TECHNICAL UNIVERSITY OF LIBEREC
Institute for Nanomaterials, Advanced Technologies and Innovation

Test protocol				
Test code	filter EN 143 149 14683			
Type of test:	Flat sheet sample according to EN 149, EN 143, EN 14683			
Customer	TOREX BOHEMIA,s.r.o.			
Laboratory:	Technical University of Liberec, CXI, INTEC			
Tester:	Michal Komárek, Jakub Hrůza			
Date of test:	3 July 2020	Signature:		

Test parameters	Value	Unit	
filter area:	100	cm^2	
face velocity:	15,50	cm/sec	
dust/aerosol:	DEHS	-	
discharge:	no	-	
downstream test duration	60	sec	
total volume flow:	95,00	l/min	
particle size range	0,12 – 3,5	µm	
number of test samples	3,00	-	
temperature	21	°C	
relative humidity	54	%	
atmospheric pressure	1010	mbar	

Test filter parameters		
Sample:	Description	
type: Torex 1A		
type: Torex 1A		
type: Torex 1A		
type: Torex 2A		
type: Torex 2A		
type: Torex 2A		
type: Torex 3A		
type: Torex 3A		
type: Torex 4A		
type: Torex 4A		
type: Torex 4A		

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Tested properties		
Δp0 95 (Pa)	Initial pressure drop fro flow 95 l/min	
Δp0 30 (Pa)	Initial pressure drop fro flow 30 l/min	
BFE (%)	Estimation of efficiency for particle size 3 µm according to EN 14683.	
E (0,6 µm)	Efficiency for particle size 0.6 µm - estimation of efficiency according to EN 143 or EN 149	

Test results						
Sample:	Δp_0 95 (Pa)	Δp_0 30 (Pa)	E (0,6 µm)	BFE (%)	Classification (EN 149)	
type: Torex 1A	**106,0**	**37,0**	**97,88**	**100,00**	**FFP2**	
type: Torex 1A	**114,0**	**39,0**	**97,49**	**100,00**	**FFP2**	
type: Torex 1A	**104,0**	**36,0**	**97,35**	**100,00**	**FFP2**	
type: Torex 2A	**147,0**	**48,0**	**99,70**	**100,00**	**FFFP3**	
type: Torex 2A	**147,0**	**47,0**	**99,10**	**100,00**	**FFP3**	
type: Torex 2A	**155,0**	**51,0**	**99,58**	**100,00**	**FFP3**	
type: Torex 3A	**82,0**	**28,0**	**96,18**	**100,00**	**FFP2**	
type: Torex 3A	**75,0**	**24,0**	**96,59**	**100,00**	**FFP2**	
type: Torex 3A	**81,0**	**28,0**	**96,41**	**100,00**	**FFP2**	
type: Torex 4A	**105,0**	**35,0**	**77,51**	**100,00**	**no**	
type: Torex 4A	**100,0**	**32,0**	**79,60**	**100,00**	**close to FFP1**	
type: Torex 4A	**105,0**	**34,0**	**75,46**	**100,00**	**no**	

Classification according to EN 149 standard (EN 143)

