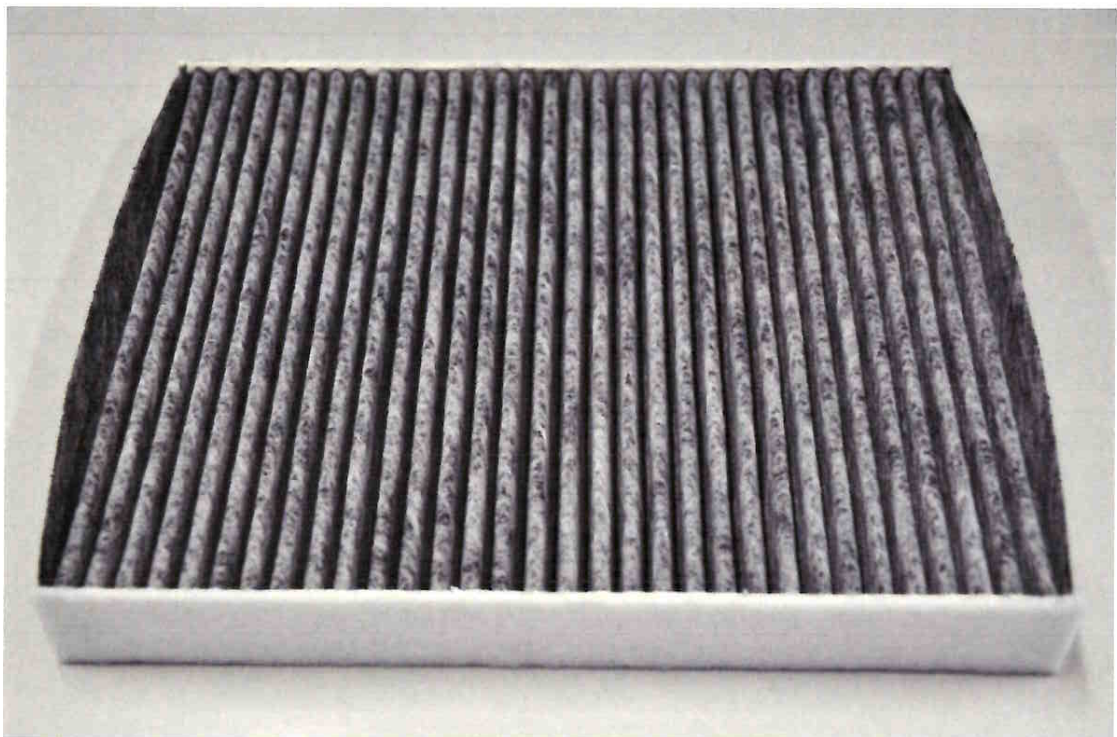


CABIN AIR FILTER PERFORMANCE TESTS ON COMBINED FILTERS



Test Report DAG 150401

Mainleus, May 13th, 2015

acc. DIN 71460-1 / ISO 11155-2

initiated by:

**Dongguan Air Guard Filter Mfr,
CO., Ltd**

1. Objectives and Test Set-up

On combination filters the particle filtration performance and the adsorption performance had to be tested according to the test procedure below.

All test conditions and parameters not given will be chosen according to DIN 71460-1 and ISO 11155-2 „Air filters for passenger compartments of motor vehicles“.

- a) Test requested by: Dongguan Air Guard Filter Mfr, CO., Ltd
- b) Test specimen / Construction: Cabin air filter with flexible textile frame
- c) Model/Parts ID: N/A
- d) Upstream side: see picture
- e) Printing: Filter numbers (see attachments)
- f) Dimensions: ca. 245 x 203 x 30 mm
- g) Samples were received on: April 24th, 2015.
- h) Test has been performed on: April 28th – May 11th, 2015.

Table 1: Test Procedure

Test	fiatec-No: DAG 150401_	K1	K2	K3	K4	K5	K6
Filter weight		X					
Pressure Drop curve 3, 6, 9 and 12 kg/min		X					
Fractional Filtration Efficiency, Test Dust: NaCl		X					
Fractional Filtration Efficiency, Test Dust: A2		X					
Conditioning under test conditions		X					
Filter weight		X					
Dust Loading until +200 Pa, Test Dust: A2		X					
Filter Weight, Determination of Dust Holding Capacity		X					
Conditioning acc. ISO 11150			X	X	X	X	X
Adsorption Test with 80 ppm n-Butane			X				
Adsorption Test with 80 ppm Toluene				X			
Adsorption Test with 30 ppm SO ₂					X		
Adsorption Test with 30 ppm NO _x						X	
Adsorption Test with 10 ppm Formaldehyde							X

* The concentrations of all nitrogen oxides (NO_x) and nitrogen dioxide (NO₂) were detected in parallel.

Test Conditions Particle Filtration

- Flow Rate: 6 kg/min
- Temperature: 23°C ± 3°C
- Relative Humidity: 50% ± 5%
- Particle Efficiency Test Dust: 1. Sodium Chloride (2% NaCl)
2. ISO 12103-1 A2 (Powder Technology Inc., USA)
- Particle Efficiency Size Range: 1. 0.05 – 0.5 µm
2. 0.5 - > 10 µm aerodynamic
- Test Dust for Dust Loading: 75 mg/m³ ISO 12103-1 A2 (Powder Technology Inc., USA)

For determination of fractional efficiencies in the particle size range of 0.05 – 0.5 µm a SMPS (Scanning Mobility Particle Sizer, TSI Inc.) was used as detector. For efficiency measurements in the size range of 0.5 - >10 µm (aerodynamic) an APS 3321 (Aerodynamic Particle Sizer, TSI Inc.) was used.

The sodium chloride aerosol was generated by an atomizer AGK 2000 (PALAS GmbH). The test dust A2 was injected with a rotating brush generator RBG 1000 (PALAS GmbH). The test dusts were not electrostatically neutralized.

Pressure drops were measured using three sensors of the ranges 0 - 100, 0 - 500 und 0 - 3000 Pa. The accuracy of the pressure transducers is 1% of the range maximum. The accuracy of the flow controls is 2% of the nominal value.

Test Conditions Gas Adsorption

Flow Rate:	3 kg/min
Temperature:	23°C ± 1°C
Relative Humidity:	50% ± 3%
Test Gas Concentration n-Butane; Toluene:	80 ppm ± 5%
Test Gas Concentration SO ₂ , NO ₂ :	30 ppm ± 5%
Test Gas Concentration Formaldehyde:	10 ppm ± 5%
Test Duration:	until 95% Breakthrough or 1h

2. Results

The detailed results are reported in the attachments 1 through 6.

2.1 Particle Filtration

The tables 2; 3 and 4 show a summary of the most important test results.

Table 2: Summary of the pressure drop results

filter	Filter state	Flow Rate [kg/min]				
		0	3	6	9	12
		Pressue Drop [Pa]				
K1	New	0	45	112	195	304

Tables 3 : Summary of the Efficiency results

Particle Size (mobility diam.) [µm]	New Filter K1, (NaCl) [%]	Particle Size (aerodynamic) [µm]	New Filter K1, (A2) [%]
0,1	63	0,5	92,9
0,2	55	1,0	95,1
0,3	54	2,5	99,2
0,4	56	3,0	99,7
0,5	60	5,0	99,9

Tables 6 : Summary of the Dust Holding Capacity

	K1 [g]
+200 Pa	26,5

2.2 Adsorption

For the measurement with nitrogen dioxide (NO₂) the concentrations of the sum of nitrogen oxides (NO_x) and nitrogen monoxide (NO) were detected in parallel. The concentrations of nitrogen dioxide (NO₂) were calculated as difference. It is assumed that on the filter downstream side NO and NO₂ are only available. Other nitrogen oxides can also exist but their concentrations are supposed as very small and are ignored.

