



EFFICIENCY TESTS ON FLAT SHEET MEDIA

Test Report STT 200201

Mainleus, February 6th, 2020

According DIN 71460-1

initiated by:

Take Cair UG (haftungsbeschränkt)

1. Objectives and test set-up

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

The test shall indicate if the media is suitable regarding particle efficiency for the use in a FFP3 mask according EN149.

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|----------------------------------|-------------------------------------|
| a) Test requested by: | Take Cair UG (haftungsbeschränkt) |
| b) Test specimen / Construction: | flat sheet media |
| c) Media ID: | M27 |
| d) Media Type : | synthetic |
| e) Flow direction: | both sides can be used |
| f) Dimension: | ø190 mm ; effective ø150mm |
| g) Samples received on: | February 03 rd , 2020 |
| h) Test performed on: | February 05+06 th , 2020 |

Test conditions

Media velocity:	8 + 23 cm/s
Temperature:	22°C ± 1°C
Relative humidity:	45%
Absolute pressure:	976 mbar
Particle efficiency size range:	0,3 – 3 µm
Particle Counter:	Optical Particle Counter, TSI Inc., Model 3330
Test aerosol:	DEHS (pure) polydisperse
Test Sample Size:	Ø 150 mm

Comments / Information on EN 149:

Test Aerosol:	Sodium Chloride (NaCl) + Paraffin oil. DEHS efficiencies can be considered equivalent to paraffin oil (see ISO 29463 / EN1822). Efficiencies with NaCl are usually higher than with DEHS.
Air Flow:	95 l/min (referred to a respirator) Assuming a effective media area of 0,7 dm ² this would result in a media velocity of 22,6 cm/s
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) > 0,2-0,3 µm and does not differentiate in small particle size ranges. Therefore we have reported also the mass signal measured with the optical particle counter.

The accuracy of the airflow 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 DEHS aerosol was generated by an atomizer UGF 2000 (Palas GmbH). The test aerosol was not electro-statically 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, 8 cm/s

Particle Size (µm)	Mean Efficiency (%) FW1-3	Sample	Pressure Drop (Pa)	Mass Efficiency * (%)
0,33	95,5	FW1:	110 Pa	99,74
0,42	98,3	FW2:	124 Pa	99,70
0,52	99,4	FW3:	116 Pa	99,74
0,65	99,7			
0,80	99,8	Mean:	117 Pa	99,73
1,00	99,8			
1,25	99,8			
1,55	99,8			
1,93	99,9			
2,41	99,9			
3,00	>99,9			

Table 2: Summary of the pressure drop results, 23 cm/s

Particle Size (µm)	Mean Efficiency (%) FW3-5	Sample	Pressure Drop (Pa)	Mass Efficiency * (%)
0,33	90,5	FW4:	333 Pa	99,55
0,42	97,1	FW3:	324 Pa	99,57
0,52	99,2	FW5:	351 Pa	99,58
0,65	99,6			
0,80	99,8	Mean:	336 Pa	99,57
1,00	99,9			
1,25	99,9			
1,55	99,9			
1,93	99,9			
2,41	99,8			
3,00	>99,9			

* Average of minimum 4 scans up and downstream. The value has been taken from the same scans as for the fractional efficiencies. The optical particle counter calculates from the particle counts vs. particle size a value in mg/m³ for each scan. The mass efficiency is calculated from the mg/m³ values up and downstream the sample.



Steffan Trnetschek
 (Managing Director)

