Blue Heaven Technologies
2820 S. English Station Road - Louisville, KY 40299
Tel: (502) 357-0132 Fax (502) 267-8379

TEST NO. 21-433-2

ISO 16890:2016 Air Filter Test Result Summary

Sections 2, and 4

Counter Information

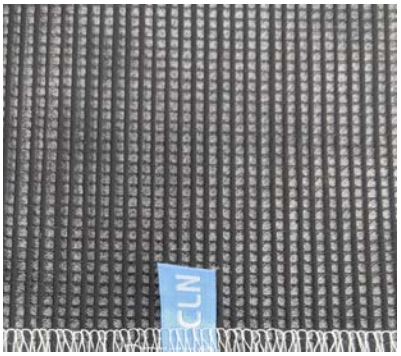
Manufacturer	TSI, Inc.
Model No.	3330
Serial Number:	3330115003
IPA Discharge Method	☑ Vapor Treated ☐ IPA Dip Method

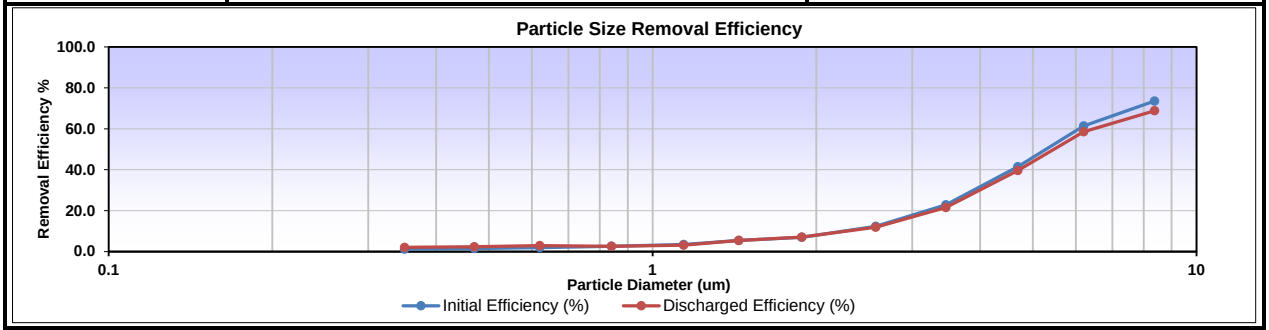
Test Conditions

Test Flow Rate (FPM)	14.3 FPM / 7.25 cm/s
Test Aerosol	Aerosolized KCl & DEHS
Temperature (Deg F)	76.0
Relative Humidity (%)	48.2
Barometer (in Hg)	29.45

Device Tested

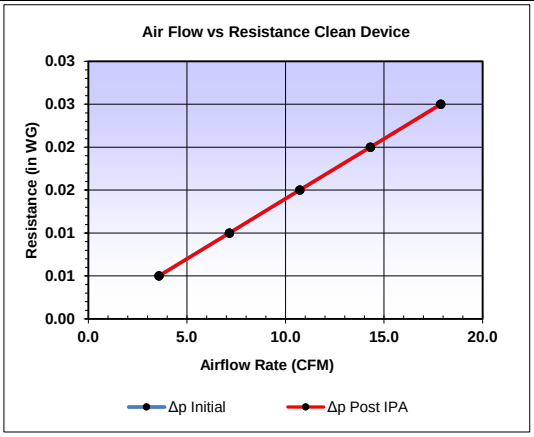
Manufacturer	Good Air Teams LLC
Model	Flat Sheet Media
Part Number	K9-Mask Clean Breathe
Dimensions	12.5" X 5.5"
Type of Media	PP Lattice/PP Spunbond/Carbon
Media Area	Tested : 0.145 ft^2
Construction	Flat Sheet Media
Filter/Media Electrostatic Charge	NA
Media Color	Grey / Black
Media Adhesive	NA
Sample Procurement	Good Air Teams LLC
Initial Filter Weight (g)	NA
Final Device Weight (g)	NA
Initial Pressure Drop ("w.c.)	0.02





