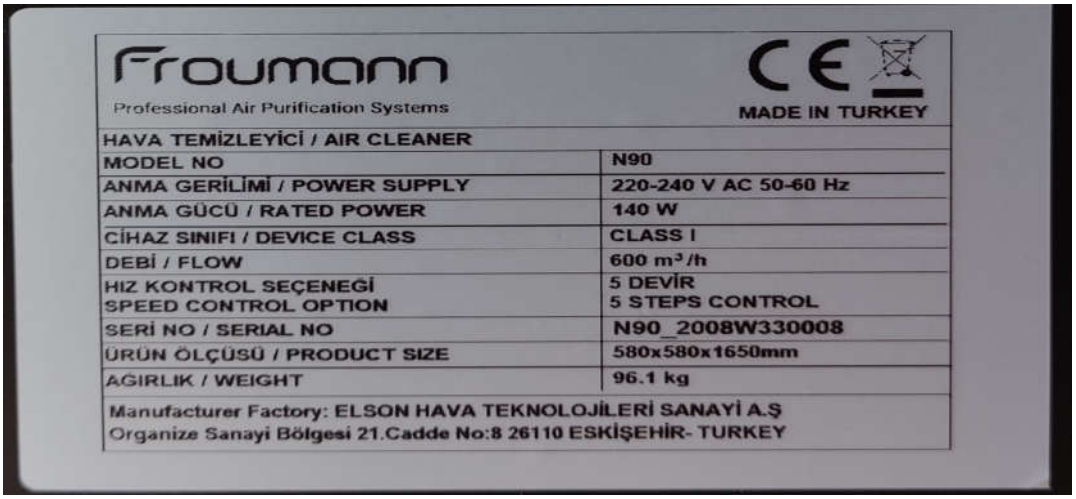
1. Objectives and Test Set-up

On a portable room air cleaner with installed filter system the particle filtration performance against Potassium Chloride Particles and other ECARF criteria had to be tested according to the test procedure below.
The general test procedure of this one-pass efficiency test follows state of the art techniques and methods described e.g. in ISO 11155 or EN1822.

a) Test requested by: ECARF Institute GmbH
b) Test specimen / Construction: Air purifier for home application (see pictures)
The installed filter element system a "F8" pre filter, a multi-layer adsorption filter element with pleated filter media and a H14 Filter element, Filter IDs:
F8-Filter : FC-F8-AC-400x400-FB/E
Multi-layer Filter : AC-AM-400x400-FC/E
H14-Filter : HC-H14-AM-400x400-FB/3P



c) Model/Parts ID: Elson Hava Froumann N90
d) Flow Direction: Air inlet on the front, left and right side of the device, air outlet on the top side of the purifier (see picture of device)
e) Label/Identification: see picture below



f) Dimensions Total: ca. 580 x 580 x 1650 mm (L-B-H)
g) Samples were received on: September 29th, 2020
h) Test has been performed on: October 21st to 22nd, 2020

Test Procedure

No.	Test fiatec-No.: ECA 200902-	RL1
1	Conditioning in Climate Chamber	x
2a	Efficiency Test Room Air Cleaner, SMPS, 0,05 - 0,5 µm, highest blower level	x
2b	Efficiency Test Room Air Cleaner, OPC, 0,5 - 5 µm, highest blower level	x
3	Odor test following VDA 270	x
4	Temperature Diff. In-/Outlet	x
5	Ozone Test Room Air Cleaner	

Test Conditions (Efficiency test)

Air Flow:	Air purifier internal blower ca. 530 m³/h on highest air blower level, with filter element
Temperature:	23 ± 1 °C
Relative Humidity:	ca. 37 %
Test Aerosol:	KCl, 10 % Solution
Particle Size Range:	0,05 – 0,52 µm with SMPS and 0,5 – 5,0 µm with OPC
Particle Counter:	SMPS (Scanning Mobility Particle Sizer, TSI Inc.) and OPC (Optical Particle Counter, TSI Inc.)

Preconditioning of installed filter elements
24 hours in a climate chamber with 50 °C and 95 % humidity

Airflow
The air flow was measured with an anemometer in an adapted air outlet tube with 235 mm diameter. This measurement principle has only a medium accuracy (ca. ± 5 – 10 %) but was not in the focus of the test.

Particle Size and generation
The particle size range was chosen to measure the efficiency in the most penetration particle size range. The efficiency for larger particles then in the measured range can expected to be higher.

For determination of fractional efficiencies in the particle size range of 0,05 – 0,5 µm a SMPS (Scanning Mobility Particle Sizer, TSI Inc.) and in the particle size range of 0,5 – 5,0 µm a OPC (Optical Particle Counter, TSI Inc.) were used as detectors.
The potassium chloride aerosol was generated by an atomizer AGK 2000 (PALAS GmbH). The test dust was not electrostatically neutralized.

