Camfil Farr
1 North Corporate Drive
Riverdale, NJ 07457
(973) 616-7300

ASHRAE® 52.2-2007(B) Test Results w/Appendix J Results

Filter Description

Manufacturer	Filter Model	Filter Part Number
Camfil Farr	**HF-ES M14/24/24/22/10**	**405619A22**

Filter Type	Media Type	Media Color	Media Area (ft^2)
Pocket Filter	**Fiberglass/Air Laid**	**Green**	**71**

Nominal Size	Actual Size						
HxWxD	Hgt (in)	Wid (in)	Dep (in)	Pleats/Pockets	UL Rating	LabFile	CrRef
24x24x22	**23 3/8**	**23 3/8**	**22**	**10**	**Class 2**	**1414**	**1414**

ASHRAE® 52.2-2007(B)

Date:	03/19/2010		
Test Number:	2010-0319-0723		
Test Data	**Test Results**	**Rated Values**	
AirFlow (cfm)	1970	1970	
Nominal Vel (fpm)	493	493	
Initial ΔP (inWG)	0.48	0.45	
MERV	14	14	@1970cfm
E_1 (0.3-1.0µm), (%)	82	≥ 75	
E_2 (1.0-3.0µm), (%)	99	≥ 90	
E_3 (3.0-10µm), (%)	100	≥ 90	
Final DP, (inWG)	1.5	1.5	
Arrestance, (%)	100	98	
DHC, (g)	321		

Temp, (F)	76	Test Aerosol	KCL
RH, (%)	38	Loading Dust	ASHRAE

Comments

ASHRAE® 52.2-2007(B) w/App J

Date:	01/13/2011		
Test Number:	2011-0113-0627		
Test Data	**Test Results**	**Rated Values**	
AirFlow (cfm)	1970	1970	
Nominal Vel (fpm)	493	493	
Initial ΔP (inWG)	0.44	0.45	
MERV-A	14A	14A	@1970cfm
E_1-A (0.3-1.0µm), (%)	76	< 75	
E_2-A (1.0-3.0µm), (%)	98	≥ 90	
E_3-A (3.0-10µm), (%)	100	≥ 90	
Final DP, (inWG)	1.5	1.5	
Arrestance-A, (%)	100	98	
DHC-A, (g)	286		

Temp, (F)	76	Test Aerosol	KCL
RH, (%)	33	Loading Dust	ASHRAE

Comments

Certified Test Per ASHRAE 52.2-2007 (B)		Operator	Particle Counter	Model
Approval:	*Don Thornburg* Electronic Signature, Original on file	**A. Acain**	**Climet**	**CI-500**
		Camfil Farr Permission Required for Distribution		

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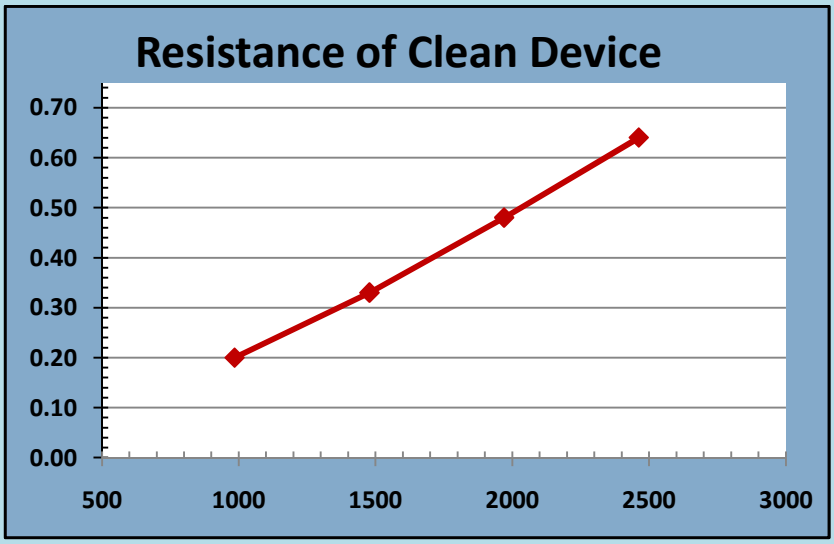
ASHRAE® 52.2-2007(B) Test Results