The calculation of the NO_x adsorption capacity is based on the molecular weight of NO₂. The initial efficiency and the capacity values are shown in table 5 refer to the NO_x concentration.

Table 5: Summary of the most important adsorption results

Test gas	Filter	Initial Break-through [%]	after 1 Minute [%]	after 5 Minutes [%]	after 10 Minutes [%]	after 15 Minutes [%]	Capacity [mg]	Capacity [g/dm ²]**
n-Butane	K2	41	71	87	93	-	850	0,177
Toluene	K3	20	26	31	38	47	16015	3,336
SO ₂	K4	28	52	72	79	82	2064*	0,430
NO _x	K5	22	29	39	48	54	3244*	0,676
NO ₂	K5	21	26	32	38	42	4278*	0,891
Formaldehyde	K6	40	48	63	71	74	392*	0,082

* After 1h

** with effective Face area ca. 4,8 dm²



Steffan Trnetschek

Attachments:6

Attachment 1-6: Summary of Test Results of Sample DAG 150401_K1-K6

Attachment 1 to Test Report DAG 150401

Summary of Test Results for Sample

1

fiatec-No.: DAG 150401-K1

1. Particle Collection Efficiency

Test Dust:	ISO 12103-1 A2 (PTI)	Particle Counter:	APS 3321
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Flow Rate: 6 kg/min		A2, New Filter	
Particle Size (aerodyn.)	Particle Size (geometric) ***	η_{mean}^*	Δ_{max}^{**}
[μm]	[μm]	[%]	[%]
0,54	0,33	92,9	0,3
0,58	0,36	93,1	0,4
0,63	0,38	93,4	0,1
0,67	0,41	93,6	0,2
0,72	0,44	93,9	0,2
0,78	0,48	94,0	0,2
0,84	0,51	94,3	0,2
0,90	0,55	94,5	0,0
0,97	0,59	94,8	0,4
1,04	0,64	95,1	0,4
1,11	0,68	95,4	0,2
1,20	0,74	95,8	0,4
1,29	0,79	96,1	0,1
1,38	0,85	96,4	0,5
1,49	0,91	96,9	0,1
1,60	0,98	97,2	0,7
1,72	1,05	97,6	0,3
1,84	1,13	98,0	0,2
1,98	1,22	98,3	0,1
2,13	1,31	98,6	0,1
2,29	1,41	98,8	0,2
2,46	1,51	99,2	0,1
2,64	1,62	99,3	0,2
2,84	1,74	99,6	0,2
3,05	1,87	99,7	0,1
3,28	2,01	99,7	0,0
3,52	2,16	99,8	0,2
3,79	2,33	99,8	0,1
4,07	2,50	99,9	0,3
4,37	2,69	99,9	0,2
4,70	2,89	99,9	0,2
5,05	3,10	99,9	0,0
5,43	3,33	99,9	0,2
5,83	3,58	99,8	0,4
6,26	3,85	99,8	0,5
6,73	4,14	99,9	0,3
7,23	4,44	>99,9	0,0
7,77	4,78	>99,9	0,0
8,35	5,13	>99,9	0,0
8,98	5,51	>99,9	0,0
9,65	5,93	>99,9	0,0
10,37	6,37	>99,9	0,0
11,14	6,84	>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

*** Particle Size (geometric) = Particle Size (aerodynamic)/root from the density of the test aerosol

Attachment 1 to Test Report DAG 150401

Summary of Test Results for Sample

1

fiatec-No.: DAG 150401-K1



Filter & Aerosol Technologie GmbH

Test Dust:	NaCl (2%)	Particle Counter:	SMPS
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Flow Rate: 6 kg/min	NaCl, New Filter	
Particle Size (mobility diameter)	η_{mean}^*	Δ_{max}^{**}
[μm]	[%]	[%]
0,029	74,2	2,1
0,034	74,5	1,3
0,039	73,7	3,0
0,045	72,9	2,3
0,052	71,8	2,1
0,060	70,5	2,6
0,070	68,2	2,3
0,081	66,3	2,7
0,093	64,0	2,3
0,108	61,4	0,4
0,124	59,4	2,8
0,143	57,5	1,1
0,166	56,0	1,6
0,191	55,1	1,0
0,221	54,5	3,0
0,255	54,1	2,9
0,294	54,3	2,3
0,340	54,8	2,9
0,392	56,1	2,2
0,453	58,0	1,6
0,523	60,8	1,5

* 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

Particle Size	Effizienz [%]
[μm] (mobility)	NaCl, New Filter
0,1	63
0,2	55
0,3	54
0,5	60
[μm] (aerodynamic)	A2, New Filter
0,5	92,9
1,0	95,1
2,5	99,2
3,0	99,7
5,0	99,9

Attachment 1 to Test Report DAG 150401

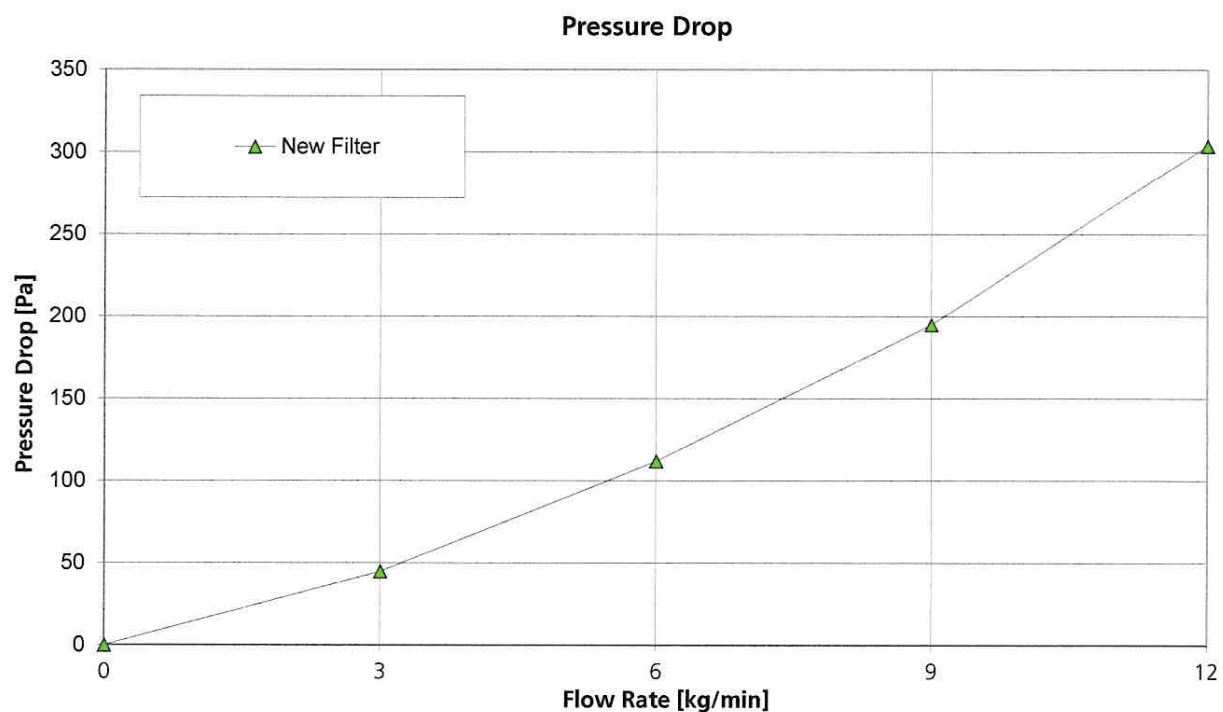
Summary of Test Results for Sample

1

fiatec-No.: DAG 150401-K1

2. Pressure Drop [Pa]

Flow Rate [kg/min]	3	6	9	12
New Filter	45	112	195	304



3. Dust Loading

Flow Rate: 6 [kg/min]