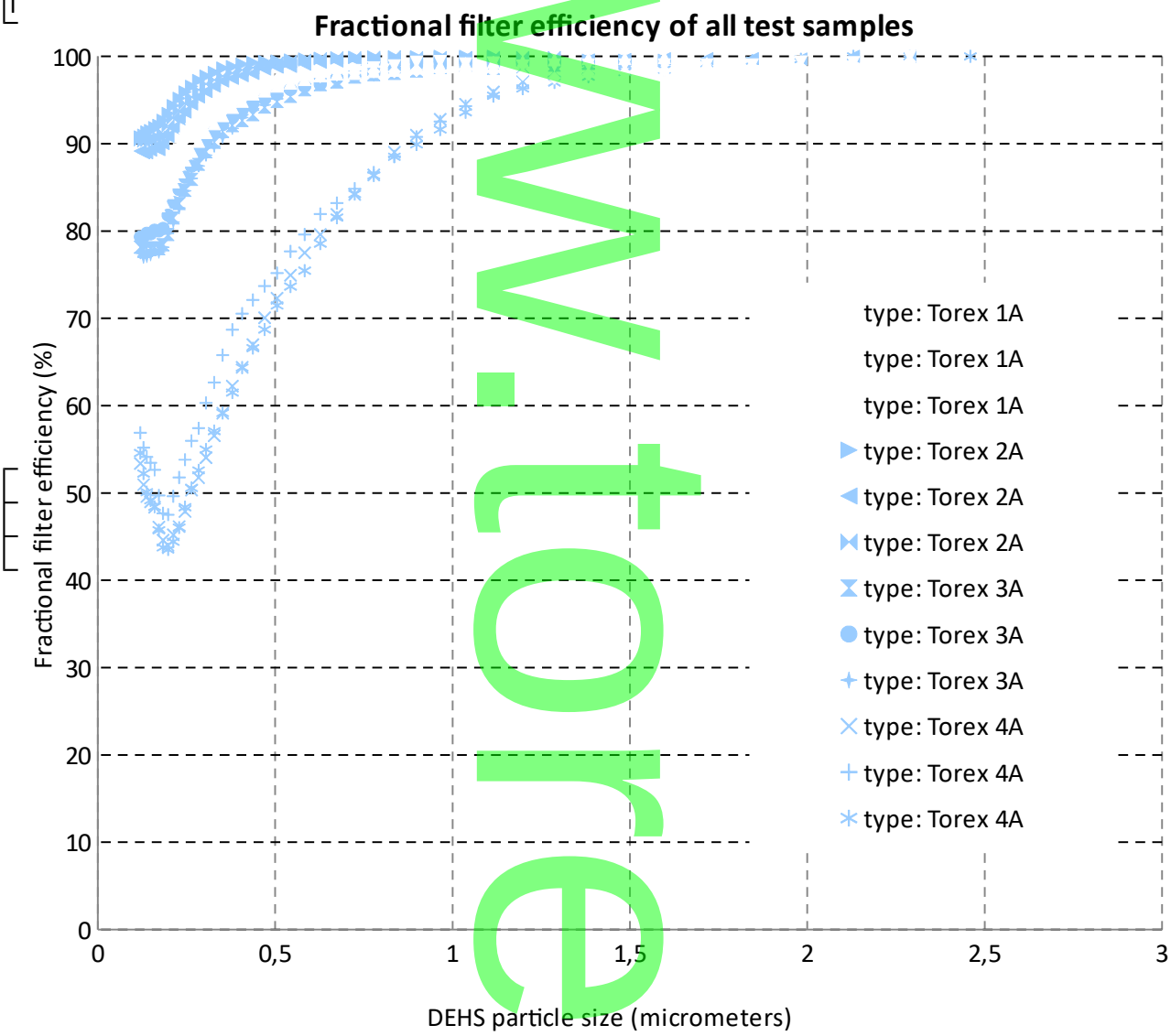
Maximum pressure drops (Pa)		
Class	flow 30 l/min	flow 95 l/min
FFP1	60	210
FFP2	70	240
FFP3	100 (120 for EN 143)	300 (420 for EN 143)

Minimum filter efficiency for particle with mean size 0,6 µm (%)		
Class	Sodium chloride particles	Parafin oil particles
FFP1	80	80
FFP2	94	94
FFP3	99	99

Zkrácená

Classification according to EN 14683 standard

Class	minimum efficiency of 3 µm droplets with bacteria	Maximum pressure drop for air velocity 5,3 cm/sec (Pa)	Special requirement	
Type I	95	29,4		
Type I R	95	49	Water repelency	
T				
T				