DEHS Size .03 - 1.0 and KCL Size 1.0 - 10.0

Range (µm)	Geo. Mean	Initial Efficiency (%)	Discharged Efficiency (%)	Upstream Number of Particles per Test	
				Pre	Post
0.3-0.4	0.35	1	2	438479	680236
0.4-0.55	0.47	2	2	228927	371979
0.55-0.7	0.62	2	3	95805	164151
0.7-1.0	0.84	3	3	147861	260290
1.0-1.3	1.14	4	3	44083	79129
1.3-1.6	1.44	5	5	35137	63334
1.6-2.0	1.88	7	7	74816	135964
2.0-3.0	2.57	12	12	56370	100469
3.0-4.0	3.46	23	22	32665	55243
4.0-5.5	4.69	41	40	16043	26279
5.5-7.0	6.20	61	59	2900	4409
7.0-10.0	8.37	74	69	2293	3200



Reporting Data	ePM 1	ePM 2,5	ePM 10
Minimum	2%	4%	--
Average	2%	4%	30%
Reported	N/A*	N/A*	N/A*

* Any Reporting value of N/A shows the minimum efficiency is below 50% for that ePM

%	Airflow (CFM)	Δp Initial (in WG)	Δp Post IPA (in WG)
25	3.6	0.005	0.005
50	7.2	0.010	0.010
75	10.7	0.015	0.015
100	14.3	0.020	0.020
125	17.9	0.025	0.025

Test Operator Information — Test Performed By: G. Toloczko — Approved by: — Completion Date: 8/4/2021

ISO 16890-1

Data Entry Table

DEHS

d_i	d_{i+1}	d_m	$\Delta\ln d_i$	E_i	$E_{D,i}$	$E_{A,i}$
0.30	0.40	0.35	0.29	1.2%	2.1%	1.7%
0.40	0.55	0.47	0.32	1.5%	2.4%	2.0%
0.55	0.70	0.62	0.24	1.9%	2.9%	2.4%
0.70	1.00	0.84	0.36	2.6%	2.6%	2.6%

KCL

d_i	d_{i+1}	d_m	$\Delta\ln d_i$	E_i	$E_{D,i}$	$E_{A,i}$
1.00	1.30	1.14	0.26	3.5%	3.1%	3.3%
1.30	1.60	1.44	0.21	5.4%	5.4%	5.4%
1.60	2.20	1.88	0.32	7.0%	7.0%	7.0%
2.20	3.00	2.57	0.31	12.3%	11.9%	12.1%
3.00	4.00	3.46	0.29	22.8%	21.5%	22.2%
4.00	5.50	4.69	0.32	41.4%	39.6%	40.5%
5.50	7.00	6.20	0.24	61.4%	58.5%	60.0%
7.00	10.00	8.37	0.36	73.6%	68.8%	71.2%

Reporting Data

	ePM_1	$ePM_{2,5}$	ePM_{10}
Minimum	2%	4%	--
Average	2%	4%	30%
Reported	N/A*	N/A*	N/A*

* Any Reporting value of N/A shows the minimum efficiency is below 50% for that ePM value