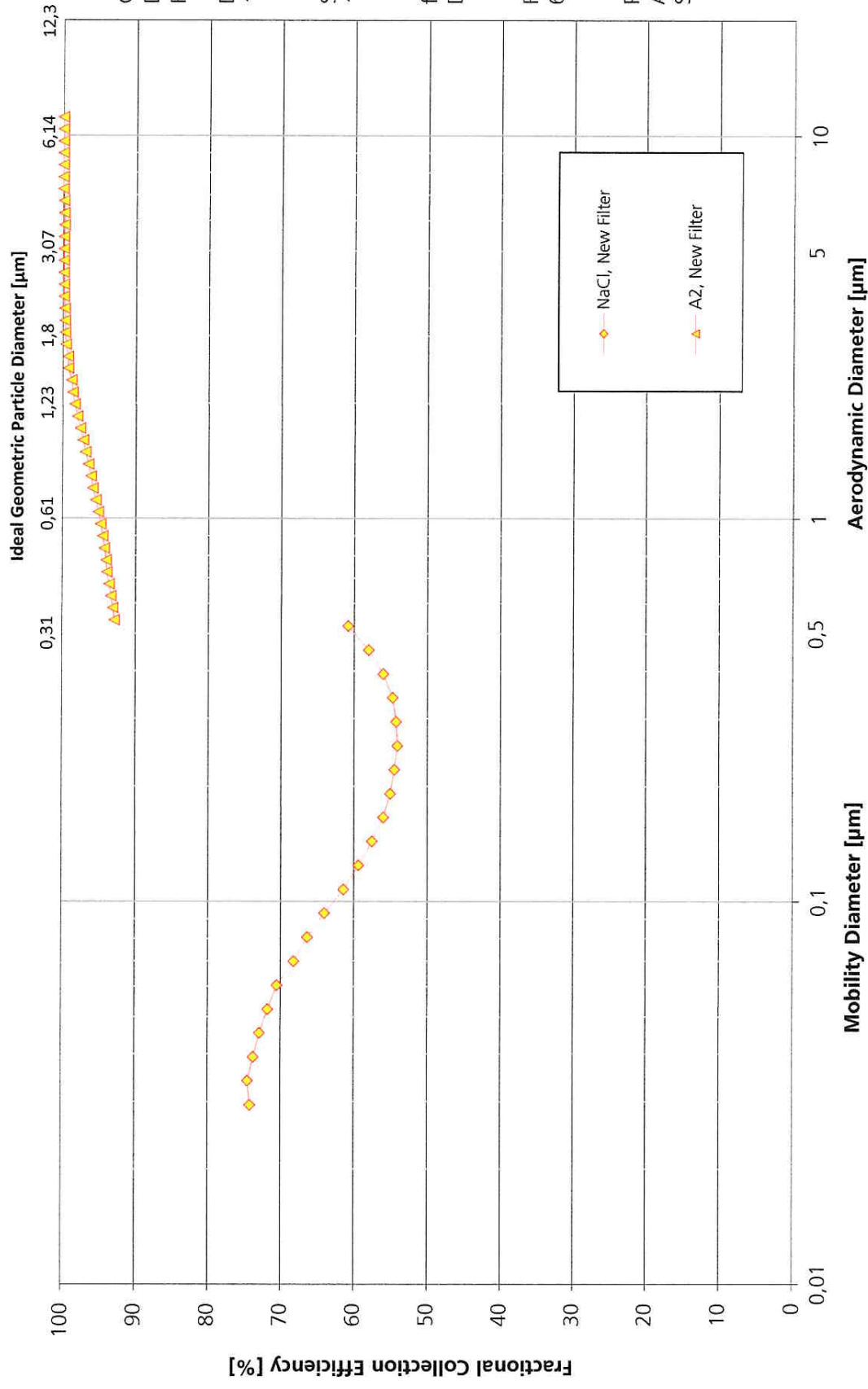
Test Dust: ISO 12103-1 A2 (PTI)

$\Delta p_{\text{Initial}}$	[Pa]	112	Dust Holding Capacity [g]
Mass _{New Filter}	[g]	198,5	
Mass _{after Aging}	[g]	N/A	
Mass _{Cond.}	[g]	199,1	
Mass _{+200 Pa}	[g]	225,6	
			26,5

Attachment 1 to Test Report DAG 150401

Diagram: Fractional Collection Efficiency

Particle Collection Efficiencies



Customer:
Dongguan Air Guard
Filter Mfr, CO.,Ltd

Date:
11.05.2015

Sample:
1

fiatec-No.:
DAG 150401 K1

Flow Rate [kg/min]:
6

Particle Counters:
APS 3321
SMPS

Attachment 2 to Test Report DAG 150401

Summary of Test Results for Sample

2

fiatec-No.: DAG 150401-K2

Adsorption of 80 ppm n-Butane

Specified Raw Gas Concentration:	80 ± 4 ppm
Average Upstream Concentration at the Beginning (A):	79,89 ± 0,23 ppm
Average Upstream Concentration at the End (B):	79,29 ± 0,2 ppm
Ratio A/B:	1,008
Date of Test:	28.04.2015
Mass of New Filter:	218 g
Mass after Conditioning:	208,2 g
Flow Rate:	3 kg/min
Pressure Drop:	55 Pa
Temperature:	23°C ± 1°C
Relative Humidity:	50% ± 3%
Initial Breakthrough:	41,4%
Test Duration:	95% Breakthrough
Capacity:	850 mg

time [min]	downstream concentration [ppm]	breakthrough [%]	mass adsorbed [mg]
0,00	32,99	41,4	0
0,17	43,91	55,2	40
0,34	48,50	60,9	73
0,50	51,29	64,4	102
0,67	53,21	66,9	128
0,84	54,95	69,0	153
1,01	56,41	70,9	176
1,17	57,68	72,5	198
1,34	58,77	73,8	219
1,49	59,67	75,0	237
1,66	60,56	76,1	256
1,83	61,36	77,1	274
2,00	62,10	78,0	291
2,16	62,78	78,9	308
2,33	63,40	79,7	324
2,50	63,97	80,4	340
2,67	64,51	81,1	355
2,83	65,01	81,7	369
3,00	65,48	82,3	383
3,17	65,92	82,8	397
3,34	66,34	83,3	410
3,50	66,73	83,8	422
3,67	67,10	84,3	435
3,84	67,45	84,7	447
4,01	67,78	85,2	458
4,16	68,07	85,5	469
4,33	68,37	85,9	480
4,49	68,66	86,3	490
4,66	68,94	86,6	501

