



Clean Air Filter // *Quality Tested. Performance Proven.*

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

September 23, 2019

To all concerned about silica and toxic dust exposure:

Introducing myself as Michael P. Schmitz, President and head of Research and Development for Clean Air Filter, Defiance, Iowa. We have been in the cabin filtration industry for over 30 years developing filters, laboratory test procedures, field testing protocols for agriculture, mining, and industrial applications.

I have been laboratory and field testing filters and cabs for over 20 years, cross referencing both particulates and vapors. I have served on multiple standards committees, performed standards review testing, and in 1996 Cal EPA vapor cab testing.

In 1999, I was requested by NIOSH/CDC to assist in determining a methodology to reduce enclosed cab operators respirable dust exposure to silica. For this reason, I headed the development of the first Filtration Pressurization System (FPS) for Clean Air Filter.

The current measuring methodology used by OSHA is gravimetric (TWA), reference 29 CFR 1926.1153.

Clean Air Filter uses particle counting methodology in its cab and filter testing, using protocols similar to ASABE S613 (using 0.3 μ m), EN15695 (using 5.0 μ m, which does not measure leakage at the submicron or vapor range), and ASAE S525 (using 3.0 μ m, which was rescinded because testing at 3.0 μ m proved by NIOSH investigators to be insufficient.) CAF has adapted the methods to using 0.3 μ m, as it is in the range of the most penetrating particle size for the lung, with the majority of the particles below 0.5 μ m, raw data concentrations report 190711-1.

Enclosed you will find information showing how OSHA's:

- 1) Gravimetric testing is not showing large quantities of submicron particles.
- 2) Why cab leakage must be considered.

Sincerely,

Michael P. Schmitz
and Clean Air Filter Team

ENC: Gravimetric Testing Silicosis document, September 2019.

Test report numbers: 190711-1, 190711-2, 190711-3

Test raw data concentration report: 190711-1

MPS/kks

CC:

Clean Air Filter®



Clean Air Filter // Quality Tested. Performance Proven.

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

Gravimetric Testing for Silicosis document 2.0: September 23, 2019

Recently I, Michael P. Schmitz, tested a cab in an underground mine that is experiencing worker health issues from silica. The company was meeting all Governmental gravimetric standards of 0.1mg/m³. The American Conference of Governmental Industrial Hygienists (ACGIH) requires .05% mg/m³. The industrial hygienist for the company we tested has a target of .025 mg/m³.

1. Gravimetric methodology is not sensitive to the 0.3 micron particle size. Particle count testing shows the deficiencies in gravimetric testing methodology. As written in *Aerosol Technology, Properties, Behavior, and Measurement of Airborne Particles* by William C. Hinds: Department of Environmental Health Sciences, Harvard University School of Public Health, pg.221, "Historically this has been done for harmful mineral dusts by using microscopic particle counting. Hazard was assessed by number concentration (dust counting) instead of mass concentration because the former correlated with the prevalence and extent of respiratory disease observed in miners."

Enclosed please find field data test report #190711-3, a snapshot of particle counting at 3 different ranges.

Column 1: 0.30µm in the sub-micron range @ 27.2% efficient
Column 2: 0.50µm in the sub-micron range @ 60.38% efficient
Column 3: 5.0µm is in the gravimetric range @ 96.89% efficient, in alignment with the gravimetric testing used by the industrial ACGIH gravimetric standard, reference 29 CFR 1926.1153.

Note the low efficiencies at the submicron range which are not sensitive to gravimetric measurements. These are the majority of the particles that enter the deep lung.

Conclusion:

Gravimetric testing is NOT adequate for measuring silica particles in the sub-micron range. Workers preventative health care is at risk using gravimetric test methodology, the current OSHA standard.



Clean Air Filter // *Quality Tested. Performance Proven.*

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

2. Method for controlling exposure

Cab Leakage

OSHA is mandating filters that are > 95% at 0.3 μ m (29 CFR 1926.1153) in cabs, implying the operators are protected.

Test reports 190711-1 and 190711-2 show leakage from the HVAC.

Test percentage results increased 29.44% after disconnecting power to the HVAC, see attached.

They need to make it mandatory to test all cabs for leakage.

CAF recommends particle testing at 0.3 μ m.

Conclusion:

It cannot be assumed that a cab operator is protected by installing a filter with greater than 95% efficiency at 0.3 μ m. Cab integrity/leakage must be measured.



Clean Air Filter // Quality Tested. Performance Proven.

