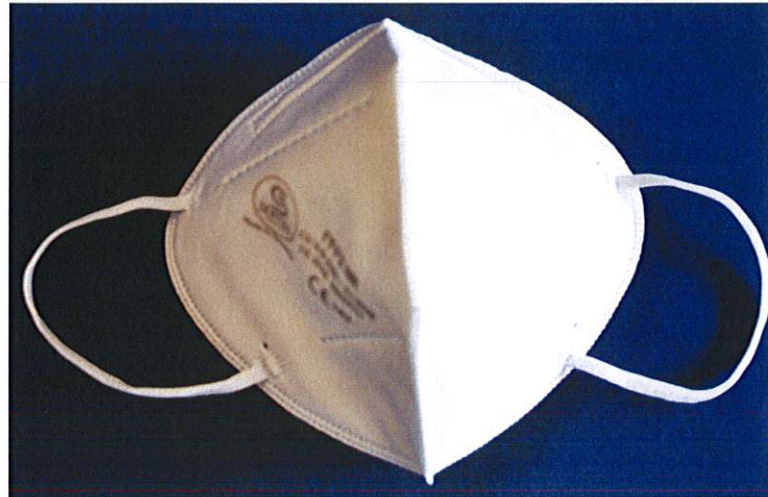


EFFICIENCY TESTS ON RESPIRATOR MASKS



TEST REPORT S-SEN 200701

Mainleus, August 17th, 2020

according DIN 71460-1

initiated by:

Sentias GmbH & Co. KG

1. Objectives and test set-up

This test project focused on the initial efficiencies on respirator masks and the test procedure below. All test conditions and parameters not given will be chosen according to DIN 71460-1.

The test shall indicate which filtration efficiency the new masks could provide in a respirator mask tested according EN149, chapter 8.11 / EN 13274-7. Leaks in finished masks are not considered. Potential leaks between for example a human face and the masks are not considered.

Important note: This is not a classification (FFPx-grades) according EN149. EN149 describes several additional tests and requirements on finished masks (usage and efficiency tests after different storage and conditioning simulations as well as mechanical strength tests, leakage in real use, dust loading ...).

a) Test requested by:	Sentias GmbH & Co. KG
b) Test specimen / Construction:	Respirator masks
c) Media ID:	FFPS NR
d) Media type:	Synthetic
e) Dimension:	N/A
f) Samples received on:	August 6 th , 2020
g) Test performed on:	August 13 th , 2020

Test conditions:

Flow rate:	95 l/min
Temperature:	23°C ± 1°C
Relative humidity:	50% ± 3%
Absolute pressure:	977 mbar
Particle efficiency size range:	0,3 – 5 µm
Particle counter:	Optical Particle Counter, TSI Inc., Model 3330
Test aerosol:	Paraffin oil + Sodium Chloride

Comments / Information on EN 149, Chapter 8.11 / EN 13274-7:

Test aerosol:	Sodium Chloride (NaCl) + Paraffin oil. Efficiencies with NaCl are usually higher than with paraffin oil.
Particle detector:	It is referenced to EN 13274-7 in which a photometer is used. A photometer usually measures the sum of all particles (as a volume or mass signal) > ca. 0,2 µm and does not differentiate in small particle size ranges. The aerosol concentration in this test is noticeably lower than a test with a photometer (EN 13274-7). A possible loading effect with high amounts of the aerosol is therefore not considered.

The accuracy of the flow rate control is 3% of the nominal value.

Pressure drops were measured using three sensors of the ranges 0 – 100 Pa, 0 - 500 Pa and 0 - 3000 Pa. The accuracy of the pressure transducers is 1% of the range maximum.

The paraffin oil aerosol was generated by an atomizer ATM 220 (Topas GmbH). The test aerosol was not electrostatically neutralized.

The sodium chloride aerosol was generated by an atomizer AGK 2000 (PALAS GmbH). They have not been electrostatically neutralized

The fractional filter efficiency graphs were derived from a total of six to eight measurements of particle size distributions. Minimum three measurements were taken upstream and min. three were taken downstream of the filter. The figures and the tables in the attachments show the average values of the three efficiency measurements as well as the total scattering range for each size channel.

2. Results

The detailed results are reported in the attachment.

Table 1: Summary of the pressure drop results

S-SEN 200701-	95 l/min	160 l/min
M1.1	98 Pa	166 Pa
M1.2	105 Pa	179 Pa

Table 2: Summary of the efficiency results

Particle size (optical) [µm]	M1.1 NaCl [%]	M1.2 Paraffin oil [%]
0,33	99,1	96,4
0,42	99,2	96,8
0,52	99,2	97,2
0,65	99,3	97,6
0,80	99,4	97,9
1,00	99,5	98,1
1,25	99,6	98,3
1,55	99,7	98,7
1,93	99,8	99,2
2,41	99,9	99,6
3,00	>99,9	>99,9
3,86	>99,9	>99,9
4,94	>99,9	>99,9

Experience has shown that the values of the efficiency measured with a photometer correspond to the values of ca. 0,5 -0,6 µm of the fractional efficiency values measured with the TSI OPC. But this is only an indication and may vary slightly to other particle sizes.