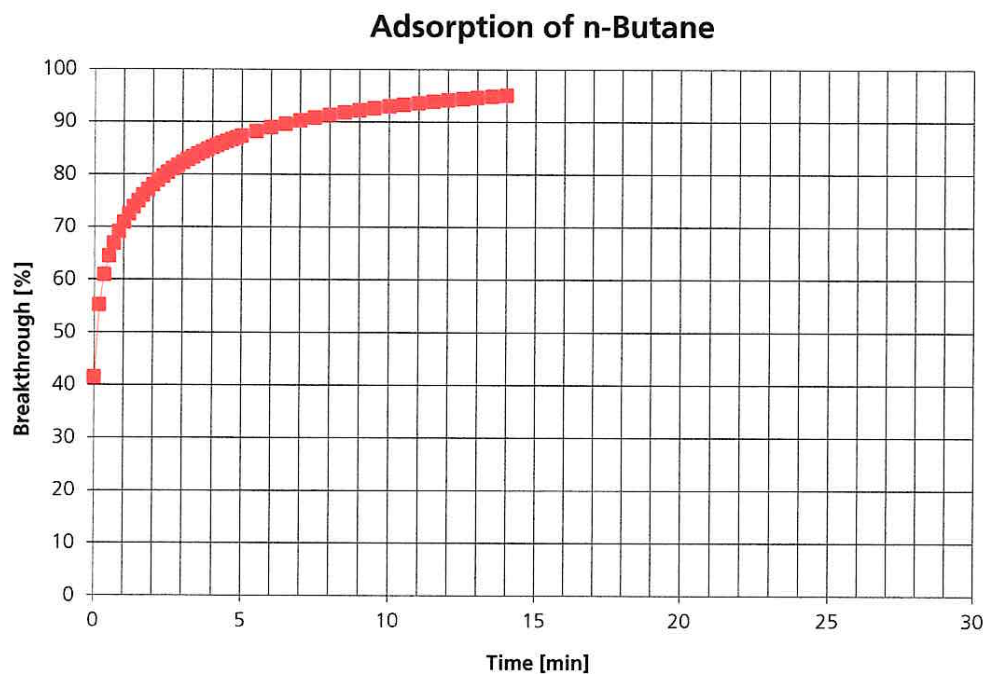
Attachment 2 to Test Report DAG 150401

Summary of Test Results for Sample

2

fiatec-No.: DAG 150401-K2

4,83	69,20	86,9	511
5,00	69,45	87,3	521
5,50	70,15	88,1	550
6,00	70,76	88,9	576
6,50	71,31	89,6	601
7,01	71,80	90,2	625
7,49	72,24	90,8	646
8,00	72,64	91,3	667
8,50	73,01	91,7	687
9,00	73,35	92,2	706
9,50	73,66	92,6	723
10,01	73,95	92,9	740
10,49	74,21	93,2	756
11,00	74,46	93,5	771
11,50	74,68	93,8	786
12,00	74,90	94,1	800
12,51	75,10	94,4	813
12,99	75,28	94,6	826
13,50	75,45	94,8	838
14,00	75,61	95,0	850



Attachment 3 to Test Report DAG 150401

Summary of Test Results for Sample

3

fiatec-No.: DAG 150401-K3

Adsorption of 80 ppm Toluene

Specified Raw Gas Concentration:	80 ± 4 ppm
Average Upstream Concentration at the Beginning (A):	80,15 ± 0,31 ppm
Average Upstream Concentration at the End (B):	79,18 ± 0,28 ppm
Ratio A/B:	1,012
Date of Test:	28.04.2015
Mass of New Filter:	206,1 g
Mass after Conditioning:	203,9 g
Flow Rate:	3 kg/min
Pressure Drop:	53 Pa
Temperature:	23°C ± 1°C
Relative Humidity:	50% ± 3%
Initial Breakthrough:	19,9%
Test Duration:	60 Minutes
Capacity:	16015 mg

time [min]	downstream concentration [ppm]	breakthrough [%]	mass adsorbed [mg]
0,00	15,85	19,9	0
0,17	18,11	22,7	97
0,34	19,02	23,9	191
0,50	19,70	24,7	285
0,67	20,17	25,3	377
0,84	20,61	25,9	468
1,01	20,61	25,9	559
1,16	20,90	26,2	642
1,32	21,08	26,5	732
1,49	21,37	26,8	822
1,66	21,51	27,0	912
1,83	21,73	27,3	1002
2,00	21,84	27,4	1091
2,16	22,05	27,7	1180
2,33	22,38	28,1	1268
2,50	22,49	28,2	1357
2,67	22,70	28,5	1445
2,83	22,81	28,6	1534
3,00	22,94	28,8	1621
3,17	23,06	28,9	1708
3,34	23,19	29,1	1796
3,51	23,33	29,3	1883
3,67	23,46	29,5	1969
3,84	23,61	29,6	2056
4,01	23,75	29,8	2143
4,16	23,88	30,0	2221
4,33	24,03	30,2	2306
4,49	24,19	30,4	2392
4,66	24,35	30,6	2478

Attachment 3 to Test Report DAG 150401

Summary of Test Results for Sample

3

fiatec-No.: DAG 150401-K3

4,83	24,51	30,8	2563
5,00	24,67	31,0	2648
5,50	25,18	31,6	2902
6,00	25,71	32,3	3153
6,51	26,26	33,0	3402
7,01	26,83	33,7	3648
7,49	27,39	34,4	3883
8,00	28,00	35,1	4123
8,50	28,62	35,9	4362
9,00	29,25	36,7	4597
9,51	29,90	37,5	4829
9,99	30,53	38,3	5050
11,00	31,87	40,0	5499
12,00	33,23	41,7	5936
12,99	34,59	43,4	6352
14,00	35,99	45,2	6763
15,00	37,39	46,9	7162
15,99	38,76	48,7	7540
17,00	40,15	50,4	7913
18,01	41,52	52,1	8273
18,99	42,85	53,8	8614
20,00	44,18	55,5	8949
21,01	45,49	57,1	9272
22,00	46,74	58,7	9577
23,00	47,98	60,2	9877
24,01	49,18	61,7	10165
25,00	50,32	63,2	10437
26,00	51,44	64,6	10704
27,01	52,53	65,9	10961
28,00	53,55	67,2	11203
29,00	54,55	68,5	11441
29,99	55,48	69,6	11665
31,00	56,40	70,8	11885
32,00	57,26	71,9	12097
32,99	58,07	72,9	12297
34,00	58,86	73,9	12493
35,01	59,60	74,8	12683
35,99	60,29	75,7	12862
37,00	60,95	76,5	13039
38,01	61,58	77,3	13209
38,99	62,15	78,0	13371
40,00	62,71	78,7	13531
41,01	63,22	79,4	13686
42,00	63,70	80,0	13833
43,00	64,15	80,5	13979
44,01	64,57	81,1	14121
45,00	64,96	81,5	14257
46,00	65,32	82,0	14392
46,99	65,66	82,4	14521