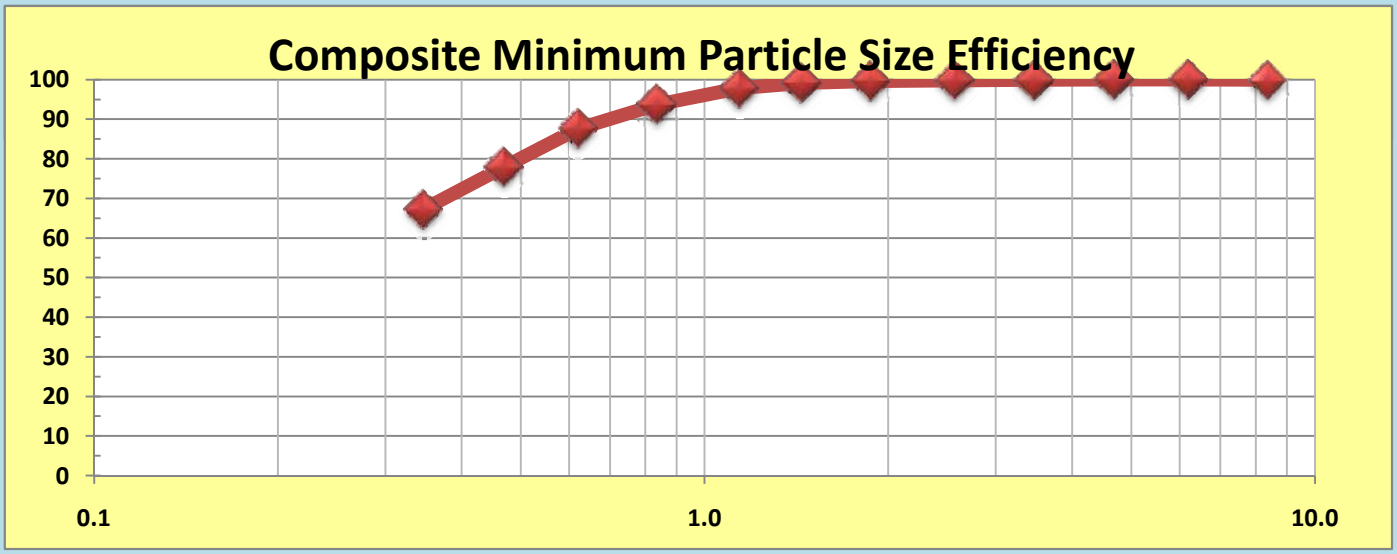
Date:	03/19/2010	Test Number:	2010-0319-0723

Manufacturer	Filter Model	Filter Part Number
Camfil Farr	**HF-ES M14/24/24/22/10**	**405619A22**

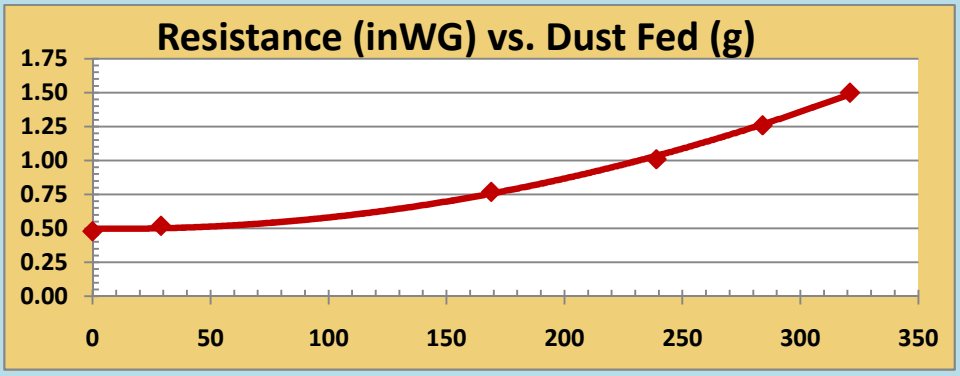
Clean Resistance Table

cfm	m^3/s	inWG	Pa
985	0.46	0.2	50
1478	0.70	0.33	82
1970	0.93	0.48	119
2462	1.16	0.64	159





ΔP (inWG)	Dust Fed (g)
0.48	**0**
0.52	**29**
0.77	**169**
1.01	**239**
1.26	**284**
1.50	**321**



