fiatec
Filter & Aerosol Technologie GmbH

# PERFORMANCE TEST OF POCKET FILTER FOR GENERAL VENTILATION APPLICATIONS

## With Synthetic Media Class F7

Test Report
Report Number: DEF 061001_T1
30/10/06

according to EN 779:2002

Initiated by:

Delta Filtration Ltd.

fiatec
Filter & Aerosol Technologie GmbH

| | |
|---|---|
| Requested by: | Delta Filtration Ltd.<br>Kilmallock Industrial Estate<br>Bruree Road<br>Co Limerick<br>Ireland |
| Order: | Mr. Donal McGoey |
| Subject: | Performance test of pocket filter device utilizing synthetic media according to EN 779:2002. |
| Sample: | Pocket filter F7 with eight pockets in metal frame.<br><br>Sample was received on October 20th, 2006.<br>Test has been performed on October 26th, 2006. |
| Test method: | Test has been performed following the procedures as defined in EN 779:2002 "Particulate air filters for general ventilation – Requirements, testing, marking". The efficiencies have been tested with diluted DEHS (10% DEHS in isopropylalcohol)<br><br>Refer to page 2 of the attachments for details of instrumentation. |
| Results: | See attachments for detailed information. The findings are summarized on page 1 of the attachments.<br><br>The results apply to the tested specimen only. Filter performance data of related filters of the same design and media will be similar. Filtration performance under certain application conditions cannot necessarily be predicted from these data. |

Monday, October 30th, 2006

H. Bittermann

Attachement: DEF 061001_T1 5 Pages

**AIR FILTER TEST CERTIFICATE ACCORDING TO: EN 779:2002**

fiatec
Filter & Aerosol Technologie GmbH

## SUMMARY PAGE

Testing organisation: fiatec Filter & Aerosol Technologie GmbH Report no.: DEF 061001_T1

### GENERAL

| | | | | | |
|---|---|---|---|---|---|
| Test no.: | DEF 061001_T1 | Date of test: | 26.10.06 | Supervisor: | H. Bittermann |
| Test requested by: | Delta Filtration Ltd. | | | Device received: | 20.10.2006 |
| Device delivered by: | Delta Filtration Ltd. | | | | |

### DETAILS OF DEVICE

| Model: | Manufacturer: | Construction and design |
|---|---|---|
| F7 Bagfilter | Delta Filtration | Pocket filter with eight pockets in metal frame |
| **Type of media:** | **Net effective filtering area [m²]:** | **Dimensions** |
| Synthetic Media | 6,2 m² | length x width x heigth [mm] 592x592x650 |

### TEST DATA

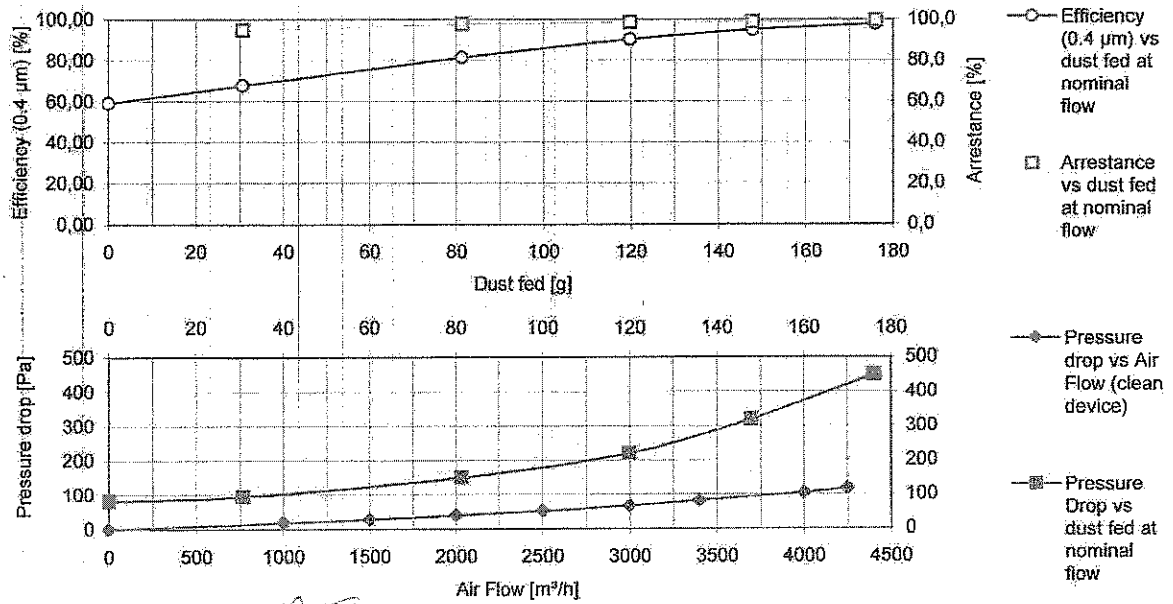
| Test air flow rate: | Test air temperature: | Rel. Humidity: | Test aerosols | |
|---|---|---|---|---|
| [m³/h] | [°C] | [%] | Efficiency: | Loading: |
| 3400 | 23 ± 1 | 55 ± 3 | 10% DEHS | ASHRAE 52/76 |