Attachment 3 to Test Report DAG 150401

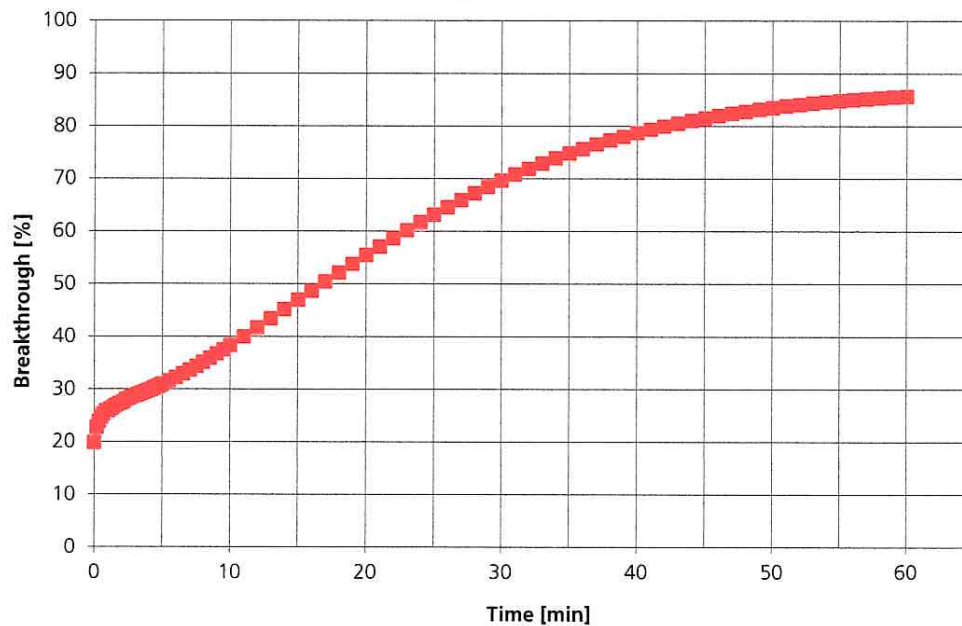
Summary of Test Results for Sample

3

fiatec-No.: DAG 150401-K3

48,00	65,97	82,8	14649
49,00	66,26	83,2	14774
49,99	66,53	83,5	14895
51,00	66,78	83,8	15016
52,00	67,01	84,1	15134
52,99	67,22	84,4	15249
54,00	67,41	84,6	15363
55,00	67,59	84,8	15476
55,99	67,75	85,0	15585
57,00	67,90	85,2	15695
58,01	68,04	85,4	15803
58,99	68,16	85,6	15909
60,00	68,27	85,7	16015

Adsorption of Toluene



Attachment 4 to Test Report DAG 150401

Summary of Test Results for Sample

4

fiatec-No.: DAG 150401-K4

Adsorption of 30 ppm Sulfur Dioxide

Specified Raw Gas Concentration:	30 ± 1,5 ppm
Average Upstream Concentration at the Beginning (A):	30,15 ± 0,04 ppm
Average Upstream Concentration at the End (B):	30,25 ± 0,05 ppm
Ratio A/B:	0,997
Date of Test:	08.05.2015
Mass of New Filter:	204,9 g
Mass after Conditioning:	204,4 g
Flow Rate:	3 kg/min
Pressure Drop:	46 Pa
Temperature:	23°C ± 1°C
Relative Humidity:	50% ± 3%
Initial Breakthrough:	28,4%
Test Duration:	60 Minutes
Capacity:	2064 mg

time [min]	downstream concentration [ppm]	breakthrough [%]	mass adsorbed [mg]
0,00	8,57	28,4	0
0,17	10,60	35,1	22
0,34	12,39	41,0	43
0,50	13,51	44,7	61
0,67	14,43	47,8	78
0,82	15,13	50,1	93
0,99	15,81	52,3	109
1,16	16,39	54,3	124
1,33	16,91	56,0	139
1,49	17,37	57,5	153
1,66	17,79	58,9	167
1,83	18,17	60,1	180
2,00	18,51	61,3	193
2,16	18,82	62,3	205
2,33	19,11	63,3	217
2,50	19,37	64,1	229
2,67	19,62	65,0	240
2,83	19,85	65,7	252
3,00	20,06	66,4	263
3,17	20,26	67,1	273
3,34	20,45	67,7	284
3,50	20,63	68,3	294
3,66	20,78	68,8	304
3,82	20,94	69,3	314
3,99	21,09	69,8	324
4,16	21,23	70,3	333
4,33	21,36	70,7	343
4,49	21,49	71,2	352
4,66	21,61	71,6	362

Attachment 4 to Test Report DAG 150401

Summary of Test Results for Sample

4

fiatec-No.: DAG 150401-K4

4,83	21,73	71,9	371
5,00	21,84	72,3	380
5,50	22,14	73,3	406
6,00	22,41	74,2	432
6,49	22,64	75,0	456
6,99	22,86	75,7	480
7,50	23,05	76,3	503
8,00	23,22	76,9	526
8,50	23,38	77,4	548
9,00	23,53	77,9	570
9,49	23,66	78,3	591
9,99	23,79	78,8	612
11,00	24,01	79,5	653
12,00	24,20	80,1	692
12,99	24,37	80,7	729
14,00	24,52	81,2	767
14,99	24,65	81,6	802
15,99	24,77	82,0	838
17,00	24,88	82,4	872
17,99	24,98	82,7	906
19,00	25,07	83,0	939
20,00	25,15	83,3	972
20,99	25,23	83,5	1004
22,00	25,30	83,8	1036
23,00	25,36	84,0	1067
23,99	25,42	84,2	1098
25,00	25,48	84,4	1128
26,00	25,53	84,5	1159
26,99	25,58	84,7	1188
28,00	25,63	84,9	1218
29,00	25,67	85,0	1247
29,99	25,72	85,1	1276
31,00	25,75	85,3	1305
32,00	25,79	85,4	1333
32,99	25,83	85,5	1361
34,00	25,86	85,6	1389
34,99	25,89	85,7	1417
35,99	25,92	85,8	1445
37,00	25,95	85,9	1472
37,99	25,98	86,0	1499
39,00	26,00	86,1	1526
40,00	26,03	86,2	1553
40,99	26,05	86,3	1580
42,00	26,08	86,3	1606
43,00	26,10	86,4	1633
43,99	26,12	86,5	1659
45,00	26,14	86,6	1685
46,00	26,16	86,6	1711
46,99	26,18	86,7	1737