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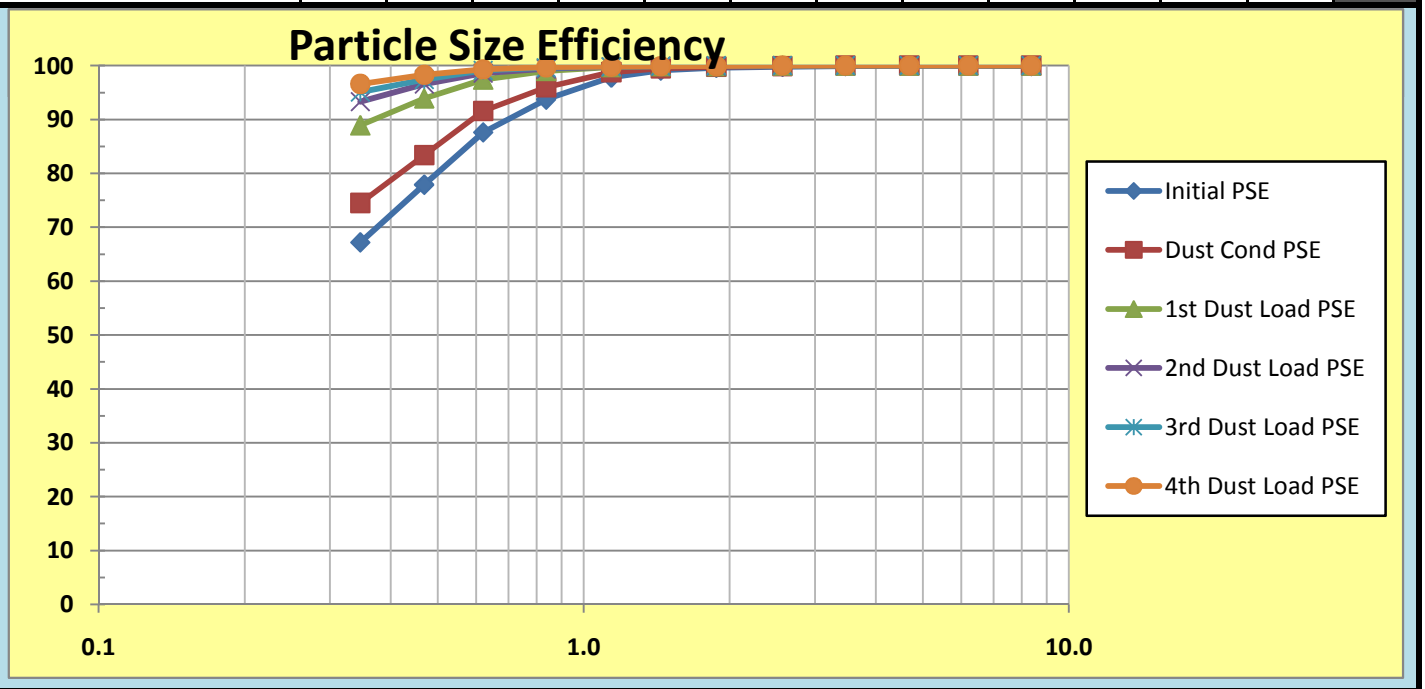
ASHRAE® 52.2-2007(B) Test Results

Date	03/19/2010	Test Number	2010-0319-0723
Manufacturer		Filter Model	Filter Part Number
Camfil Farr		HF-ES M14/24/24/22/10	405619A22

Efficiency Data Table	1	2	3	4	5	6	7	8	9	10	11	12	
Minimum Dia (µm)	0.3	0.4	0.55	0.7	1.0	1.3	1.6	2.2	3.0	4.0	5.5	7.0	0.35
Maximum Dia (µm)	0.4	0.55	0.7	1.0	1.3	1.6	2.2	3.0	4.0	5.5	7.0	10.0	0.45
Geometric Mean (µm)	**0.35**	**0.47**	**0.62**	**0.84**	**1.14**	**1.44**	**1.88**	**2.57**	**3.46**	**4.69**	**6.20**	**8.37**	**0.40**
Initial PSE	**67**	**78**	**88**	**94**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**72**
Dust Cond PSE	**75**	**83**	**92**	**96**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**78**
1st Dust Load PSE	**89**	**94**	**97**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**91**
2nd Dust Load PSE	**93**	**97**	**99**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**95**
3rd Dust Load PSE	**95**	**97**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**96**
4th Dust Load PSE	**97**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**97**
Composite Min PSE	**67**	**78**	**88**	**94**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**72**



All testing is performed in compliance with the latest revision of ASHRAE Standard 52.2 in a state-of-the-art laboratory facility located at Camfil Farr's U.S. corporate headquarters in Riverdale, NJ. Test Reports without DHC values show efficiency only and the associated MERV value is a estimated value based on the single efficiency data shown. For more information, contact your local Camfil Farr representative or distributor.