### RESULTS

| Initial pressure drop: | Initial arrestance: | Initial Efficiency: | Influence of Charges-Media check at 0.4 µm: | |
|---|---|---|---|---|
| [Pa] | [%] | [%] | Eff. Shipping state [%]: | Discharged eff. [%] |
| 82 | 94,8 | 59,09 | N/A | N/A |
| **Final pressure drop:** | **Average arrestance:** | **Average Efficiency** | **Filter Class** | **Dust Holding Capacity [g]** |
| [Pa] | [%] | [%] | | 450 Pa |
| 450 | 97,8 | 81,51 | **F7** | 172 |

Note: The performance results apply to the tested item and do not allow to predict performance in actual service under specific conditions

Remarks:




26.10.2006

Date Signature

**AIR FILTER TEST CERTIFICATE ACCORDING TO: EN 779:2002**

fiatec
Filter & Aerosol Technologie GmbH

## INSTRUMENTATION

Testing organisation: fiatec Filter & Aerosol Technologie GmbH

Report no.: DEF 061001_T1

| Test no.: | DEF 061001_T1 | Date of test: | 26.10.06 | Test mode: | EN 779:2002 |
|---|---|---|---|---|---|
| | | | | Sample ID | N/A |

TEST DUST DISPERSION

| Dust loading: | | Efficiency measurments: | |
|---|---|---|---|
| Test dust: | ASHRAE 52/76 | Test dust: | 10 % DEHS |
| Generator: | Fiatec | Generator: | UGF 1000 |
| Concentration | 70 mg/m³ | Concentration: | 5 x $10^5$ Particles/l |

PARTICLE COUNTING

| | |
|---|---|
| Particle counter (Make/Model) | TSI Inc. APS 3321 |
| Working Principle | Aerodynamic Laser Counter, Time of Flight Spectrometer |
| Sampling | 6 samples up- and downstream of device, 60 seconds each |
| Sample Probes | Effective Diameter 6 mm |
| Sample Flow: | 5 l/min |
| Software | Aerosol Instrument Manager 3.0 |

FLOW MEASUREMENTS

| | |
|---|---|
| Make/Model | Quantometer + Wilson Grid |
| Working Principle | Turbine Gas Meter + Prandtl Tube |

PRESSURE DROP, HUMIDITY AND TEMPERATURE

| | |
|---|---|
| Pressure drop accuracy | 5 Pa |
| Humidity | Controlled: Set Point 55 ± 3 % |
| Temperature | Controlled: Set Point 23 ± 1°C |

**AIR FILTER TEST CERTIFICATE ACCORDING TO: EN 779:2002**

fiatec Filter & Aerosol Technologie GmbH

## Table 1: Collection Efficiencies at Various Dust Loads

Testing organisation: fiatec Filter & Aerosol Technologie GmbH

Report no.: DEF 061001_T1

| Test no.: | DEF 061001_T1 | Date of test: | 26.10.06 | Test mode: | EN 779:2002 |
|---|---|---|---|---|---|
| | | | | Sample ID: | N/A |

