



T018 (EN ISO/IEC 17025)



Determination of the filtration performance of air filter CD408/34.5/140 according to EN 779:2002

Requested by: Nordic Air Filtration A/S



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Task **Determination of the filtration performance of air filter
CD408/34.5/140 according to EN 779:2002**

Sample The customer delivered one air filter, which is detailed in Appendix 1, Device tested.

The sample was received 19.12.2005.
The measurements were made 24. - 26.1.2006.

Test method

The tests were made according to EN 779:2002 /1/. Diverging from the standard, the filter material discharging test was not made.

The test aerosol was DEHS and the bipolar aerosol charger (neutralizer) was a radioactive Am-241 source. The particle counter was of type PMS LAS-X.

The air flow rate was measured with a calibrated orifice plate with corner pressure tappings. The orifice plate has been calibrated against an orifice plate built according to ISO 5167:1980 /2/.

The instruments used in the measurements are presented in Appendix 5.

The Centre for Metrology and Accreditation has accredited our laboratory (no. T018, FINAS Accreditation) to perform the following measurements mentioned in this test report: EN 779:2002.

Results

A summary of the test results is presented in Appendix 1.

A summary of the initial and average efficiencies is presented in Appendix 2. The average efficiencies have been interpolated/ extrapolated to the final pressure drops 250, 350 and 450 Pa.

Efficiencies after different dust loading phases are presented in Appendix 3.

Measurement data relating to pressure drop and dust loading are presented in Appendix 4.

The results are only valid for the tested filter sample.

References

/1/ EN 779:2002. Particulate air filters for general ventilation – Determination of the filtration performance.

/2/ ISO 5167:1980. Measurement of fluid flow by means of orifice plates, nozzles and venturi tubes in circular ducts running full.

Espoo, 1.2.2006



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APPENDICES

5

DISTRIBUTION

Customer
VTT

Original (2pcs)
Original

EN 779:2002. AIR FILTER TEST RESULTS
GENERAL

Test no.:	062003	Date of test: 24. - 26.1.2006	Supervisor: RHO
Test requested by:	Nordic Air Filtration A/S		Device receiving date 19.12.2005
Device delivered by:	Nordic Air Filtration A/S		

DEVICE TESTED

Model CD408/34.5/140	Manufacturer Nordic Air Filtration A/S	Construction Cylindrical cartridge filter
Type of media NA 140	Net effective filtering area 33.5 m ²	Filter dimensions (diameter x length) 408 mm x 876 mm