Camfil Farr
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Riverdale, NJ 07457
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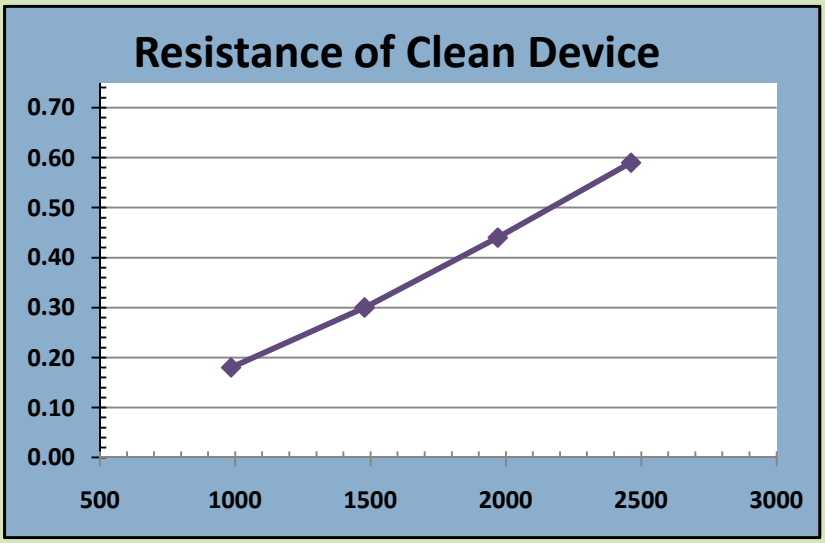
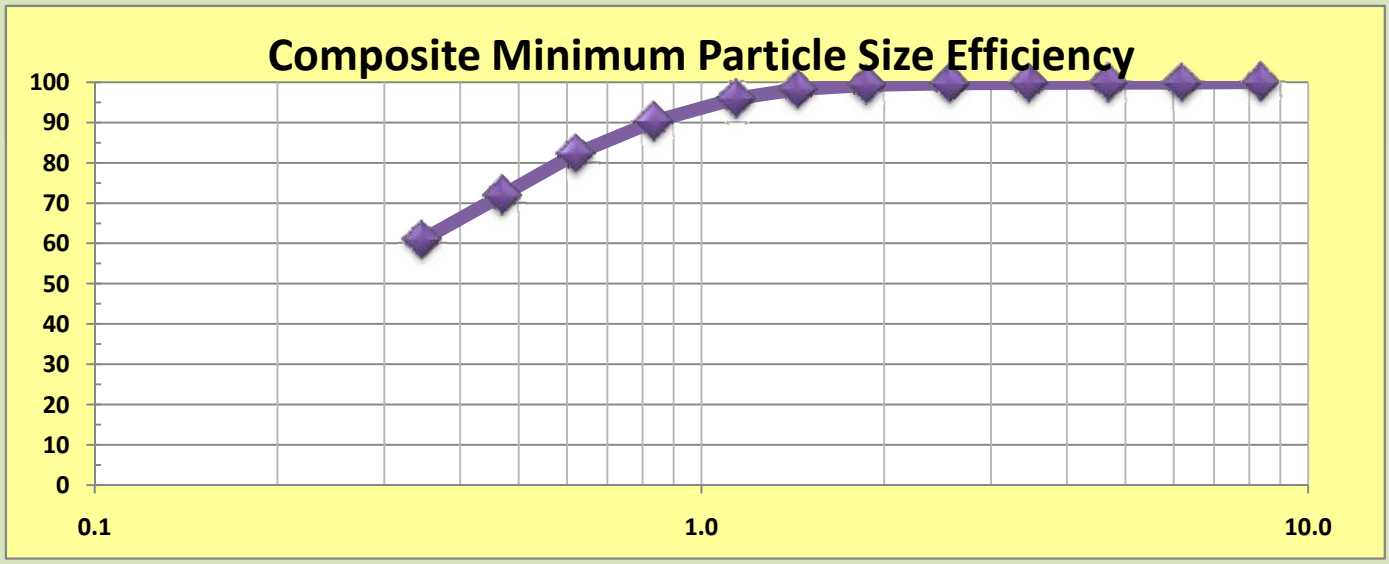
ASHRAE® 52.2-2007(B) Test Results w/ Appendix J Results

Date:	01/13/2011	Test Number:	2011-0113-0627

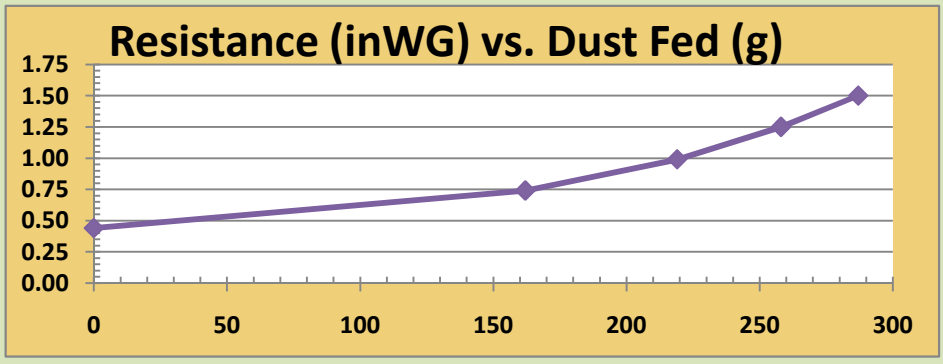
Manufacturer	Filter Model	Filter Part Number
Camfil Farr	**HF-ES M14/24/24/22/10**	**405619A22**

Clean Resistance Table			
cfm	m^3/s	inWG	Pa
985	0.46	0.18	45
1478	0.70	0.3	75
1970	0.93	0.44	109
2462	1.16	0.59	147





ΔP (inWG)	Dust Fed (g)
0.44	**0**
0.74	**162**
0.99	**219**
1.25	**258**
1.50	**287**