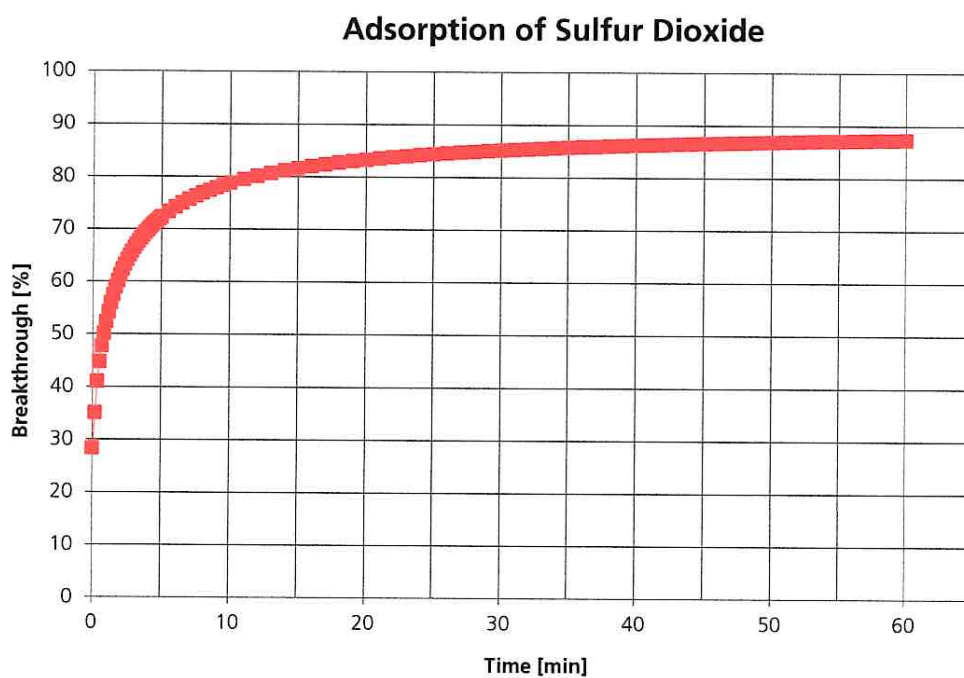
Attachment 4 to Test Report DAG 150401

Summary of Test Results for Sample

4

fiatec-No.: DAG 150401-K4

48,00	26,20	86,7	1763
49,00	26,22	86,8	1789
49,99	26,23	86,9	1814
51,00	26,25	86,9	1839
52,01	26,27	87,0	1865
52,99	26,28	87,0	1890
54,00	26,30	87,1	1915
54,99	26,31	87,1	1940
55,99	26,32	87,2	1965
57,00	26,34	87,2	1990
57,99	26,35	87,2	2014
59,00	26,36	87,3	2039
60,00	26,38	87,3	2064



Date of Test:
 Mass of New Filter:
 Mass after Conditioning:
 Flow Rate:
 Pressure Drop:

30.04.2015
 198,9 g
 197,9 g
 3 kg/min
 45 Pa

Adsorption of 30 ppm Nitrogen Dioxide

Specified Raw Gas Concentration:
 Average Value of the Raw Gas Concentration at the Beginning (A):
 Average Value of the Raw Gas Concentration at the End (B):
 Ratio A/B:
 Temperature:
 Relative Humidity:
 Initial Breakthrough NO_x:
 Test Duration:
 Capacity NO_x:

30 ppm ± 1,5 ppm
 30,09 ± 0,06 ppm
 30,13 ± 0,08 ppm
 0,999
 23°C ± 1°C
 50% ± 3%
 22,4%
 60 Minutes
 3244 mg

time [min]	NO _x concentration [ppm]	NO _x breakthrough [%]	NO _x capacity [mg]	NO ₂ concentration [ppm]	NO ₂ breakthrough [%]	NO ₂ capacity [mg]	NO concentration [ppm]	NO mass after filter [mg]
0,00	6,73	22,4	0	6,20	20,7	0	0,53	0
0,15	7,19	23,9	16	6,61	22,1	16	0,58	0
0,32	7,60	25,2	34	6,96	23,3	34	0,64	1
0,49	7,94	26,4	51	7,24	24,2	52	0,70	1
0,65	8,22	27,3	68	7,45	24,9	69	0,77	1
0,82	8,45	28,1	85	7,63	25,5	86	0,82	2
0,99	8,66	28,8	101	7,77	26,0	104	0,88	2

Attachment 5 to Test Report DAG 150401

Summary of Test Results for Sample
5

fiatec-No.: DAG 150401-K5

1,16	8,86	29,4	118	7,92	26,5	121	0,94	3
1,32	9,01	29,9	134	8,02	26,8	138	0,99	3
1,49	9,16	30,4	150	8,12	27,1	154	1,04	4
1,66	9,31	30,9	166	8,21	27,4	171	1,08	4
1,83	9,45	31,4	182	8,30	27,7	188	1,14	5
2,00	9,59	31,9	198	8,39	28,0	205	1,20	5
2,16	9,73	32,3	214	8,48	28,3	221	1,26	6
2,33	9,87	32,8	230	8,56	28,6	238	1,31	6
2,50	10,00	33,2	245	8,64	28,9	254	1,37	7
2,67	10,14	33,7	261	8,73	29,1	271	1,43	8
2,83	10,27	34,1	276	8,80	29,4	287	1,48	9
2,98	10,38	34,5	290	8,87	29,6	302	1,53	9
3,15	10,51	34,9	305	8,95	29,9	318	1,58	10
3,32	10,64	35,3	320	9,02	30,1	334	1,63	11
3,49	10,76	35,7	335	9,09	30,4	350	1,68	12
3,65	10,88	36,1	350	9,17	30,6	366	1,73	12
3,82	11,00	36,5	365	9,24	30,9	382	1,78	13
3,99	11,12	36,9	379	9,31	31,1	398	1,83	14
4,16	11,24	37,3	394	9,37	31,3	414	1,88	15
4,32	11,35	37,7	408	9,44	31,5	430	1,93	16
4,49	11,46	38,1	423	9,51	31,8	446	1,98	17
4,66	11,58	38,4	437	9,57	32,0	461	2,02	18
4,83	11,69	38,8	451	9,64	32,2	477	2,07	19
5,00	11,80	39,2	466	9,70	32,4	493	2,11	20
5,50	12,11	40,2	508	9,88	33,0	539	2,24	23
5,98	12,41	41,2	548	10,06	33,6	584	2,36	26
6,49	12,70	42,2	588	10,23	34,2	630	2,48	30
6,99	12,98	43,1	628	10,40	34,7	675	2,59	34
7,49	13,25	44,0	667	10,56	35,3	720	2,70	38
8,00	13,51	44,9	706	10,71	35,8	765	2,80	42
8,50	13,77	45,7	744	10,87	36,3	809	2,90	46
8,98	14,00	46,5	780	11,01	36,8	852	2,99	51
9,49	14,23	47,3	818	11,15	37,3	895	3,08	55