Test Setup
The air purifier was installed in a closed chamber with an air inlet tube and aerosol injection system installed on the front side of the chamber. The outlet of the purified air was adapted to a 235 mm diameter outlet tube. The air inlet and outlet tubes of the test chamber were open to atmosphere to allow the blower of the test device to suck and blow the air without restriction from ambient air / ambient pressure. To prevent differences in the aerosol concentration of 2 sampling positions (before and after test device) due to different air flow profiles only the aerosol sampling position at the clean air side in the outlet tube was used. The upstream concentration of the test aerosol was measured without installed filter element and corrected by the higher air flow.

2. Results

2.1 Air Flow

Highest air blower level with installed filter elements: ca. 530 m³/h

Lowest air blower level with filter element: ca. 130 m³/h

2.2 Particle Filtration

The detailed results of the efficiency test are reported in the attachment.

The fractional filter efficiency graphs were derived from a total of minimum six measurements of particle size distributions. Three measurements were taken upstream (without filter elements as described above) and three were taken downstream of the air purifier with filter elements. The figures and the tables in the attachment show the averaged values of the three efficiency measurements as well as the total scattering range for each size channel.

Summary of the Efficiency results:

Particle Size (mobility diameter) [µm]	Complete Device at highest air speed grade [%]
0,1 0,3 0,5	99,949 99,953 99,976
(geometric diameter) [µm]	
0,5 1,0 2,0 3,0 5,0	99,96 99,99 >99,99 >99,99 >99,99

Comment: In this setup the particle concentration was not high enough to get statistically sufficient particle counts for all particle size ranges on the clean air side.
For the determination of exact particle filtration efficiency following EN 1822 it is recommended to test with DEHS aerosol and at two different air flow levels.

In an additional test we measured the particle size distribution of the room (ambient air, relative low concentration) and the outlet concentration without particle generator on and without installed filter elements.
As we did not found a noticeable difference it can be assumed that the blower motor does not produce particles due to abrasion.

Specification ECARF

Minimum Efficiency at the most penetrating particle size (≥ 0,1 ≤ 0,3 µm): ≥ 85 %
Collection Efficiency at particle size at 0,5 µm (Bacteria, fine dust): ≥ 90 %
Collection Efficiency at particle size ≥ 3 µm (mold spores, pollen): ≥ 95 %

The specification criteria is fulfilled.

2.3 Odor Assessment following VDA 270

The air purifier was placed on the floor in a room with neutral odor and operated at the following setting modes:
Blower at maximum speed, operation time > 30 min.
A test panel of three persons evaluated the odor of outlet air of the purifier by assigning grades on a scale from one to six: one being odorless and six representing unbearable odor.

	Grade
Person 1 / 2 / 3	2 / 2 / 2
Mean Value	2
	(perceptible, not disturbing)

The specification criteria is fulfilled.

2.4 Temperature difference (room temperature compared to exhaust air)

The temperature was measured with a calibrated Humidity and Temperature sensor (Vaisala HMP75).
Operating time of the blower before measurement: ca. 30 - 40 min, measured on minimum 3 positions at in-and outlet

It should be considered that the uncertainty of the temperature measurement due to different air velocities and small changes of the location in addition to the uncertainty of the sensor is estimated with 0,1 - 0,2 °C.

Air inlet: 21,2 °C
Air outlet: 21,4 °C

Specification ECARF

Temperature Difference: < 0,3 °C

The specification criteria is fulfilled.

2.5 Ozone Emission

An **Ozone test** was not performed as the device do not use any potential ozone producing components. (nothing visible on operating panel, in manual or in accessible openings)

Steffan Trnetschek
(Managing Director)

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Attachment 1 to Test Report ECA 200902-RL1

Summary of Test Results for Sample
Elson Hava Froumann N90
fiatec-No.: ECA 200902-RL1

1. Particle Collection Efficiency

Test Aerosol:	KCl	Particle Counter:	TSI OPC 3330

Air Flow: 530 m³/h	KCl Efficiency (OPC)	
Particle Size (optical)	η_{mean} *	Δ_{max} **
[µm]	[%]	[%]
0,62	99,98	0,00
0,84	99,98	0,00
1,14	>99,99	0,01
1,44	>99,99	0,00
1,88	>99,99	0,01
2,57	>99,99	0,01
3,46	>99,99	0,01
4,69	>99,99	0,00

Test Aerosol:	KCl	Particle Counter:	SMPS

Air Flow: 530 m³/h	KCl Efficiency (SMPS)	
Particle Size (mobility diameter)	η_{mean} *	Δ_{max} **
[µm]	[%]	[%]
0,029	99,997	0,0
0,034	99,993	0,0
0,039	99,980	0,0
0,045	99,977	0,0
0,052	99,977	0,0
0,060	99,971	0,0
0,070	99,965	0,0
0,081	99,957	0,0
0,093	99,949	0,0
0,108	99,949	0,0
0,124	99,940	0,0
0,143	99,940	0,0
0,166	99,945	0,0
0,191	99,944	0,0
0,221	99,945	0,0
0,255	99,948	0,0
0,294	99,953	0,0
0,340	99,953	0,0
0,392	99,964	0,1
0,453	99,976	0,0

