Title: On site air filter test system

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On site air filter test system

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- Current European filter test method
- On-site test system and measurement site
- Results
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General ventilation air filters

- Protect building occupants from outdoor contaminants
- Reduce the soiling of the HVAC system (heating and cooling coils, ductwork)
- Key properties:
  - Filtration efficiency
  - Pressure drop
  - Dust holding capacity
Filter testing according to EN 779

Measurement of initial efficiency & dp

Loading with test dust

Measurement of removal efficiency & dp

dp ≥ 450 Pa

No

Yes

Calculating average efficiency Em (D_p=0.4 µm)

F7: 80< Em<90%

F8: 90< Em<95%

F9: Em>95%

Minimum efficiency for 0.4 µm particles:

F7: 35%

F8: 55%

F9: 70%
Why additional tests are needed?

- The EN 779 provides a comparable but simplified evaluation process of air filters which does not describe the real life behaviour.
- In real operating conditions, the filter performance may differ greatly from that obtained in laboratory due to:
  - Differences between ambient aerosol characteristics and the test dust used in EN 779: concentrations and particle size distributions.
  - Ambient conditions.
  - Filter face velocity distribution, and filter operating and loading conditions.
- Some parameters are time-dependent!
On-site on-line test system

- Particle counter
- Valve system
- USB-modem
- 3G Filter
- PC
- Car
Test results – filter used for 2 weeks

Filtration efficiency for fine particles (0.4 um) is high.

Indoor/Outdoor ratio varies greatly due to indoor activities (and sources).

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Test results: detection of anomalies

Changes in performance affecting the protection efficiency can be seen in real time.

Indoor/Outdoor ratio changes due to reduced efficiency.
Filter used for 6 weeks – charger back in operation

Remediation of charger
Filter used for 7 weeks
Fractional filtration efficiency

![Graph showing filtration efficiency versus particle size.](image)
Particle size distributions

Size distribution 1.8.2014 in the range 0.3 - >5 µm
Conclusions

- The developed test system can measure and monitor filter performance in real time and on-line.
- The results describe real life behaviour of the filter:
  - Filtration efficiency
  - Pressure drop increase due to loading
  - Dust holding capacity
- Based on the results the optimal filter change time can be estimated accurately.
- It is possible to enhance the filtration efficiency for electret filters with High Voltage charging.
- The effect of enhanced filtration efficiency on indoor air quality and improved protection of occupants could be clearly seen.
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