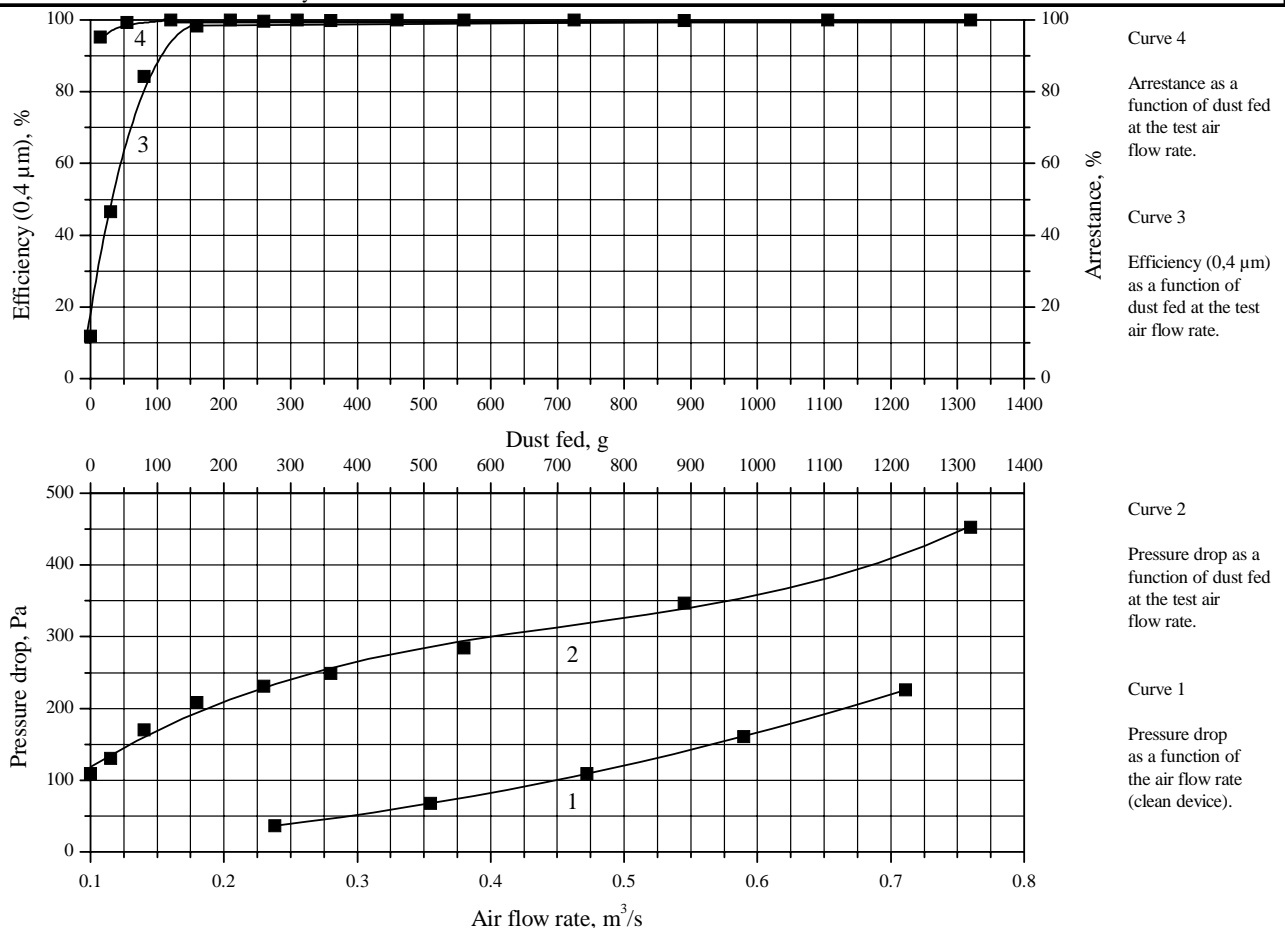
TEST DATA

Test air flow rate 0.472 m ³ /s	Test air temperature 20 - 21 °C	Test air relative humidity 17 - 25 %	Test aerosol DEHS	Loading dust ASHRAE
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RESULTS

Initial pressure drop 109 Pa	Initial arrestance 95 %	Initial efficiency (0,4 µm) 12 %	Dust holding capacity 365 / 911 / 1308 g	Untreated / discharged efficiency of filter material (0.4 µm) Not measured
Final pressure drop 250 / 350 / 450 Pa	Average arrestance >99 / >99 / >99 %	Average efficiency (0,4 µm) 87±0 / 95±0 / 96±0 %	Filter class (450 Pa) F9 (0.472 m ³ /s)	