Matthias Eber
(Managing Director)



I.A. Vanessa Grampp
(Lab Technician)

No. of attachments: 1

Attachment 1 to test report S-SEN 200701

Summary of test results

FFP2 NR

fiatec-no.: S-SEN 200701-M1.1 - M1.2

1. Particle collection efficiency

Test aerosol:	NaCl + Paraffin oil	Particle counter:	TSI OPC 3330
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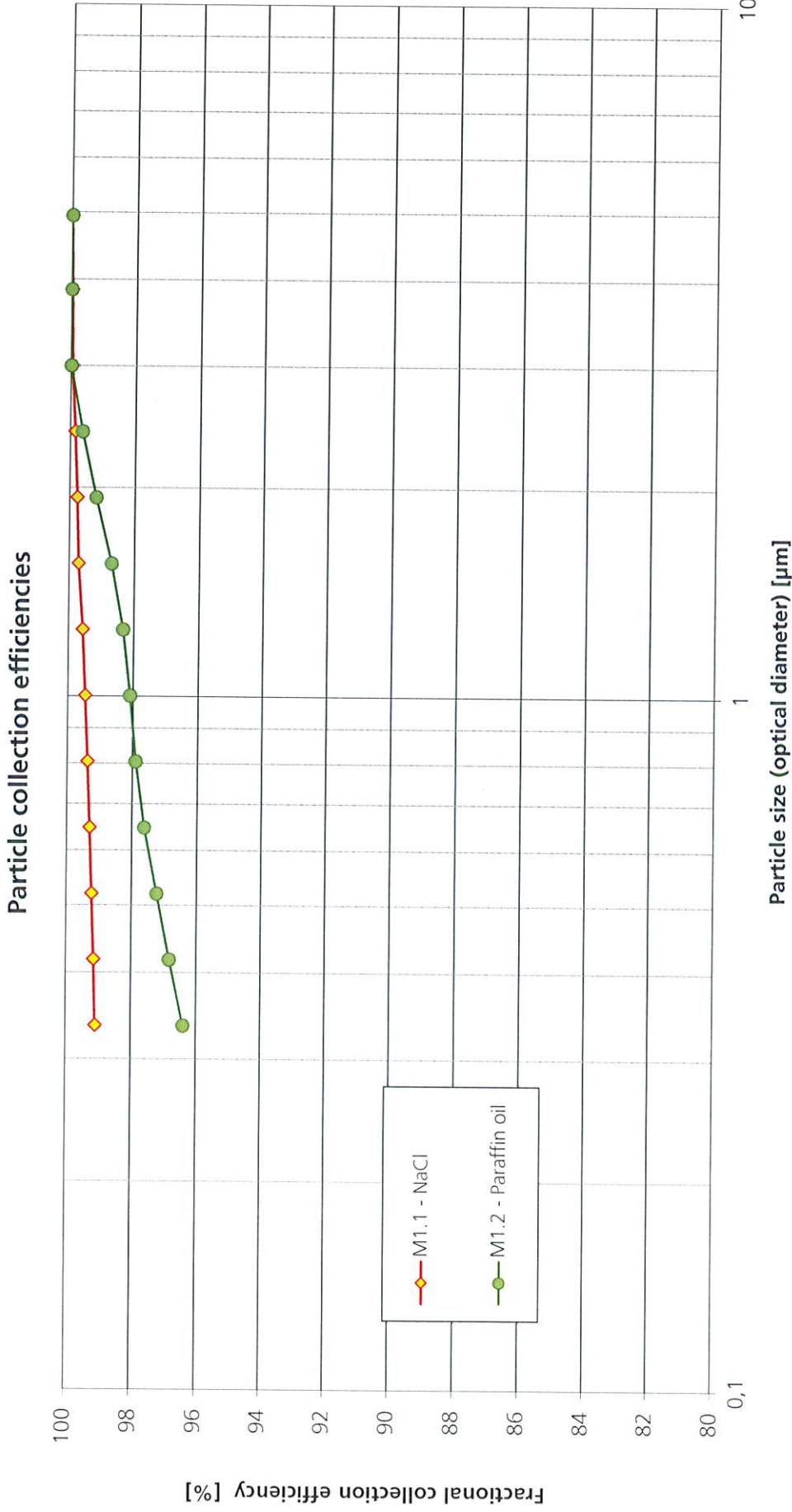
Flow rate: 95 l/min	M1.1 - NaCl		M1.2 - Paraffin oil	
Particle size (optical)	η_{mean}^*	Δ_{max}^{**}	η_{mean}^*	Δ_{max}^{**}
[μm]	[%]	[%]	[%]	[%]
0,33	99,1	0,1	96,4	0,1
0,42	99,2	0,1	96,8	0,2
0,52	99,2	0,1	97,2	0,2
0,65	99,3	0,1	97,6	0,0
0,80	99,4	0,1	97,9	0,0
1,00	99,5	0,0	98,1	0,0
1,25	99,6	0,0	98,3	0,0
1,55	99,7	0,1	98,7	0,1
1,93	99,8	0,0	99,2	0,1
2,41	99,9	0,0	99,6	0,2
3,00	>99,9	0,0	>99,9	0,0
3,86	>99,9	0,0	>99,9	0,0
4,94	>99,9	0,0	>99,9	0,0

* η_{mean} is the average particle collection calculated from three sets of up- and downstream measurements

** Δ_{max} represents the full scattering range of single values for each size channel

2. Pressure drop

Flow rate:	[l/min]	95	160
M1.1	[Pa]	98	166
M1.2	[Pa]	105	179



Customer: Sentias GmbH & Co. KG
fiatec no.: S-SEN 200701-M1.1 - M1.2
Sample: FFP2 NR

Flow rate: 95 l/min
Test aerosol: NaCl + Paraffin oil
Date: 13.08.2020
Particle counter: TSI OPC 3330