Attachment: 1

Attachment 1 to Test Report STT 200201

Summary of test results

M27

fiatec-no.: STT 200201-FW

1. Particle collection efficiency

Test aerosol:	DEHS	Particle counter:	TSI OPC 3330
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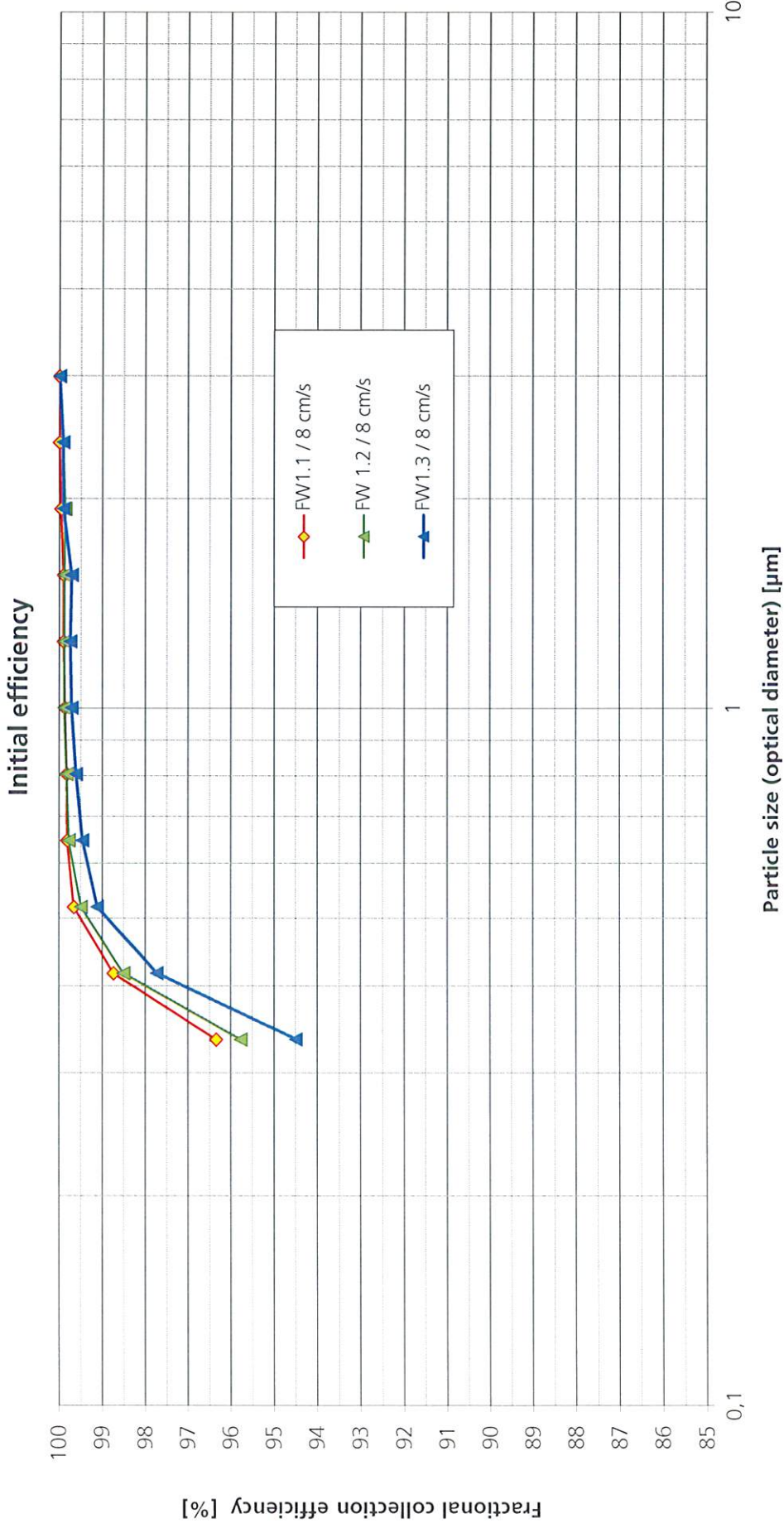
Flow velocity	FW1.1 / 8 cm/s		FW 1.2 / 8 cm/s		FW1.3 / 8 cm/s		8 cm/s
Particle size	η_{mean}^*	Δ_{max}^{**}	η_{mean}^*	Δ_{max}^{**}	η_{mean}^*	Δ_{max}^{**}	Mean value
[μm]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
0,33	96,3	0,2	95,8	0,1	94,5	0,2	95,5
0,42	98,7	0,1	98,5	0,1	97,7	0,2	98,3
0,52	99,7	0,1	99,5	0,0	99,1	0,1	99,4
0,65	99,8	0,0	99,8	0,0	99,5	0,1	99,7
0,80	99,8	0,1	99,8	0,1	99,6	0,1	99,8
1,00	99,9	0,1	99,9	0,0	99,7	0,2	99,8
1,25	99,9	0,1	99,9	0,1	99,8	0,1	99,8
1,55	99,9	0,0	99,9	0,1	99,7	0,0	99,8
1,93	>99,9	0,1	99,9	0,0	99,9	0,1	99,9
2,41	>99,9	0,0	99,9	0,2	99,9	0,2	99,9
3,00	>99,9	0,0	>99,9	0,0	>99,9	0,0	>99,9

Flow velocity	FW1.3 / 16 cm/s	
Particle size	η_{mean}^*	Δ_{max}^{**}
[μm]	[%]	[%]
0,33	91,9	0,4
0,42	96,8	0,0
0,52	98,9	0,1
0,65	99,4	0,1
0,80	99,5	0,2
1,00	99,7	0,1
1,25	99,7	0,1
1,55	99,9	0,1
1,93	99,8	0,3
2,41	99,9	0,4
3,00	>99,9	0,0

Flow velocity	FW1.4 / 23 cm/s		FW1.3 / 23 cm/s		FW1.5 / 23 cm/s		23 cm/s
Particle size	η_{mean}^*	Δ_{max}^{**}	η_{mean}^*	Δ_{max}^{**}	η_{mean}^*	Δ_{max}^{**}	Mean value
[μm]	[%]	[%]	[%]	[%]	[%]	[%]	[%]
0,33	90,2	0,2	90,6	0,3	90,8	0,1	90,5
0,42	97,0	0,1	97,1	0,0	97,3	0,1	97,1
0,52	99,2	0,1	99,3	0,1	99,2	0,1	99,2
0,65	99,6	0,1	99,6	0,1	99,6	0,1	99,6
0,80	99,8	0,0	99,8	0,2	99,7	0,1	99,8
1,00	99,9	0,0	99,9	0,1	99,9	0,0	99,9
1,25	99,9	0,0	99,9	0,0	99,9	0,0	99,9
1,55	99,9	0,0	>99,9	0,1	>99,9	0,1	99,9
1,93	99,9	0,2	>99,9	0,1	>99,9	0,1	99,9
2,41	99,8	0,6	>99,9	0,0	>99,9	0,0	99,8
3,00	>99,9	0,0	>99,9	0,0	>99,9	0,0	>99,9