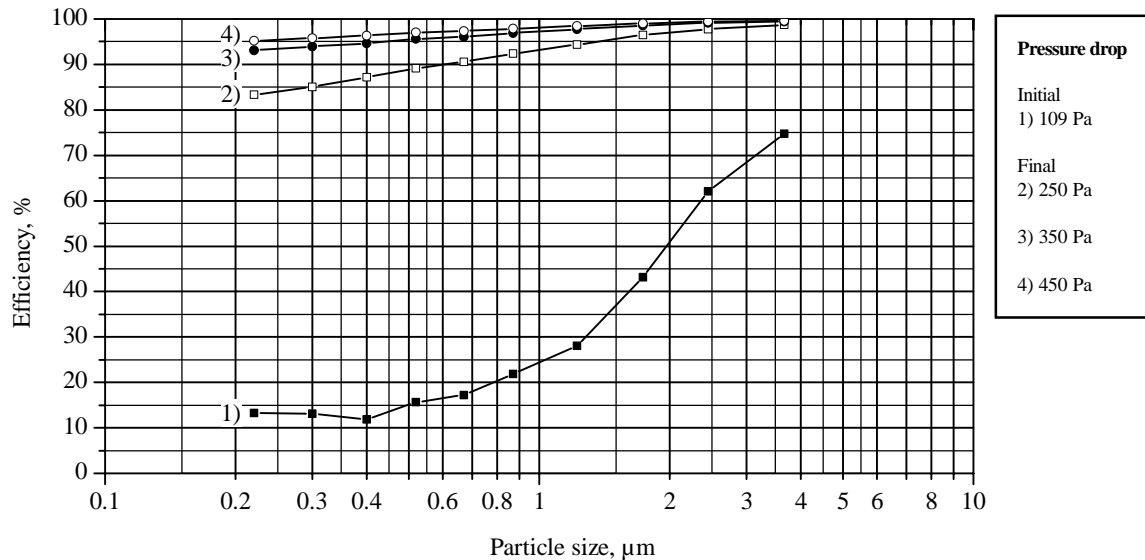
Remarks: -

 NOTE: The performance results cannot by themselves be quantitatively applied to predict filter performance in service.
The results relate only to the tested item.


Air filter: CD408/34.5/140
Initial and average efficiency at different final pressure drops
EN 779:2002

Test no.: 062003

Test aerosol: DEHS

 Air flow rate: 0.472 m³/s

Air filter: CD408/34.5/140
Initial and average efficiency at different final pressure drops
EN 779:2002