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sample	type: Torex 1A	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore
X [µm]	E [%]	E [%]	E [%]	E [%]	E [%]	E [%]	E [%]	E [%]
0,12	85,356837	85,90277	82,79485	90,77276	89,1456	90,43741	78,15	79,33
0,129	85,559975	85,42507	82,49842	90,96629	88,95371	90,31212	77,79	79,35
0,138	85,559467	85,44421	82,69163	91,33252	88,97029	90,37418	78,03	79,74
0,149	85,801642	85,64634	82,85695	91,51601	89,28353	90,46726	77,90	79,69
0,16	86,132372	86,14201	83,1811	91,86057	89,59658	90,68413	78,10	80,10
0,172	86,362756	85,85732	82,90493	92,11264	89,3311	90,71836	77,98	80,01
0,184	86,725523	86,38728	83,40022	92,68785	90,03241	91,15179	78,42	80,30
0,198	87,522345	87,17218	84,39661	93,46492	90,86692	92,03362	79,60	81,82
0,213	88,488529	88,23395	85,6476	94,37343	91,81011	92,97874	81,50	83,28
0,229	89,59759	89,32294	86,76631	95,21287	92,85796	93,78137	83,14	84,76
0,246	90,419374	90,56315	88,11371	95,93972	93,64236	94,6323	84,66	86,16
0,264	91,422988	91,63047	89,13098	96,56183	94,54682	95,3542	85,92	87,42
0,284	92,315148	92,56495	90,28964	97,25405	95,36917	96,17309	87,66	89,06
0,305	93,200768	93,27454	91,29672	97,74848	95,99362	96,84894	89,08	90,21
0,328	93,999913	94,19172	92,30074	98,17676	96,59782	97,28531	90,17	91,39
0,352	94,790268	94,87509	93,2111	98,65875	97,17594	97,74369	91,40	92,19
0,379	95,484099	95,31621	94,16664	98,82746	97,49755	98,1183	92,07	92,99
0,407	96,107071	95,78291	94,8588	99,1164	97,81174	98,45143	92,66	93,90
0,437	96,477766	96,17815	95,68965	99,29786	98,04527	98,69154	93,33	94,60
0,47	97,003455	96,41551	96,03488	99,42718	98,56277	98,98664	94,19	95,16
0,505	97,341425	96,86	96,58937	99,4885	98,76801	99,24318	94,83	95,67
0,543	97,685605	97,20289	96,93667	99,59623	98,85121	99,41109	95,40	96,21
0,583	97,875258	97,49452	97,35217	99,69991	99,10443	99,57756	96,18	96,59
0,627	97,978574	97,68714	97,77057	99,79883	99,33387	99,7224	96,76	96,82
0,674	98,250502	97,88888	97,98258	99,82295	99,47776	99,83086	97,08	97,51
0,724	98,134035	98,37743	98,03762	99,90445	99,63399	99,85519	97,64	97,74
0,778	98,23424	98,6916	98,27486	99,91508	99,68341	99,883	97,92	98,11
0,836	98,233553	98,92067	98,40062	99,92448	99,61817	99,95027	98,05	98,56
0,898	98,377674	99,32794	98,67505	99,96453	99,65025	99,82759	98,34	98,87
0,965	98,249925	99,42068	98,89765	100	99,75502	99,87732	98,71	98,91
1,037	98,277447	99,15951	99,16788	100	99,79656	99,87732	98,97	99,03
1,115	98,294022	99,25745	99,32593	100	99,54055	99,87732	98,64	99,01
1,198	97,935152	98,89426	99,39365	99,56599	99,54055	99,87732	98,77	99,27
1,287	97,525343	99,0268	99,61042	99,56599	99,54055	99,87732	99,01	99,30

1,383	97,936509	99,0268	99,75638	99,56599	99,59012	99,19	99,47
1,486	98,098228	99,0268	99,75638	99,56599	99,63635	99,41	99,47
1,597	98,339858	99,0268	99,85777	99,56599	99,74398	99,61	99,47
1,717	98,339858	99,0268	99,18002		99,74398	99,61	99,47
1,845	98,730865	99,0268			99,74398	99,61	99,65
1,982	98,713268	99,37927			99,71198	99,56	99,61
2,13	98,72876	99,29059			100	100,00	100,00
2,289	99,385286	100			100	100,00	100,00
2,46	100	100			100	100,00	100,00