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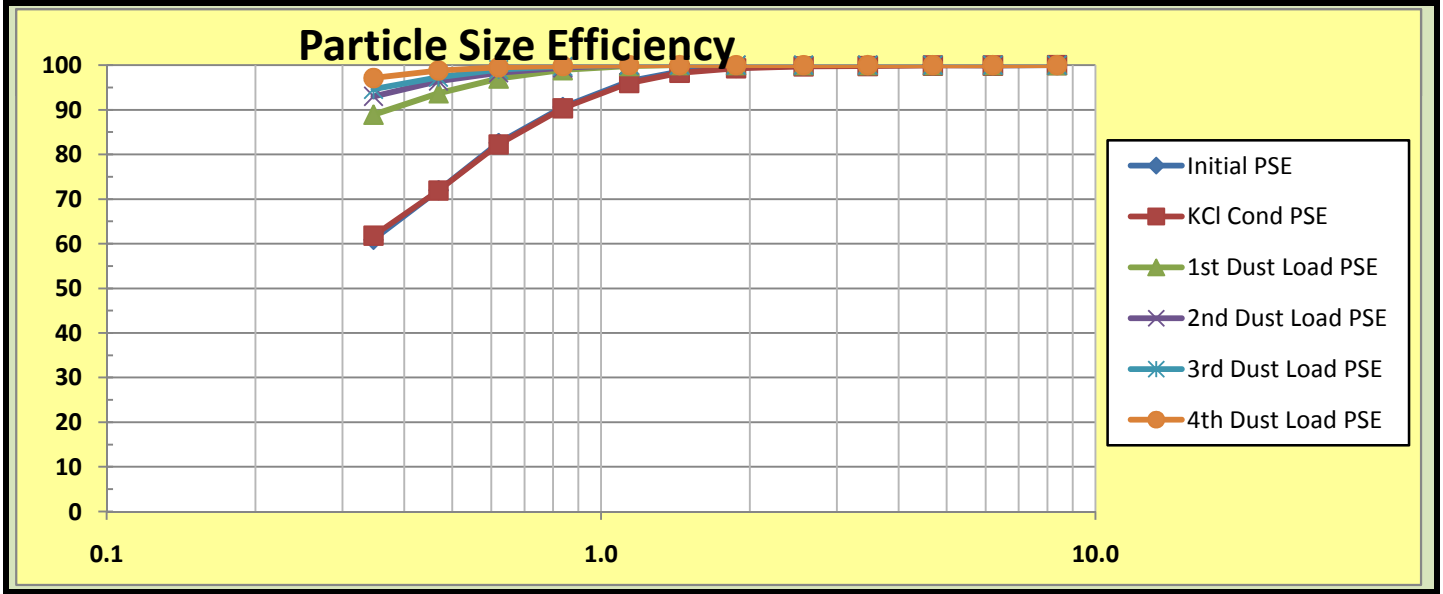
ASHRAE® 52.2-2007(B) Test Results w/ Appendix J Results

Date:	01/13/2011	Test Number:	2011-0113-0627

Manufacturer	Filter Model	Filter Part Number
Camfil Farr	**HF-ES M14/24/24/22/10**	**405619A22**

Efficiency Data Table	1	2	3	4	5	6	7	8	9	10	11	12	
Minimum Dia (µm)	0.3	0.4	0.55	0.7	1.0	1.3	1.6	2.2	3.0	4.0	5.5	7.0	0.35
Maximum Dia (µm)	0.4	0.55	0.7	1.0	1.3	1.6	2.2	3.0	4.0	5.5	7.0	10.0	0.45
Geometric Mean (µm)	**0.35**	**0.47**	**0.62**	**0.84**	**1.14**	**1.44**	**1.88**	**2.57**	**3.46**	**4.69**	**6.20**	**8.37**	**0.40**
Initial PSE	**61**	**72**	**83**	**91**	**96**	**99**	**99**	**100**	**100**	**100**	**100**	**100**	**67**
KCl Cond PSE	**62**	**72**	**82**	**90**	**96**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**67**
1st Dust Load PSE	**89**	**94**	**97**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**92**
2nd Dust Load PSE	**93**	**96**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**95**
3rd Dust Load PSE	**95**	**97**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**96**
4th Dust Load PSE	**97**	**99**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**98**
Composite Min PSE	**61**	**72**	**82**	**90**	**96**	**98**	**99**	**100**	**100**	**100**	**100**	**100**	**67**



Bkg Concentration (particles/cm^3)	Avg Cond Aerosol Conc (particles/cm^3)	Cumulative Cond Duration (minutes)	Cumulative Cond CT (particles-min/cm^3)
0.1	**4.89E+05**	**135**	**6.61E+07**

Large Particle Concentration (Particles ft^3)	Ratio Small to Large (>20,000)	Conditioning ΔP (inWG)		Same duct?
		Initial ΔP	Final ΔP	
44,445	**311,417**	**0.44**	**0.44**	**Yes**