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

Engineering Control Filtration Efficiency Test Report: Without Operator



Test Number: 190711-1



CAF Rep:
Michael P Schmitz



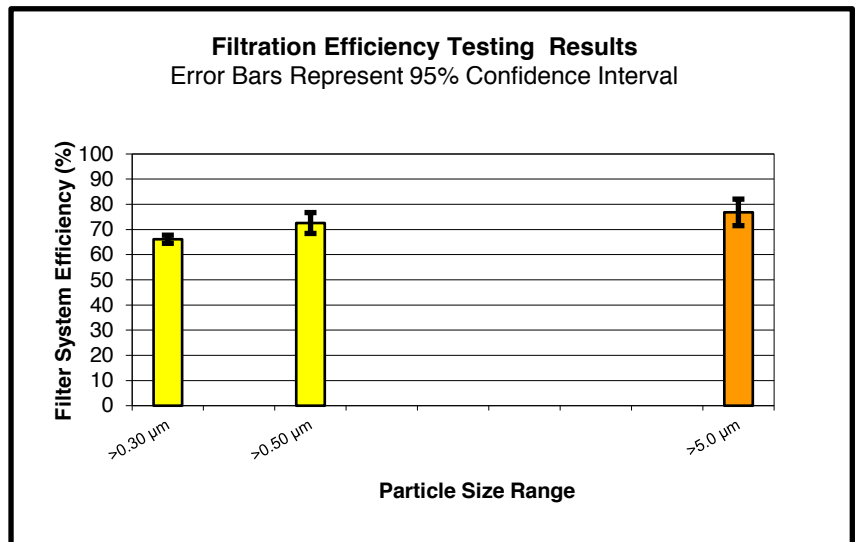
Additional Present:



TEST A - CUMULATIVE COUNT RESULTS (negative values removed)

Outside OPC# 624
Inside OPC Serial# 618
Inside Test: 15:32
Outside Test: 15:51

Particle Size Range	Mean Efficiency (%)	95% Confidence Interval	
		Minimum (%)	Maximum (%)
>0.30 μm	66.131	64.523	67.738
>0.50 μm	72.576	68.427	76.726
>5.0 μm	76.798	71.529	82.067



Not sensitive to gravimetric measurement methodologies

AC on Hi, HVAC leakage 29.44%

<5% coincidence at 0.3 μm

Comments: 30.1 deg C, 65% Rh, 0.036 cab pressure, 24 VDC, 62.8 CFM

AC on Hi, HVAC Leakage approximately 30% at 0.3 μm

CC:



Clean Air Filter // Quality Tested. Performance Proven.

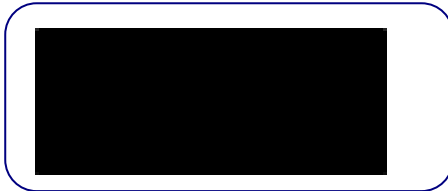
2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

Engineering Control Filtration Efficiency Test Report: Without Operator



11-Jul-2019

Test Number: 190711-2



CAF Rep:
Michael P Schmitz



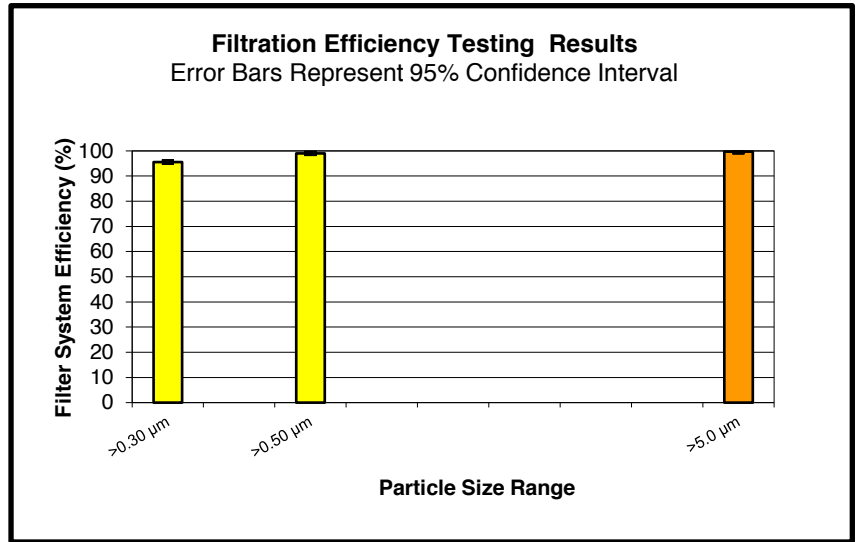
Additional Present:



TEST A - CUMULATIVE COUNT RESULTS (negative values removed)

Outside OPC# A
Inside OPC Serial# B
Inside Test: 16:40
Outside Test: 16:40

Particle Size Range	Mean Efficiency (%)	95% Confidence Interval	
		Minimum (%)	Maximum (%)
>0.30 μm	95.570	95.570	95.570
>0.50 μm	99.010	99.010	99.010
>5.0 μm	99.670	99.670	99.670



AC off

Not sensitive to gravimetric measurement methodologies

<5% coincidence at 0.3 μm

Comments: 32.1 deg C, 66.4% Rh, 0.036 cab pressure, 24 VDC, 57.76 CFM, Stabilizing

CC:



Clean Air Filter // Quality Tested. Performance Proven.