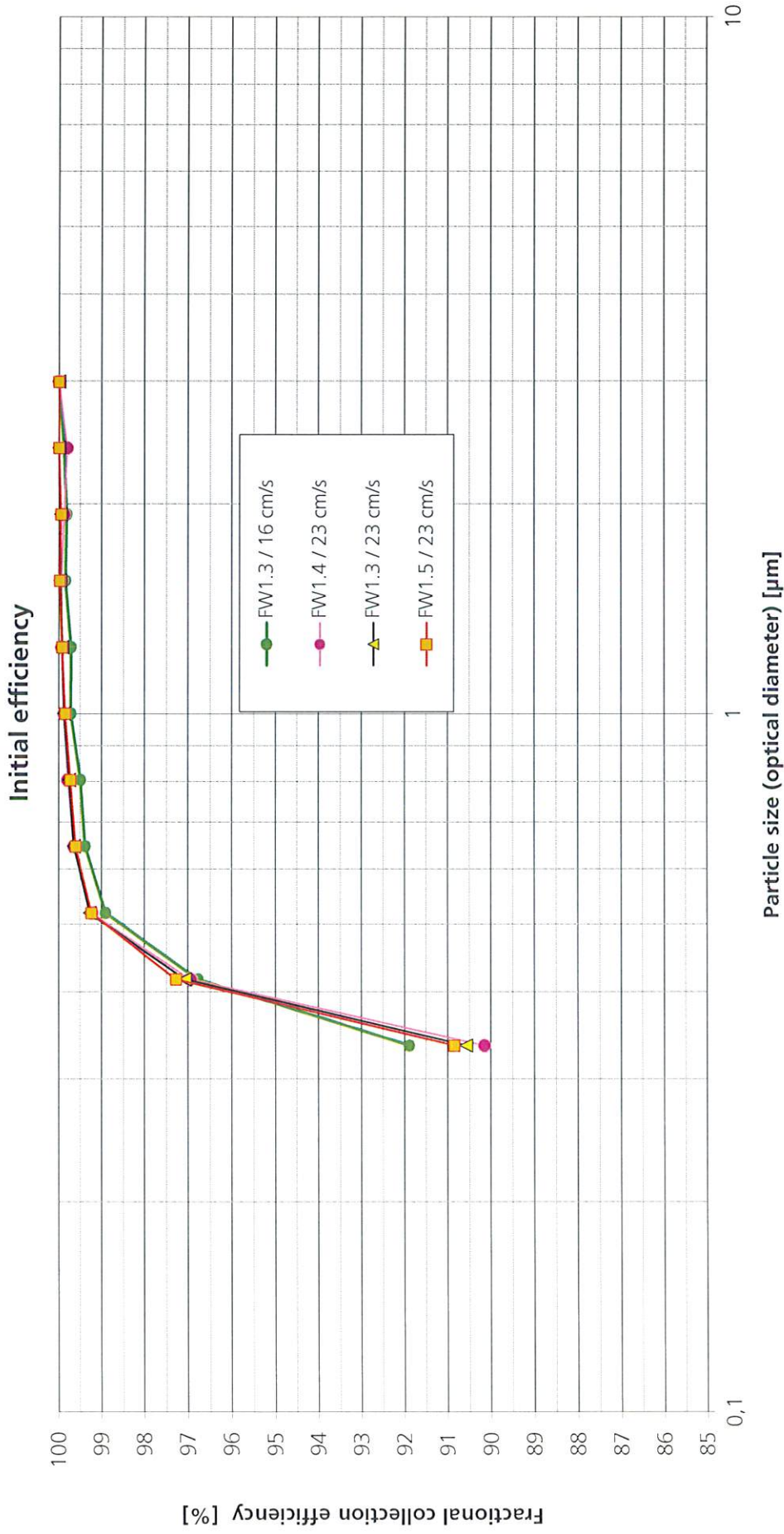
* η_{mean} is the average particle collection calculated from three sets of up- and downstream measurements

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



Customer: Take Cair UG (haftungsbeschränkt)
fiatec no.: STT 200201-FW
Sample: M27

Flow velocity: 8 cm/s
Test dust: DEHS
Date: 05.02.2020
Particle Counter: TSI OPC 3330



Customer: Take Cair UG (haftungsbeschränkt)
fiatec no.: STT 200201-FW
Sample: M27

Flow velocity: 16 + 23 cm/s
Test dust: DEHS
Date: 05.02.2020
Particle Counter: TSI OPC 3330