### Table 1: Efficiencies at Various Dust Loads

| | New Device | | 30 g Dust | | 150 Pa | | 220 Pa | | 320 Pa | | 450 Pa | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Particle Size (aerodynamic) | $\eta_{mean}$ * | $\Delta_{max}$ ** | $\eta_{mean}$ * | $\Delta_{max}$ ** | $\eta_{mean}$ * | $\Delta_{max}$ ** | $\eta_{mean}$ * | $\Delta_{max}$ ** | $\eta_{mean}$ * | $\Delta_{max}$ ** | $\eta_{mean}$ * | $\Delta_{max}$ ** |
| (µm) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) | (%) |
| 0,423 | 59,09 | 1,26 | 67,78 | 1,01 | 81,38 | 0,71 | 90,41 | 0,70 | 95,00 | 0,29 | 97,75 | 0,38 |
| 0,542 | 59,29 | 0,84 | 68,39 | 0,76 | 82,16 | 0,16 | 91,62 | 0,26 | 95,97 | 0,24 | 98,21 | 0,27 |
| 0,583 | 60,16 | 0,13 | 69,42 | 0,71 | 83,01 | 0,19 | 92,24 | 0,18 | 96,59 | 0,18 | 98,49 | 0,18 |
| 0,626 | 61,29 | 0,65 | 71,11 | 0,56 | 84,36 | 0,15 | 93,01 | 0,30 | 97,07 | 0,25 | 98,77 | 0,05 |
| 0,673 | 62,44 | 0,95 | 72,75 | 0,66 | 85,64 | 0,30 | 93,90 | 0,25 | 97,43 | 0,47 | 98,97 | 0,08 |
| 0,723 | 63,29 | 0,30 | 74,04 | 0,78 | 86,61 | 0,21 | 94,31 | 0,28 | 97,70 | 0,24 | 99,11 | 0,18 |
| 0,777 | 64,98 | 0,57 | 75,33 | 1,33 | 87,61 | 0,15 | 95,00 | 0,16 | 98,04 | 0,31 | 99,33 | 0,08 |
| 0,835 | 66,07 | 0,40 | 76,91 | 0,64 | 88,87 | 0,20 | 95,82 | 0,49 | 98,59 | 0,21 | 99,57 | 0,08 |
| 0,898 | 67,58 | 0,37 | 78,68 | 0,44 | 90,01 | 0,71 | 96,51 | 0,23 | 99,01 | 0,14 | 99,73 | 0,08 |
| 0,965 | 68,86 | 1,07 | 80,16 | 0,59 | 91,12 | 0,29 | 97,42 | 0,31 | 99,31 | 0,15 | 99,82 | 0,05 |
| 1,037 | 70,70 | 1,56 | 82,03 | 0,46 | 92,67 | 0,29 | 98,02 | 0,35 | 99,57 | 0,07 | 99,89 | 0,08 |
| 1,114 | 73,01 | 0,53 | 84,18 | 0,57 | 94,00 | 0,55 | 98,60 | 0,26 | 99,74 | 0,04 | 99,94 | 0,04 |
| 1,197 | 75,07 | 1,88 | 86,74 | 0,40 | 95,24 | 0,57 | 99,07 | 0,13 | 99,84 | 0,03 | 99,94 | 0,00 |
| 1,286 | 77,74 | 1,01 | 88,61 | 0,12 | 96,45 | 0,86 | 99,32 | 0,07 | 99,94 | 0,02 | 99,99 | 0,03 |
| 1,382 | 80,85 | 0,52 | 90,71 | 0,30 | 97,24 | 0,86 | 99,65 | 0,19 | 99,93 | 0,06 | 99,96 | 0,06 |
| 1,486 | 83,03 | 0,25 | 92,01 | 0,92 | 97,82 | 0,70 | 99,75 | 0,12 | 99,97 | 0,08 | 99,98 | 0,04 |
| 1,596 | 85,85 | 0,52 | 93,32 | 1,07 | 98,51 | 0,26 | 99,78 | 0,11 | 99,95 | 0,08 | 99,98 | 0,03 |
| 1,715 | 87,67 | 1,70 | 94,55 | 1,06 | 98,80 | 0,34 | 99,90 | 0,03 | 100,00 | 0,00 | 99,95 | 0,09 |
| 1,843 | 90,60 | 2,38 | 96,28 | 0,36 | 99,24 | 0,11 | 99,95 | 0,00 | 99,97 | 0,05 | 99,97 | 0,08 |
| 1,981 | 91,88 | 2,43 | 96,99 | 0,38 | 99,67 | 0,12 | 99,96 | 0,13 | 99,98 | 0,06 | 100,00 | 0,00 |
| 2,129 | 93,66 | 1,24 | 98,38 | 0,84 | 99,52 | 0,16 | 100,00 | 0,00 | 99,92 | 0,25 | 99,90 | 0,23 |
| 2,288 | 95,98 | 0,53 | 98,53 | 0,87 | 99,85 | 0,01 | 100,00 | 0,00 | 99,96 | 0,11 | 100,00 | 0,00 |
| 2,458 | 96,85 | 1,32 | 99,16 | 0,98 | 99,78 | 0,46 | 100,00 | 0,00 | 100,00 | 0,00 | 99,90 | 0,17 |
| 2,642 | 98,39 | 2,33 | 99,38 | 1,31 | 99,83 | 0,51 | 99,75 | 0,51 | 100,00 | 0,00 | 100,00 | 0,00 |
| 2,839 | 99,47 | 1,02 | 99,87 | 0,40 | 99,89 | 0,34 | 100,00 | 0,00 | 100,00 | 0,00 | 100,00 | 0,00 |
| 3,051 | 98,99 | 2,13 | 99,77 | 0,70 | 100,00 | 0,00 | 99,66 | 0,53 | 100,00 | 0,00 | 100,00 | 0,00 |