Camfil USA
1 N. Corporate Dr.
Riverdale, NJ 07457

ISO 16890-1:2016 - Air Filter Test Results Summary

Test Information

Report ID	Report Date	Test Requested by	Supervisor
USA-1657-4503R	8-Jan-2020	Manufacturer	Don Thornburg

Device Tested

Manufacturer	Model	Part Number	How Test Sample Obtained & Date	
Camfil USA	Hi-Flo ES M14/24/24/22/10	405619-A22	Manufacturer Suplied	14-Aug-2017

Nom Size HxWxD (in)	Pleats/Pockets	Media Color	Media Charge	Media Adhesive
24x24x22	10	Green	None	None

Media Type	Media Area (ft^2)	Product Type	UL Rating
Fiberglass/Air Laid	71.5	Hi-Flo ES	UL 900

Test Results Summary

Resistance to Airflow

Airflow (cfm)	Measured Resistance (inWG)	*Met Published value*	Rated Initial Resistance (inWG)
2001	0.46		0.45

Arrestance:	Initial:	########	Average:	
Rated Final Resistance (inWG)			0	
Test Dust Capacity (TDC) (g)				

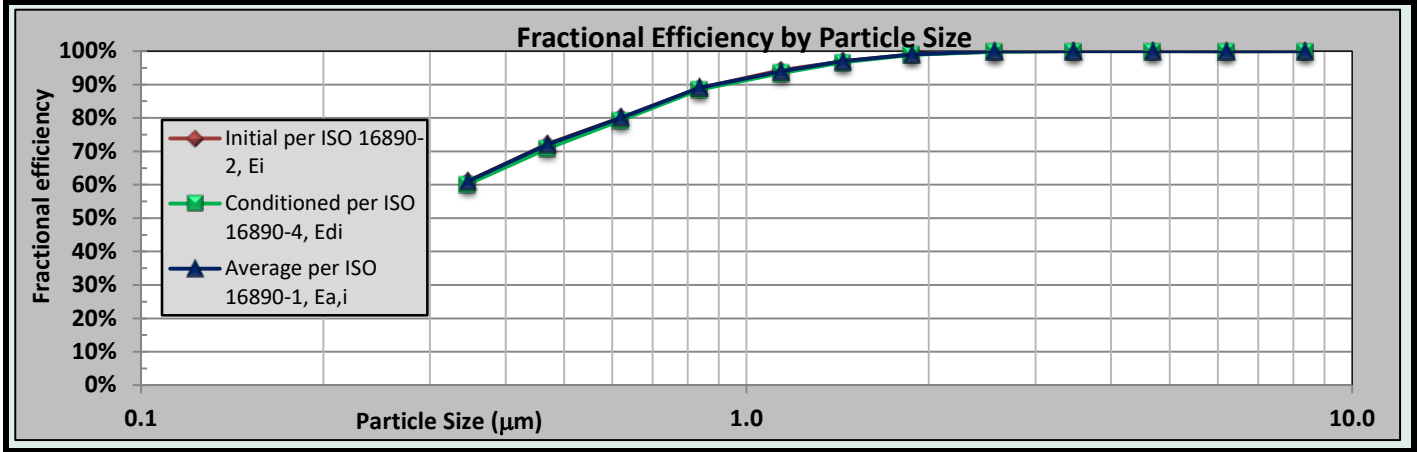
Fractional Efficiency and ISO Rating

Product Literature listed ISO 16890 Rating		ISO 16890 Rating
ISO 70%		ISO ePM1 70%

ePM 1	*ePM 1,min*	*ePM 2,5*	*ePM 2,5, min*	*ePM 10*
73%	73%	81%	80%	94%

Test Information and Included Reports

Test Type	Test ID	Test Date	Test Time	Test Operator
Initial per ISO 16890-2	USA-1657-4503	8-Jan-2020	11:14	A. Acain
Conditioned per ISO 16890-4	USA-1657-4506	9-Jan-2020	9:48	A. Acain
Dust Loaded per 16890-3	USA--	0-Jan-1900	0:00	0



Approvals

camfil	Certified Test Per ISO ISO 16890-1:2016 *Don Thornburg, R&D Manager* Electronic Signature, Original on file	Test Organization	Camfil USA 1 N. Corporate Dr. Riverdale, NJ 07457 (973) 616-7300

Note: *The results of this test relate only to the test device in the condition stated herein. The performance results cannot by themselves be quantitatively applied to predict filtration performance in all "real life" environments.*