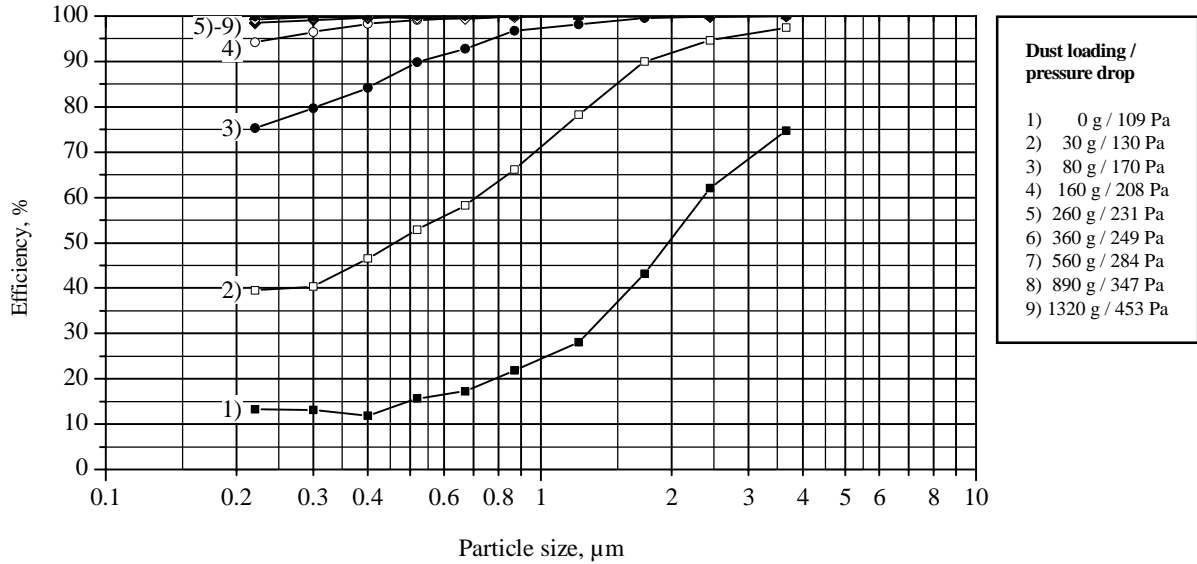
Test no: 062003

Test aerosol: DEHS

 Air flow rate: 0.472 m³/s

Particle size µm		Initial efficiency, %	Average efficiency %			
Interval	Mean		Final pressure drop			
		Pressure drop 109 Pa	250 Pa	350 Pa	450 Pa	
0.20 ... 0.25	0.22	13.2 ± 4.0	83.4 ± 0.9	93.1 ± 0.4	95.2 ± 0.3	
0.25 ... 0.35	0.30	13.1 ± 2.8	85.1 ± 0.7	93.9 ± 0.3	95.8 ± 0.3	
0.35 ... 0.45	0.40	11.8 ± 2.5	87.1 ± 0.6	94.7 ± 0.3	96.4 ± 0.2	
0.45 ... 0.60	0.52	15.7 ± 5.1	89.2 ± 0.8	95.6 ± 0.4	97.0 ± 0.3	
0.60 ... 0.75	0.67	17.2 ± 5.1	90.5 ± 1.0	96.1 ± 0.6	97.3 ± 0.4	
0.75 ... 1.00	0.87	21.9 ± 2.0	92.4 ± 0.4	96.9 ± 0.2	97.9 ± 0.2	
1.00 ... 1.50	1.22	28.1 ± 2.1	94.3 ± 0.4	97.7 ± 0.2	98.4 ± 0.1	
1.50 ... 2.00	1.73	43.1 ± 3.7	96.5 ± 0.4	98.6 ± 0.1	99.0 ± 0.1	
2.00 ... 3.00	2.45	62.1 ± 1.7	97.8 ± 0.3	99.1 ± 0.1	99.4 ± 0.1	
3.00 ... 4.50	3.67	74.7 ± 4.0	98.7 ± 0.3	99.5 ± 0.1	99.6 ± 0.1	
Dust holding capacity		-	365 g	911 g	1308 g	
Filter class		-	-	-	F9	

Air filter: CD408/34.5/140
Efficiency after different dust loading phases
EN 779:2002
 Test no.: 062003
 Test aerosol: DEHS
 Air flow rate: 0.472 m³/s



Air filter: CD408/34.5/140
Efficiency and uncertainty after different dust loading phases
EN 779:2002
 Test no: 062003
 Test aerosol: DEHS
 Air flow rate: 0.472 m³/s

Particle size µm		Efficiency %								
Interval	Mean	Pressure drop, Pa / Dust fed, g								
		109 Pa 0 g	130 Pa 30 g	170 Pa 80 g	208 Pa 160 g	231 Pa 260 g	249 Pa 360 g	284 Pa 560 g	347 Pa 890 g	453 Pa 1320 g
0.20 ... 0.25	0.22	13.2 ± 4.0	39.5 ± 1.2	75.3 ± 0.9	94.2 ± 1.0	98.4 ± 0.6	99.3 ± 0.2	99.8 ± 0.1	99.9 ± 0.1	99.9 ± 0.0
0.25 ... 0.35	0.30	13.1 ± 2.8	40.4 ± 2.3	79.7 ± 0.9	96.5 ± 0.5	99.1 ± 0.1	99.7 ± 0.2	100.0 ± 0.0	99.9 ± 0.1	99.9 ± 0.1
0.35 ... 0.45	0.40	11.8 ± 2.5	46.5 ± 1.3	84.2 ± 1.2	98.3 ± 0.3	99.6 ± 0.1	99.8 ± 0.3	100.0 ± 0.0	99.9 ± 0.0	100.0 ± 0.0
0.45 ... 0.60	0.52	15.7 ± 5.1	52.9 ± 2.3	89.8 ± 0.4	99.2 ± 0.3	99.9 ± 0.1	99.6 ± 0.8	100.0 ± 0.1	100.0 ± 0.0	100.0 ± 0.1
0.60 ... 0.75	0.67	17.2 ± 5.1	58.3 ± 2.0	92.8 ± 1.0	99.6 ± 0.4	99.8 ± 0.2	99.5 ± 1.3	100.0 ± 0.1	100.0 ± 0.0	100.0 ± 0.0
0.75 ... 1.00	0.87	21.9 ± 2.0	66.1 ± 0.9	96.8 ± 0.7	99.8 ± 0.2	100.0 ± 0.1	99.9 ± 0.3	100.0 ± 0.0	100.0 ± 0.1	100.0 ± 0.1
1.00 ... 1.50	1.22	28.1 ± 2.1	78.3 ± 1.6	98.2 ± 0.6	100.0 ± 0.1	100.0 ± 0.1	100.0 ± 0.1	99.9 ± 0.1	100.0 ± 0.0	100.0 ± 0.0
1.50 ... 2.00	1.73	43.1 ± 3.7	90.0 ± 0.8	99.6 ± 0.3	100.0 ± 0.0	99.9 ± 0.2	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.1
2.00 ... 3.00	2.45	62.1 ± 1.7	94.6 ± 0.7	99.9 ± 0.1	100.0 ± 0.1	99.9 ± 0.3	100.0 ± 0.0	100.0 ± 0.1	100.0 ± 0.0	100.0 ± 0.0
3.00 ... 4.50	3.67	74.7 ± 4.0	97.4 ± 1.3	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0	100.0 ± 0.0