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

Engineering Control Filtration Efficiency Test Report: Without Operator

11-Jul-2019

Test Number: 190711-3



CAF Rep:
Michael P Schmitz



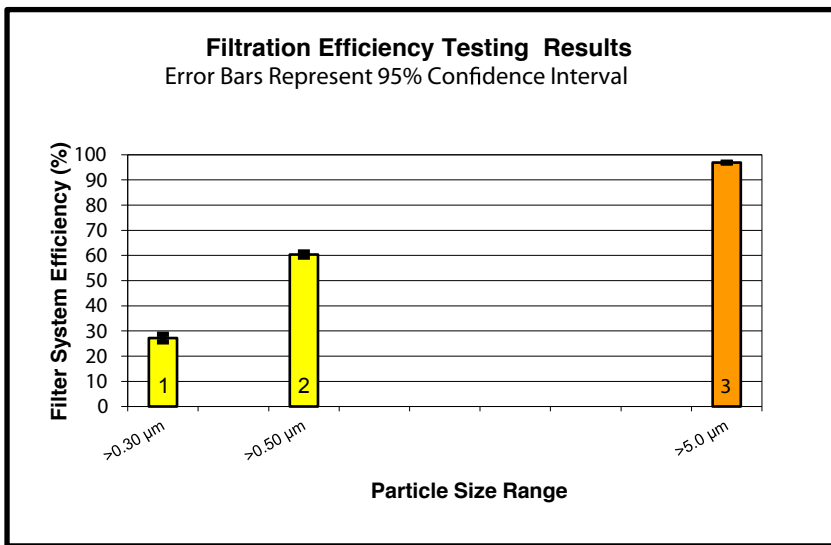
Additional Present:



TEST A - CUMULATIVE COUNT RESULTS (negative values removed)

Outside OPC Serial# A-250
Inside OPC Serial# A-250
Inside Test: 17:40-17:44
Outside Test: 17:47-17:51

Particle Size Range	Mean Efficiency (%)	95% Confidence Interval	
		Minimum (%)	Maximum (%)
>0.30 µm	27.200	25.687	28.712
>0.50 µm	60.378	59.365	61.391
>5.0 µm	96.892	96.717	97.067



Not sensitive to gravimetric measurement methodologies

Comments: **Unit "Snapshot" test**
As Is
NO CAF Filtration
Underground - maintenance area

not corrected for coincidence

CC:



Clean Air Filter // Quality Tested. Performance Proven.

2203 HWY 59 Po Box 212 Defiance, IA 51527
712 748 3642 cleanairfilter.com

CONCENTRATION REPORT

TEST NUMBER 190711-1

OPC Raw Data - Outside

Date&Time	Location	Sampling ti	Interval tim	Times	Particle Count (particles/2.38L)		
					0.3um	0.5um	5.0um
7/11/2019 15:32	1	1:00	1:00	10	755624	401121	14860
7/11/2019 15:33	1	1:00	1:00	11	718090	409619	19967
7/11/2019 15:34	1	1:00	1:00	12	699029	419795	24407
7/11/2019 15:35	1	1:00	1:00	13	674250	415398	28235
7/11/2019 15:36	1	1:00	1:00	14	668400	416398	28561
7/11/2019 15:37	1	1:00	1:00	15	681815	423542	26311
7/11/2019 15:38	1	1:00	1:00	16	709134	467315	25432
7/11/2019 15:39	1	1:00	1:00	17	725191	443399	18898
7/11/2019 15:40	1	1:00	1:00	18	745567	427695	15196
7/11/2019 15:41	1	1:00	1:00	19	753455	431278	13844
7/11/2019 15:42	1	1:00	1:00	20	750646	412473	13392
7/11/2019 15:43	1	1:00	1:00	21	753349	404196	13686
7/11/2019 15:44	1	1:00	1:00	22	770022	402090	13220
7/11/2019 15:45	1	1:00	1:00	23	781800	406648	12741
7/11/2019 15:46	1	1:00	1:00	24	799255	426707	12975
7/11/2019 15:47	1	1:00	1:00	25	775385	406030	13837
7/11/2019 15:48	1	1:00	1:00	26	730878	437595	21878
7/11/2019 15:49	1	1:00	1:00	27	722723	450949	24557
7/11/2019 15:50	1	1:00	1:00	28	707516	444565	26738
7/11/2019 15:51	1	1:00	1:00	29	695982	430850	28021

CC:

Clean Air Filter®