Camfil USA
1 N. Corporate Dr.
Riverdale, NJ 07457

ISO 16890-1:2016 - Air Filter Test Results Details

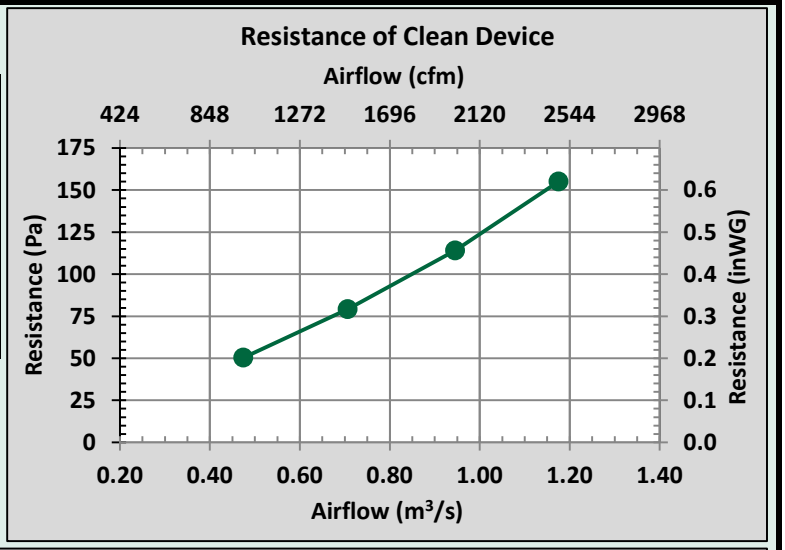
Test Information

Report ID	Report Date	Test Organization	Supervisor
USA-1657-4503R	8-Jan-2020	Camfil USA	Don Thornburg

Clean Resistance Table at 1.2kg/m³

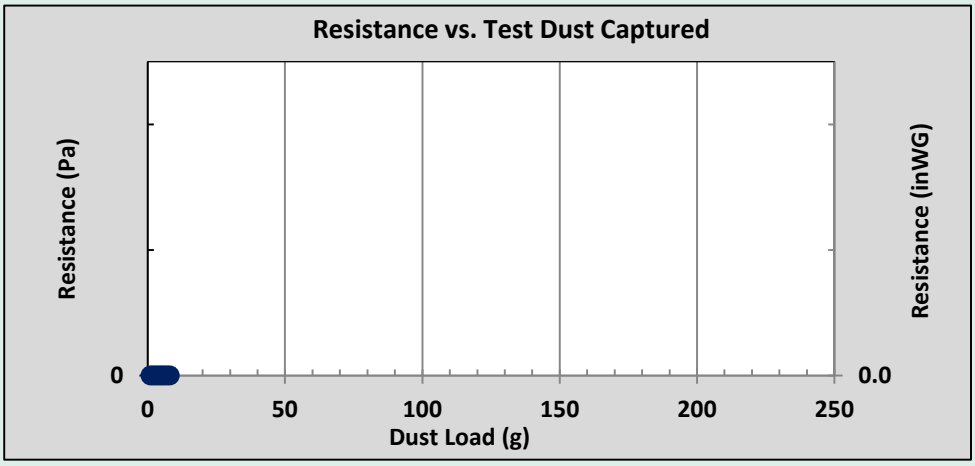
Test Airflow			Resistance	
% Rated	*m³/s*	*cfm*	*Pa*	*inWG*
50%	0.47	1000	50	0.19
75%	0.71	1500	79	0.30
100%	0.95	2000	114	0.45
125%	1.18	2500	155	0.58

For complete Test Result Details and data, please review the individual test reports for ISO 16890-2, 16890-3, and 16890-4.



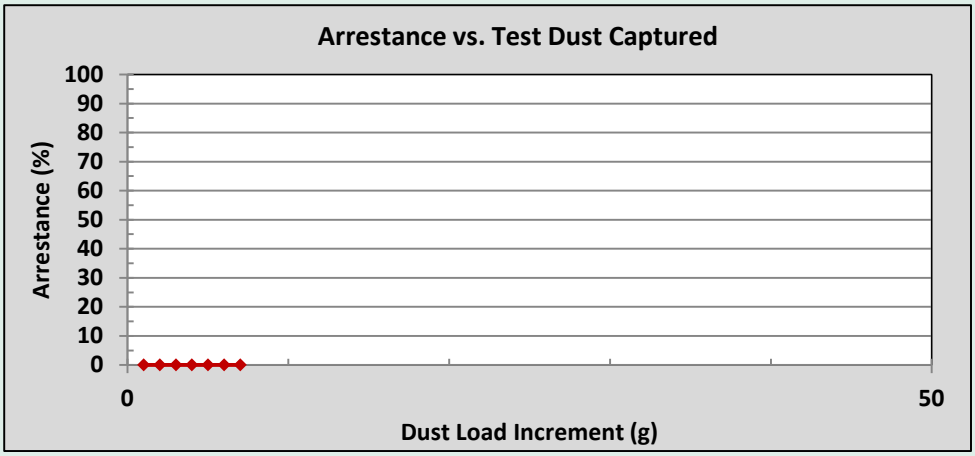
Dust Captured Table

Resistance to Airflow		Dust Load (g)
Pa	inWG	
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A
N/A	N/A	N/A