* $\eta_{mean}$ is the average efficiency at a certain loading phase calculated from six single concentration measurements up- and downstream of the filter.

** $\Delta_{max}$ represents the absolute range of the values measured for each size channel.

**AIR FILTER TEST CERTIFICATE ACCORDING TO: EN 779:2002**

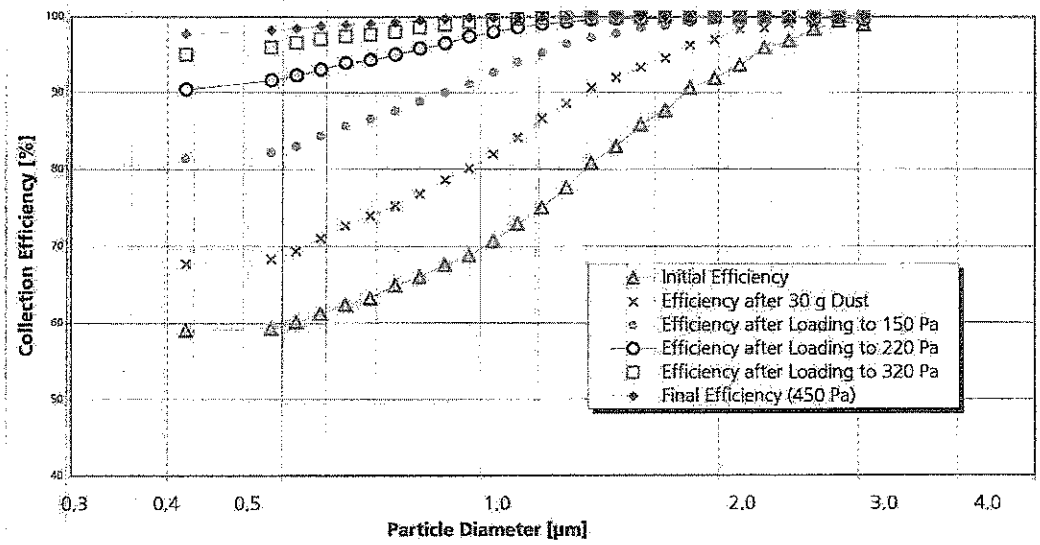
fiatec Filter & Aerosol Technologie GmbH

## EFFICIENCIES AND PRESSURE DROP DIAGRAMS

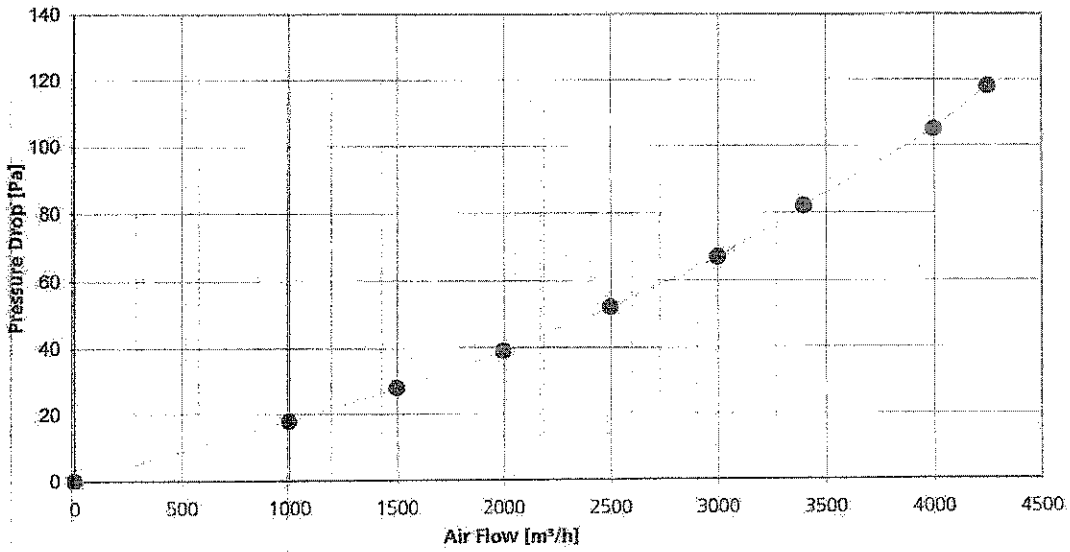
Testing organsiation: fiatec Filter & Aerosol Technologie GmbH Report nr.: DEF 061001_T1