* η_{mean} is the average particle collection efficiency calculated from three sets of up- and downstream measurements
** Δ_{max} represents the full scattering range of single values for each size channel

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Summary of Test Results for Sample
Elson Hava Froumann N90
fiatec-No.: ECA 200902-RL1

Particle Size	Effizienz [%]
[µm] (mobility)	KCl Efficiency (SMPS)
0,1	99,949
0,3	99,953
0,5	99,976
[µm] (optical)	KCl Efficiency (OPC)
0,5	99,96
1,0	99,99
2,0	>99,99
3,0	>99,99
5,0	>99,99

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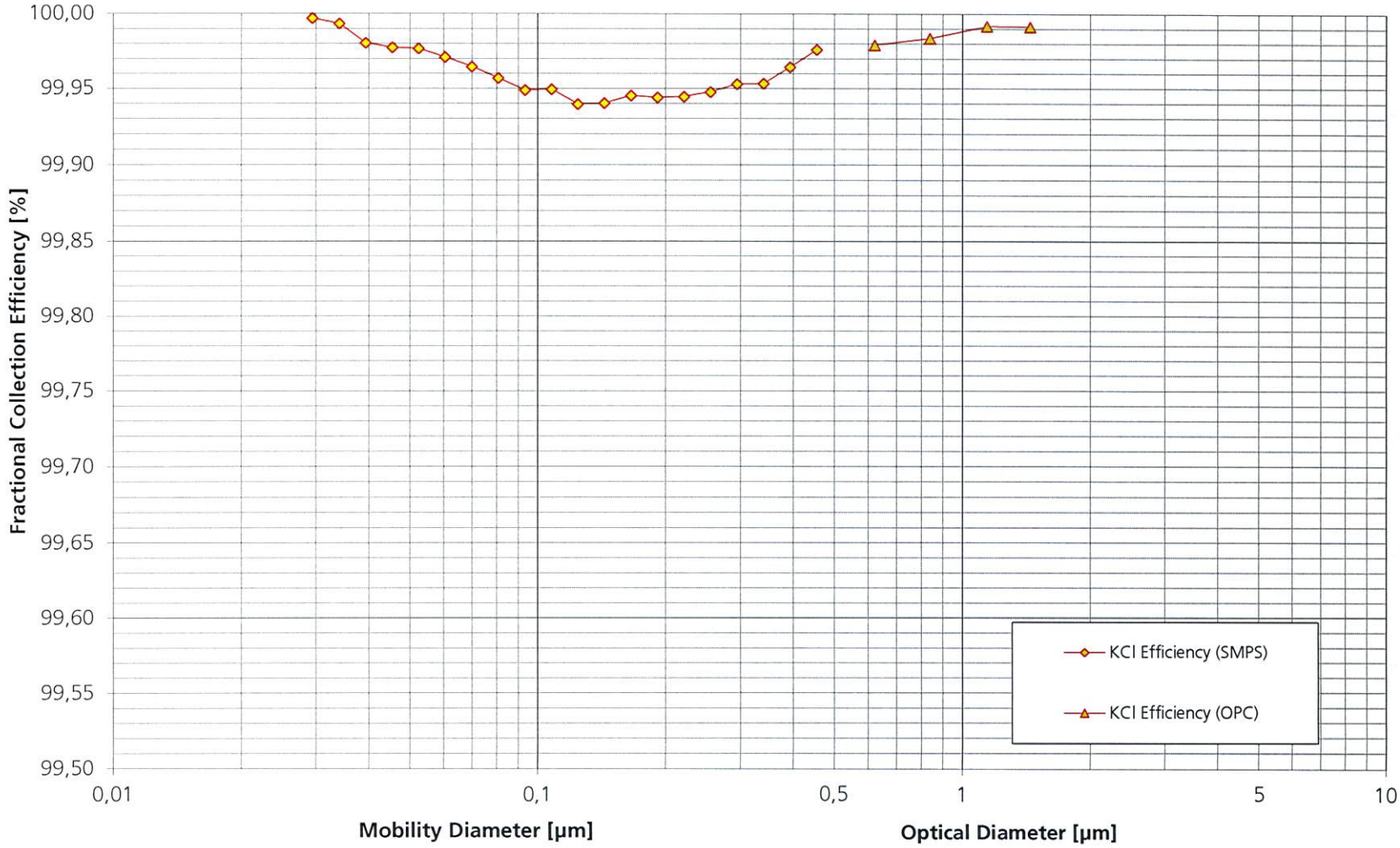
Attachment 1 to Test Report ECA 200902-RL1
Diagram: Fractional Collection Efficiency

Particle Collection Efficiencies



Customer:
ECARF Institute GmbH

Date:
21.10.2020

Sample:
Elson Hava Froumann N90

fiatec-No.:
ECA 200902-RL1

Air Flow [m³/h]:
530

Particle Counters:
OPC 3330
SMPS