Arrestance Table

Arrestance (%)	Dust Load Increment (g)
#VALUE!	N/A
#VALUE!	N/A
#VALUE!	N/A
#VALUE!	N/A
#VALUE!	N/A
#VALUE!	N/A
#VALUE!	N/A



Note:	*The results of this test relate only to the test device in the condition stated herein. The performance results cannot by themselves be quantitatively applied to predict filtration performance in all "real life" environments.*

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ISO 16890-1:2016 - Results Calculations

Report ID	Report Date	Test Organization	Supervisor
USA-1657-4503R	**8-Jan-2020**	**Camfil USA**	**Don Thornburg**

Fractional Efficiency Values

i	d_i	d_{i+1}	d_m	$\Delta \ln d_i$	E_i	$E_{D,i}$	$E_{A,i}$
1	0.30	0.40	**0.35**	0.29	61%	60%	61%
2	0.40	0.55	**0.47**	0.32	72%	71%	72%
3	0.55	0.70	**0.62**	0.24	80%	79%	80%
4	0.70	1.00	**0.84**	0.36	89%	89%	89%
5	1.00	1.30	**1.14**	0.26	94%	93%	94%
6	1.30	1.60	**1.44**	0.21	97%	97%	97%
7	1.60	2.20	**1.88**	0.32	99%	99%	99%
8	2.20	3.00	**2.57**	0.31	100%	100%	100%
9	3.00	4.00	**3.46**	0.29	100%	100%	100%
10	4.00	5.50	**4.69**	0.32	100%	100%	100%
11	5.50	7.00	**6.20**	0.24	100%	100%	100%
12	7.00	10.00	**8.37**	0.36	100%	100%	100%

Symbols and Units

d_i	Lower limit particle diameter in a size range *i* , µm
d_{i+1}	Upper limit particle diameter in a size range *i* , µm
d_m	Geometric mean diameter of a size range, µm
$\Delta \ln d_i$	Logarithmic width of a particle diameter size range i
E_i	Initial fractional efficiency of particle size range *i* of the untreated and unloaded filter element, %
$E_{D,i}$	Fractional efficiency of particle size range *i* of the conditioned filter element, %
$E_{A,i}$	Average fractional efficiency of particle size range *i* , %

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ISO 16890-1:2016 - Results Calculations

Report ID	Report Date	Test Organization	Supervisor
USA-1657-4503R	**8-Jan-2020**	**Camfil USA**	**Don Thornburg**

Calculation of PM Efficiencies

i	d_m µm	$\Delta \ln d_i$ µm	q_{3u} *(Urban Distribution)*	$q_{3u} * \Delta \ln d_i$	$E_{D,i} * q_{3u} * \Delta \ln d_i$	$E_{A,i} * q_{3u} * \Delta \ln d_i$
1	**0.35**	0.29	22.627%	0.065095	0.039149	0.039708
2	**0.47**	0.32	19.891%	0.063343	0.044877	0.045607
3	**0.62**	0.24	15.837%	0.038193	0.030295	0.030555
4	**0.84**	0.36	11.522%	0.041097	0.036374	0.036577
			Sums:	**0.207728**	**0.150695**	**0.152446**
5	**1.14**	0.26	8.503%	0.022309	0.020849	0.020971
6	**1.44**	0.21	7.618%	0.015817	0.015291	0.015343
7	**1.88**	0.32	8.022%	0.025546	0.025264	0.025290
8	**2.57**	0.31	9.984%	0.030966	0.030903	0.030966
			Sums:	**0.302366**	**0.243002**	**0.245016**

i	d_m µm	$\Delta \ln d_i$ µm	q_{3r} *(Rural Distribution)*	$q_{3r} * \Delta \ln d_i$		$E_{A,i} * q_{3r} * \Delta \ln d_i$
1	**0.35**	0.29	9.412%	0.027077		0.016517
2	**0.47**	0.32	8.395%	0.026733		0.019248
3	**0.62**	0.24	7.432%	0.017924		0.014339
4	**0.84**	0.36	7.014%	0.025016		0.022264
5	**1.14**	0.26	7.628%	0.020013		0.018813
6	**1.44**	0.21	8.833%	0.018340		0.017790
7	**1.88**	0.32	10.804%	0.034406		0.034062
8	**2.57**	0.31	13.726%	0.042573		0.042573
9	**3.46**	0.29	16.708%	0.048067		0.048067
10	**4.69**	0.32	19.542%	0.062233		0.062233
11	**6.20**	0.24	21.671%	0.052261		0.052261
12	**8.37**	0.36	23.143%	0.082545		0.082545
			Sums:	**0.457189**		**0.430712**

$ePM_{1,min}$	ePM_1
73%	***73%***

$ePM_{2,5,min}$	$ePM_{2.5}$
80%	***81%***

ePM_{10}
94%