Attachment 5 to Test Report DAG 150401

Summary of Test Results for Sample
5

fiatec-No.: DAG 150401-K5

9,99	14,46	48,0	854	11,29	37,7	939	3,16	60
11,00	14,89	49,5	925	11,56	38,6	1024	3,32	70
11,99	15,29	50,8	994	11,82	39,5	1107	3,46	80
12,99	15,66	52,0	1062	12,06	40,3	1191	3,59	91
14,00	16,01	53,2	1128	12,30	41,1	1273	3,71	102
14,99	16,34	54,3	1191	12,52	41,8	1353	3,81	114
15,99	16,65	55,3	1254	12,74	42,6	1433	3,91	126
17,00	16,95	56,3	1316	12,95	43,3	1512	3,99	138
17,99	17,22	57,2	1375	13,15	43,9	1589	4,07	150
18,99	17,49	58,1	1434	13,35	44,6	1666	4,14	163
20,00	17,74	58,9	1492	13,53	45,2	1742	4,20	175
20,99	17,97	59,7	1547	13,71	45,8	1816	4,25	188
21,99	18,19	60,4	1603	13,89	46,4	1891	4,30	201
22,98	18,40	61,1	1657	14,06	47,0	1964	4,35	214
23,99	18,61	61,8	1711	14,23	47,5	2037	4,38	227
25,00	18,80	62,4	1763	14,39	48,1	2109	4,42	240
25,98	18,98	63,0	1814	14,54	48,6	2180	4,44	253
26,99	19,16	63,6	1866	14,69	49,1	2251	4,47	267
28,00	19,33	64,2	1916	14,84	49,6	2321	4,49	280
28,98	19,48	64,7	1964	14,98	50,0	2389	4,51	293
29,99	19,64	65,2	2013	15,12	50,5	2458	4,52	307
31,00	19,78	65,7	2061	15,26	51,0	2526	4,53	320
31,99	19,92	66,2	2108	15,39	51,4	2593	4,54	334
32,99	20,06	66,6	2155	15,52	51,8	2660	4,54	347
34,00	20,19	67,0	2201	15,64	52,2	2726	4,55	361
34,99	20,31	67,5	2246	15,76	52,7	2791	4,55	375
35,99	20,43	67,8	2291	15,88	53,1	2857	4,55	388
37,00	20,54	68,2	2336	16,00	53,4	2921	4,54	402
37,99	20,65	68,6	2379	16,11	53,8	2984	4,54	415
39,00	20,76	68,9	2423	16,22	54,2	3048	4,53	429
39,98	20,86	69,3	2465	16,33	54,5	3110	4,53	442
40,99	20,95	69,6	2507	16,43	54,9	3173	4,52	454
42,00	21,05	69,9	2550	16,54	55,2	3235	4,51	460