min	85,36	85,43	82,50	90,77	88,95	90,31	77,79	79,33
mean	90,75	90,63	88,52	95,47	93,56	94,50	85,07	86,53

průměrné hodnoty

vzorek	type: Torex 1A	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore	type: Tore
dP test sta	106,00	114,00	104,00	147,00	147,00	155,00	82,00	75,00
dp test en	109,00	115,00	105,00	149,00	148,00	157,00	84,00	76,00
dp 30l/mi	35,33	38,00	34,67	49,00	49,00	51,67	27,33	25,00
E (MPPS)	85,356837	x50 = 0,11	82,49842	90,77276	88,95371	90,31212	77,79309	79,33051
E (120 nm	85,356837	85,90277	82,79485	90,77276	89,1456	90,43741	78,1473	79,33051
E (průměr	97,875258	97,49452	97,35217	99,69991	99,10443	99,57756	96,18279	96,58501

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type: Tore	type: Tore	type: Tore	type: Tore
E [%]	E [%]	E [%]	E [%]
77,51	53,38	56,91	54,58
77,00	50,96	55,18	52,23
77,07	49,59	54,15	50,09
77,28	48,98	53,46	49,17
77,86	48,37	52,65	48,43
77,58	46,09	49,72	45,73
78,15	44,60	47,68	43,75
79,73	43,99	47,52	43,53
81,02	45,20	49,63	44,41
82,65	46,15	51,79	46,04
84,59	47,89	53,81	48,38
86,04	50,33	55,97	50,58
87,45	51,76	57,42	52,59
88,68	54,06	60,32	54,99
89,73	56,57	62,65	57,09
90,75	59,13	65,79	59,17
91,77	62,23	68,70	61,51
92,99	64,38	70,54	64,36
93,82	66,99	72,11	66,59
94,44	70,06	73,69	68,72
95,14	72,31	75,17	71,47
95,96	74,94	77,67	73,65
96,41	77,51	79,60	75,46
96,98	79,59	81,94	78,56
97,56	81,90	83,21	81,54
97,68	84,19	84,84	84,23
97,85	86,42	86,70	86,37
98,12	89,03	88,55	88,50
98,40	90,98	90,77	89,92
98,61	92,80	92,55	91,63
98,73	94,51	94,31	93,60
98,72	95,92	95,45	95,50
98,99	97,13	96,33	96,33
99,13	98,18	97,69	97,01

Classification according to EN 779	Average arrestance of synthetic dust (%)	Average e µm D pa
G1	$A_m < 65$	
G2	$65 \leq A_m < 80$	
G3	$80 \leq A_m < 90$	
G4	$90 \leq A_m$	
M5		40
M6		60
F7		80
F8		90
F9		9

Classification according to EN 1822		Efficiency particles (%
E10		
E11		
E12		
H13		≥
H14		≥
U15		≥
U16		≥ 9
U17		≥ 9

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99,42	98,55	98,60	97,67
99,58	99,29	99,15	98,20
99,58	99,60	99,51	98,48
99,58	99,63	99,63	99,21
99,72	99,63	100,00	99,51
99,70	100,00	100,00	99,68
100,00	100,00	100,00	100,00
100,00	100,00	100,00	100,00
100,00	100,00	100,00	100,00
77,00	43,99	47,52	43,53
84,82	53,95	58,80	53,97

type: Tore	type: Tore	type: Tore	type: Torex 4A	
81,00	105,00	100,00	105,00	
83,00	107,00	102,00	107,00	
27,00	35,00	33,33	35,00	
76,99937	43,99369	47,51717	43,52675	
77,51069	53,37616	56,90739	54,57897	97,983955625
96,41258	77,5081	79,60445	75,46261	

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efficiency of 0,4 DEHS aerosol rticles (%)
$\leq E_m < 60$
$\leq E_m < 80$
$\leq E_m < 90$
$\leq E_m < 95$
$95 \leq E_m$

of MPPS DEHS %)
≥ 85
≥ 95
$\geq 99,5$
$\geq 99,95$
$\geq 99,995$
99,9995
99,99995
99,999995

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