ePM_1 Calculations

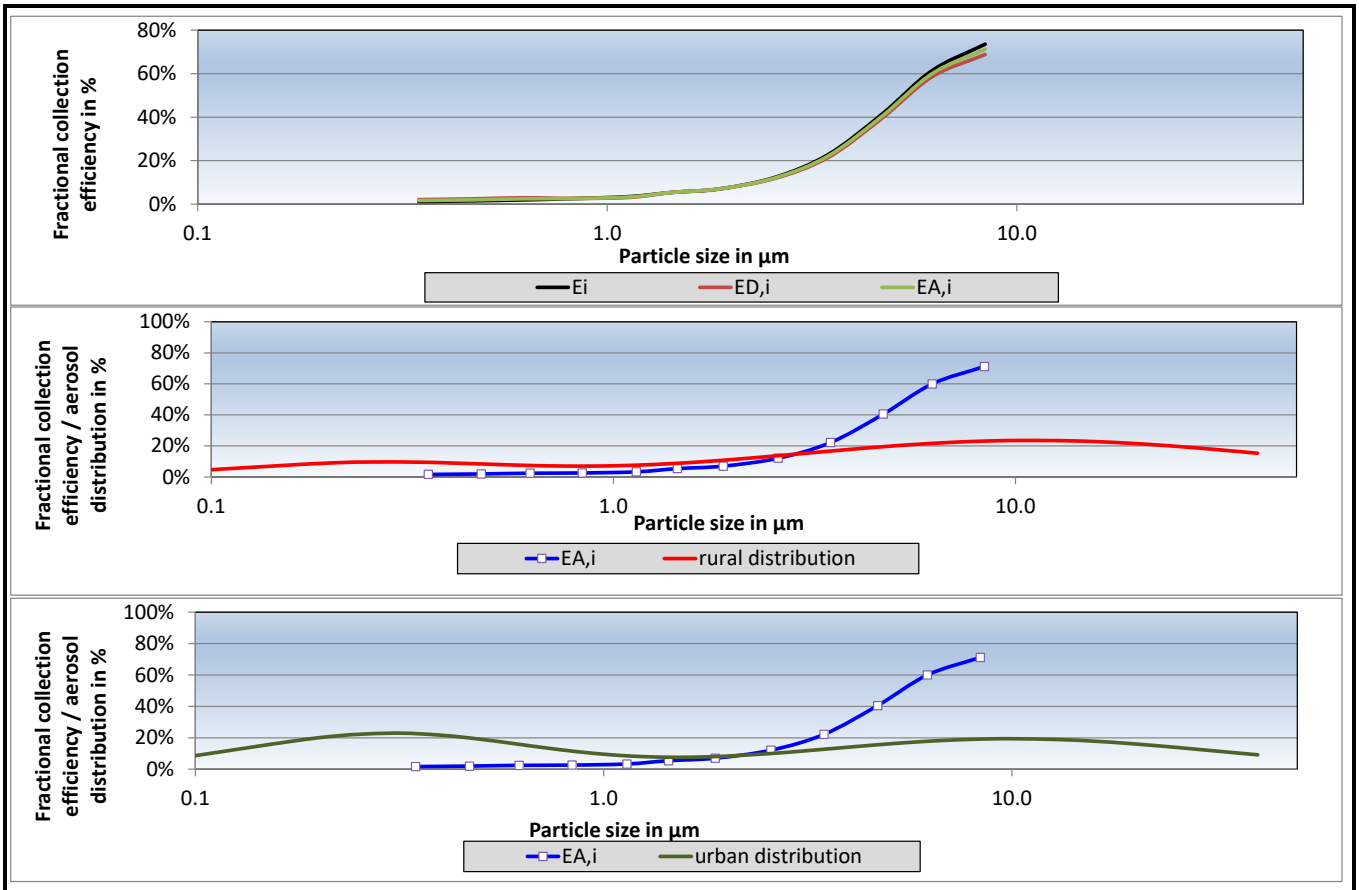
d_i	d_{i+1}	d_m	$\Delta\ln d_i$	$E_{A,i}$	q_{3u}	$q_{3u}*\Delta\ln d_i$	$E_{D,i}*q_{3u}*\Delta\ln d_i$	$E_{A,i}*q_{3u}*\Delta\ln d_i$	$E_{min}(PM_1)$	$E(PM_1)$
0.30	0.40	0.35	0.29	1.7%	22.627%	0.065095	0.001359	0.001077	2%	2%
0.40	0.55	0.47	0.32	2.0%	19.891%	0.063343	0.001532	0.001246		
0.55	0.70	0.62	0.24	2.4%	15.837%	0.038193	0.001122	0.000930		
0.70	1.00	0.84	0.36	2.6%	11.522%	0.041097	0.001082	0.001070		
						Sums:	0.207728	0.005095	0.004324	

$ePM_{2,5}$ Calculations

d_i	d_{i+1}	d_m	$\Delta\ln d_i$	$E_{A,i}$	q_{3u}	$q_{3u}*\Delta\ln d_i$	$E_{D,i}*q_{3u}*\Delta\ln d_i$	$E_{A,i}*q_{3u}*\Delta\ln d_i$	$E_{min}(PM_{2,5})$	$E(PM_{2,5})$
0.30	0.40	0.35	0.29	1.7%	22.627%	0.065095	0.001359	0.001077	4%	4%
0.40	0.55	0.47	0.32	2.0%	19.891%	0.063343	0.001532	0.001246		
0.55	0.70	0.62	0.24	2.4%	15.837%	0.038193	0.001122	0.000930		
0.70	1.00	0.84	0.36	2.6%	11.522%	0.041097	0.001082	0.001070		
1.00	1.30	1.14	0.26	3.3%	8.503%	0.022309	0.000695	0.000738		
1.30	1.60	1.44	0.21	5.4%	7.618%	0.015817	0.000856	0.000855		
1.60	2.20	1.88	0.32	7.0%	8.022%	0.025546	0.001797	0.001787		
2.20	3.00	2.57	0.31	12.1%	9.984%	0.030966	0.003672	0.003747		
						Sums:	0.302366	0.012114	0.011451	