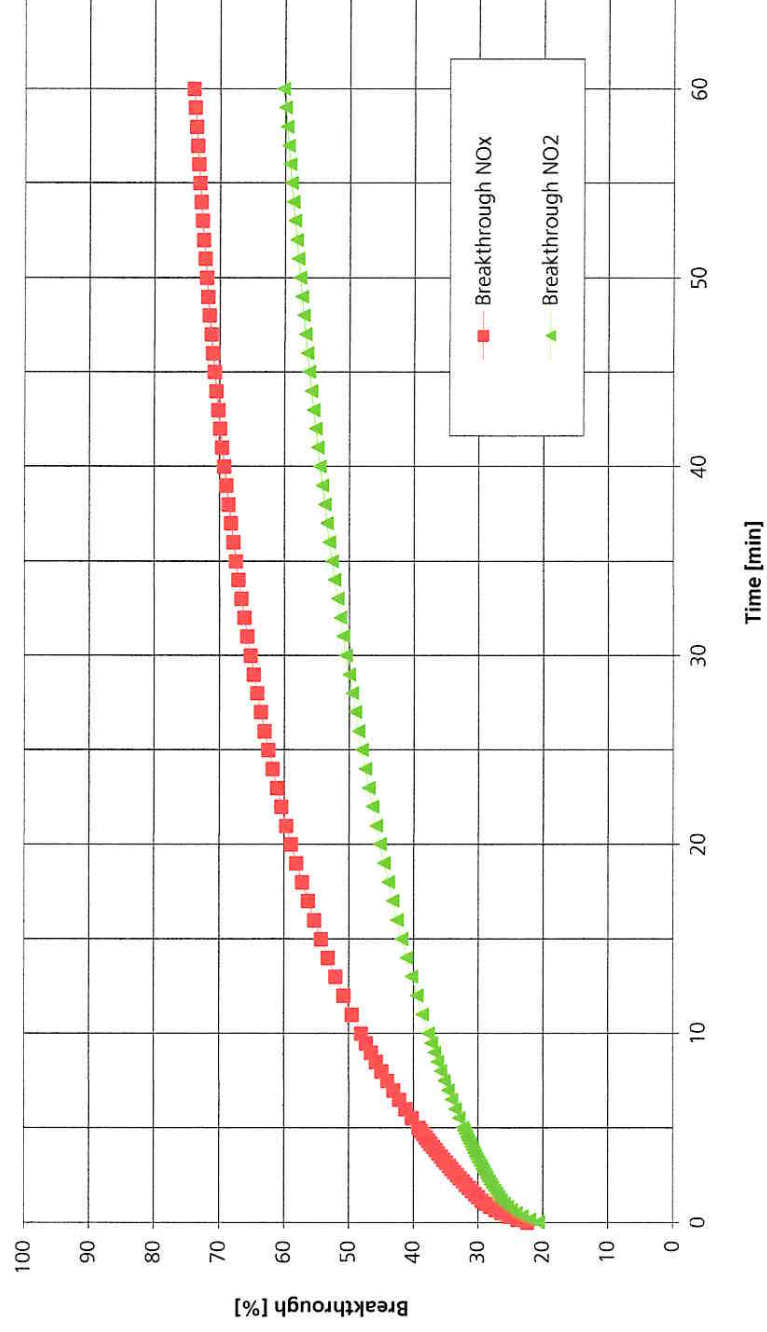
Attachment 5 to Test Report DAG 150401

Summary of Test Results for Sample
5

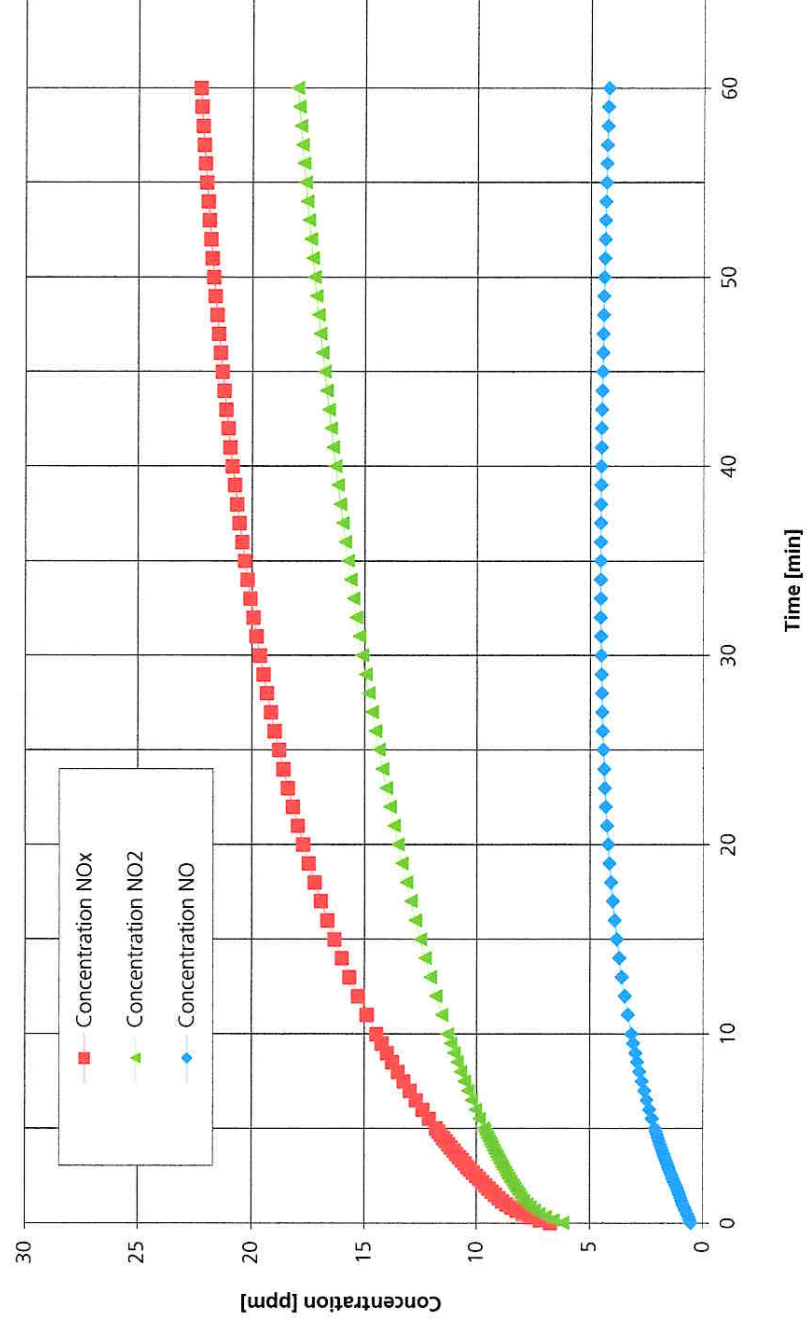
fiatec-No.: DAG 150401-K5

42,98	21,14	70,2	2591	16,64	55,6	3296	4,50	462
43,99	21,22	70,5	2632	16,73	55,9	3358	4,49	462
45,00	21,31	70,8	2673	16,83	56,2	3418	4,47	463
45,98	21,39	71,0	2713	16,92	56,5	3478	4,46	463
46,99	21,47	71,3	2753	17,02	56,8	3538	4,45	463
48,00	21,54	71,6	2793	17,11	57,1	3597	4,43	464
48,99	21,62	71,8	2832	17,19	57,4	3656	4,42	464
49,99	21,69	72,0	2871	17,28	57,7	3714	4,40	464
51,00	21,75	72,3	2910	17,36	58,0	3773	4,38	468
51,99	21,82	72,5	2947	17,44	58,3	3830	4,37	478
53,00	21,88	72,7	2986	17,53	58,5	3888	4,35	491
53,98	21,94	72,9	3023	17,60	58,8	3944	4,33	504
54,99	22,00	73,1	3061	17,68	59,1	4001	4,31	517
56,00	22,06	73,3	3098	17,76	59,3	4057	4,29	530
56,98	22,12	73,5	3134	17,83	59,6	4113	4,28	542
57,99	22,17	73,6	3171	17,90	59,8	4169	4,26	555
59,00	22,22	73,8	3208	17,97	60,0	4224	4,24	568
59,98	22,27	74,0	3244	18,04	60,3	4278	4,22	581
time [min]	NO _x concentration [ppm]	NO _x breakthrough [%]	NO _x capacity [mg]	NO ₂ concentration [ppm]	NO ₂ breakthrough [%]	NO ₂ capacity [mg]	NO concentration [ppm]	NO mass after filter [mg]

Adsorption of Nitrogen Dioxide Breakthrough



Adsorption of Nitrogen Dioxide Concentration



Attachment 6 to Test Report DAG 150401

Summary of Test Results for Sample

6

fiatec-No.: DAG 150401-K6

Adsorption of 10 ppm Formaldehyde

Specified Raw Gas Concentration:	10 ppm \pm 0.5 ppm
Average Value of the Raw Gas Concentration	9,99 ppm \pm 0,22 ppm
Date of Test:	06.05.2015
Mass of New Filter:	207,8 g
Mass after Conditioning:	205,9 g
Flow Rate:	3 kg/min
Pressure Drop:	50 Pa
Temperature:	23°C \pm 1°C
Relative Humidity:	50% \pm 3%
Initial breakthrough:	39,6%
Test Duration:	60 Minutes
Capacity:	392 mg

time [min]	downstream concentration [ppm]	breakthrough [%]	mass adsorbed [mg]
0,00	3,95	39,6	0,0
0,33	4,25	42,6	5,9
0,68	4,57	45,7	11,8
1,02	4,82	48,2	17,1
1,37	5,05	50,5	22,4
1,70	5,24	52,4	27,2
2,05	5,42	54,2	32,1
2,38	5,57	55,7	36,6
2,73	5,71	57,1	41,2
3,07	5,83	58,3	45,5
3,42	5,94	59,4	49,8
3,75	6,04	60,4	53,8
4,10	6,14	61,4	57,9
4,43	6,22	62,2	61,7
4,78	6,30	63,1	65,6
5,13	6,38	63,8	69,5
5,47	6,44	64,5	73,1
5,82	6,51	65,1	76,7
6,17	6,57	65,8	80,4
6,50	6,63	66,3	83,8
6,83	6,68	66,8	87,1
7,18	6,73	67,3	90,6
7,52	6,78	67,8	93,8
7,87	6,82	68,3	97,2
8,20	6,86	68,7	100,3
8,55	6,90	69,1	103,6
8,88	6,94	69,5	106,7
9,23	6,98	69,8	109,9
9,58	7,02	70,2	113,0
9,93	7,05	70,5	116,1
10,95	7,14	71,5	125,0
11,98	7,23	72,3	133,7

Attachment 6 to Test Report DAG 150401

Summary of Test Results for Sample

6

fiatec-No.: DAG 150401-K6

13,02	7,30	73,1	142,1
14,05	7,37	73,8	150,4
15,07	7,44	74,4	158,3
16,08	7,50	75,0	166,0
17,13	7,55	75,6	173,8
18,15	7,60	76,1	181,1
19,18	7,65	76,6	188,5
20,22	7,70	77,1	195,7
21,23	7,75	77,5	202,6
22,27	7,79	77,9	209,5
23,30	7,83	78,3	216,3
24,32	7,87	78,7	222,8
25,35	7,91	79,1	229,4
26,37	7,94	79,5	235,7
27,38	7,98	79,8	241,9
28,42	8,02	80,2	248,1
29,45	8,05	80,5	254,2
30,48	8,08	80,9	260,1
31,50	8,12	81,2	265,9
32,53	8,15	81,5	271,7
33,55	8,18	81,9	277,3
34,58	8,21	82,2	282,9
35,62	8,24	82,5	288,3
36,63	8,27	82,8	293,6
37,67	8,30	83,1	298,9
38,70	8,33	83,4	304,1
39,73	8,36	83,7	309,2
40,77	8,39	84,0	314,3
41,80	8,42	84,3	319,2
42,82	8,45	84,6	323,9
43,85	8,48	84,8	328,7
44,87	8,51	85,1	333,3
45,90	8,54	85,4	337,8
46,93	8,56	85,7	342,3
47,95	8,59	86,0	346,6
48,98	8,62	86,3	350,9
50,02	8,65	86,5	355,2
51,03	8,68	86,8	359,2
52,07	8,70	87,1	363,3
53,08	8,73	87,4	367,2
54,12	8,76	87,6	371,0
55,15	8,79	87,9	374,8
56,18	8,81	88,2	378,5
57,20	8,84	88,5	382,1
58,23	8,87	88,7	385,6
59,27	8,90	89,0	389,1
60,28	8,92	89,3	392,4
61,32	8,95	89,6	395,7
62,35	8,98	89,8	398,9
63,38	9,01	90,1	402,0
64,42	9,03	90,4	405,0

Attachment 6 to Test Report DAG 150401

Summary of Test Results for Sample

6

fiatec-No.: DAG 150401-K6