The uncertainty of the measured efficiencies is reported on a 95 % confidence level.

Air filter: CD408/34.5/140
Air flow rate and pressure drop after different dust loading phases
EN 779:2002
Test no: 062003

Date	Dust fed m_{tot} g	Calibrated orifice plate ¹⁾				Filter						
		t_f °C	p_{sf} kPa	Δp_f Pa	q_m kg/s	t °C	φ %	p_a kPa	ρ kg/m ³	q_v m ³ /s	Δp Pa	$\Delta p_{1.20}$ Pa
Clean filter												
24.1.2006	0	20.3	-0.203	608	0.861	20.8	22.4	102.4	1.211	0.711	228	226
"	0	20.3	-0.147	418	0.715	20.9	21.9	102.4	1.211	0.590	162	161
"	0	20.2	-0.103	267	0.572	20.9	20.8	102.4	1.211	0.472	110	109
"	0	20.2	-0.059	151	0.430	20.8	20.5	102.4	1.211	0.355	68	68
"	0	20.2	-0.035	67	0.288	20.8	20.0	102.4	1.212	0.238	36	36
Clean filter pressure drop is proportional to $(q_v)^n$, where $n = 1.684$												
Dust loading phase												
24.1.2006	30	20.1	-0.186	267	0.571	20.7	18.8	102.3	1.211	0.472	131	130
"	30	20.6	-0.183	267	0.571	20.5	17.4	102.3	1.211	0.472	131	130
"	80	20.2	-0.223	267	0.571	20.8	19.0	102.2	1.209	0.472	171	170
"	80	20.8	-0.220	266	0.570	20.7	19.2	102.1	1.209	0.471	170	169
"	160	20.2	-0.257	267	0.570	20.9	19.7	102.0	1.206	0.473	209	208
25.1.2006	160	20.3	-0.259	263	0.563	20.3	24.6	100.9	1.196	0.471	208	208
"	260	20.4	-0.286	264	0.564	20.9	22.7	100.9	1.193	0.472	230	231
"	260	20.7	-0.286	264	0.563	20.6	21.9	100.9	1.195	0.471	230	231
"	360	20.4	-0.296	264	0.564	21.0	23.3	101.0	1.193	0.473	248	249
"	360	20.9	-0.302	263	0.563	20.8	23.5	101.0	1.194	0.471	248	249
"	560	20.5	-0.333	263	0.563	21.2	23.7	101.0	1.193	0.472	283	284
26.1.2006	560	20.2	-0.337	265	0.569	20.5	19.8	102.0	1.208	0.471	283	282
"	890	20.4	-0.402	268	0.571	21.2	19.1	102.1	1.206	0.473	349	347
"	890	20.5	-0.399	266	0.569	21.1	19.6	102.1	1.206	0.472	346	345
"	1320	20.5	-0.507	266	0.568	21.3	19.4	102.0	1.205	0.472	455	453