| | | | | | |
|---|---|---|---|---|---|
| Test no.: | DEF 061001_T1 | Date of test: | 26.10.2006 | Test mode: | EN 779:2002 |
| Loading Dust: | ASHRAE 52/76 | Eff. Aerosol: | 10% DEHS | Sample ID | |
| Air Flow [m³/h]: | 3400 | | | | N/A |

### Fractional Collection Efficiencies at Various Loading Phases




### Pressure Drop



**AIR FILTER TEST CERTIFICATE ACCORDING TO: EN 779:2002**

fiatec
Filter & Aerosol Technologie GmbH

## DUST LOADING AND PRESSURE DROP DATA

Testing organisation: fiatec Filter & Aerosol Technologie GmbH

Report no.: DEF 061001_T1

| Test no.: | DEF 061001_T1 | Date of test: | 26.10.06 | Test mode: | EN 779:2002 |
|---|---|---|---|---|---|
| | | | | Sample ID: | N/A |

### Pressure Drop vs Air Flow

| Air Flow | | | | $\Delta p_{gesamt}$ |
|---|---|---|---|---|
| [m³/h] | [m/s] | [kg/h] | [m³/min] | [Pa] |
| 0 | | 0 | 0 | 0 |
| 1000 | | 1185 | 17 | 18 |
| 1500 | | 1778 | 25 | 28 |
| 2000 | | 2370 | 33 | 39 |
| 2500 | | 2963 | 42 | 52 |
| 3000 | | 3555 | 50 | 67 |
| 3400 | | 4029 | 57 | 82 |
| 4000 | | 4740 | 67 | 105 |
| 4250 | | 5036 | 71 | 118 |

### Pressure Drop, Arrestance and Efficiency vs Dust Feed and Dust Collection at 3400 m³/h

| Dust fed (differential) | Dust fed (cumulated) | Dust Collected (differential) | Dust Collected (cumulated) | Arrestance | Average Arrestance | Δp | Efficiency at 0.4µm | Average Efficiency 0.4 µm after each loading step | Average Efficiency | Weight of Device at Various Loading Stages |
|---|---|---|---|---|---|---|---|---|---|---|
| [g] | [g] | [g] | [g] | [%] | [%] | [Pa] | [%] | [%] | [%] | [g] |
| 0,0 | 0,0 | 0,0 | 0,0 | | | 82 | 59,09 | 59,09 | | 2595,8 |
| 30,6 | 30,6 | 29,0 | 29,0 | 94,8 | 94,8 | 95 | 67,78 | 63,43 | 63,43 | 2624,8 |
| 50,6 | 81,2 | 49,5 | 78,5 | 97,8 | 96,7 | 150 | 81,38 | 69,42 | 70,38 | 2674,3 |
| 38,6 | 119,8 | 38,0 | 116,5 | 98,4 | 97,2 | 220 | 90,41 | 74,66 | 75,38 | 2712,3 |
| 28,1 | 147,9 | 27,7 | 144,2 | 98,6 | 97,5 | 320 | 95,00 | 78,73 | 78,67 | 2740,0 |
| 28,2 | 176,1 | 28,0 | 172,3 | 99,5 | 97,8 | 450 | 97,75 | 81,90 | 81,51 | 2768,0 |

| | |
|---|---|
| **Average Efficiency [%] at 450 Pa:** | **81,5** |
| **Dust Holding Capacity [g] at 450 Pa:** | **172,3** |
| **Average Arrestance [%] at 450 Pa:** | **97,8** |