ePM_{10} Calculations

d_i	d_{i+1}	d_m	$\Delta\ln d_i$	$E_{A,i}$	q_{3r}	$q_{3r}*\Delta\ln d_i$	$E_{D,i}*q_{3u}*\Delta\ln d_i$	$E_{A,i}*q_{3r}*\Delta\ln d_i$	$Emin(PM_{10})$	$E(PM_{10})$
0.30	0.40	0.35	0.29	1.7%	9.412%	0.027077	0.000565	0.000448	29%	30%
0.40	0.55	0.47	0.32	2.0%	8.395%	0.026733	0.000647	0.000526		
0.55	0.70	0.62	0.24	2.4%	7.432%	0.017924	0.000526	0.000437		
0.70	1.00	0.84	0.36	2.6%	7.014%	0.025016	0.000658	0.000651		
1.00	1.30	1.14	0.26	3.3%	7.628%	0.020013	0.000623	0.000662		
1.30	1.60	1.44	0.21	5.4%	8.833%	0.018340	0.000992	0.000991		
1.60	2.20	1.88	0.32	7.0%	10.804%	0.034406	0.002421	0.002407		
2.20	3.00	2.57	0.31	12.1%	13.726%	0.042573	0.005048	0.005151		
3.00	4.00	3.46	0.29	22.2%	16.708%	0.048067	0.010339	0.010657		
4.00	5.50	4.69	0.32	40.5%	19.542%	0.062233	0.024619	0.025208		
5.50	7.00	6.20	0.24	60.0%	21.671%	0.052261	0.030598	0.031337		
7.00	10.00	8.37	0.36	71.2%	23.143%	0.082545	0.056795	0.058759		
						Sums:	0.457189	0.133833	0.137235	



The interpretation of test reports

This brief review of the test procedures, including those for addressing the testing of electrostatic charged filters, is provided for those unfamiliar with the procedures of this series of ISO standards. It is intended to assist in understanding and interpreting the results in the test report/summary. (For further details of procedures the full ISO 16890 document series shall be consulted). Air filters may rely on the effects of passive static electric charges on the fibres to achieve high efficiencies, particularly in the initial stages of their working life. Environmental factors encountered in service may affect the action of these electric charges so that the initial efficiency may drop substantially after an initial period of service. This could be offset or countered by an increase in efficiency (“mechanical efficiency”) as dust deposits build up. The reported, untreated and conditioned (discharged) efficiency shows the extent of the electrical charge effect on initial performance and indicates the potential loss of particle removal efficiency when the charge effect is completely removed and when at the same time there is no compensating increase of the mechanical efficiency. These test results should not be assumed to represent the filter performance in all possible environmental conditions or to represent all possible “real life” behaviour. This brief review of the test procedures, including those for addressing the testing of electrostatic charged filters, is provided for those unfamiliar with the procedures of this series of ISO standards. It is intended to assist in understanding and interpreting the results in the test report/summary. (For further details of procedures the full ISO 16890 document series shall be consulted). Air filters may rely on the effects of passive static electric charges on the fibres to achieve high efficiencies, particularly in the initial stages of their working life. Environmental factors encountered in service may affect the action of these electric charges so that the initial efficiency may drop substantially after an initial period of service. This could be offset or countered by an increase in efficiency (“mechanical efficiency”) as dust deposits build up. The reported, untreated and conditioned (discharged) efficiency shows the extent of the electrical charge effect on initial performance and indicates the potential loss of particle removal efficiency when the charge effect is completely removed and when at the same time there is no compensating increase of the mechanical efficiency. These test results should not be assumed to represent the filter performance in all possible environmental conditions or to represent all possible “real life” behaviour.