1* measured before next dust increment

2* measured after dust increment

Symbols and units

m_{tot}	Cumulative mass of dust fed to filter, g	t_f	Temperature at air flow meter, °C
p_a	Absolute air pressure upstream of filter, kPa	ρ	Air density upstream of filter, kg/m ³
p_s	Air flow meter static pressure, kPa	φ	Relative humidity upstream of filter, %
q_m	Mass flow rate, kg/s	Δp	Measured filter pressure drop, Pa
q_v	Air flow rate at filter, m ³ /s	Δp_f	Air flow meter differential pressure, Pa
t	Temperature upstream of filter, °C	$\Delta p_{1.20}$	Filter pressure drop at air density 1.20 kg/m ³ , Pa

¹⁾ Orifice plate dimensions

Duct dimensions: 610 mm x 610 mm

Orifice diameter: 216 mm

Air filter: CD408/34.5/140
Pressure drop and arrestance after different dust loading phases
EN 779:2002
Test no: 062003

Date	Δp_1 Pa	Δm g	m_{tot} g	Δp_2 Pa	m_1 g	m_2 g	Δm_{ff} g	m_d g	A %
24.1.2006	109	30	30	130	2747.1	2748.5	1.4	0.0	95.3
"	130	50	80	170	2748.5	2748.8	0.3	0.0	99.4
"	169	80	160	208	2748.8	2748.8	0.0	0.0	100.0
25.1.2006	208	100	260	231	2749.2	2749.2	0.0	0.0	100.0
"	231	100	360	249	2749.2	2749.2	0.0	0.0	100.0
"	249	200	560	284	2749.2	2749.2	0.0	0.0	100.0
26.1.2006	282	330	890	347	2749.2	2749.2	0.0	0.0	100.0
"	345	430	1320	453	2749.2	2749.2	0.0	0.0	100.0

Mass of tested device

Initial mass of tested device: 9839 g
 Final mass of tested device: 11034 g

Symbols and units

A Arrestance, %
 m_d Dust in duct after device, g
 m_{tot} Cumulative mass of dust fed to filter, g
 m_1 Mass of final filter before dust increment, g
 m_2 Mass of final filter after dust increment, g
 Δm Dust increment, g
 Δm_{ff} Mass gain of final filter, g
 Δp_1 Pressure drop before dust increment (air density 1.20 kg/m³), Pa
 Δp_2 Pressure drop after dust increment (air density 1.20 kg/m³), Pa

Loading dust

Type: ASHRAE test dust
 Manufactured by: Particle Technology Ltd
 Batch no.: 4485 30 APR 05

Instruments used

Instrument	Type code	Serial number	Calibration date	Used
Micromanometer	Alnor MP6KS	1020843	4.5.2005	X
	Alnor MP6KS	1020847	4.5.2005	X
Barometer	No. 9002588	-	10.1.2006	X
Hygrometer	Rotronic MS100TST	1188900/6	1.2.2005	X
Temperature meter	Nokeval 538-8	18455014	1.2.2005	X
Balance	Mettler PC8000-S2	A90263	1.2.2005	X
Particle counter	PMS LAS-X	26004-1091-380	27.9.2005	X
	Calibration check with 0.304 µm and 0.993 µm latex particles		2.1.2006	-
Dust feeder	ASHRAE 52-76	-	16.8.2005	X
Orifice plate	φ 216 / 610 x 610	-	8.9.1999	X
	φ 272 / 610 x 610	-	25.5.1999	-
	φ 90 / 610 x 610	-	17.3.2005	-