

Customer	Spectrum Engineering / Camfil	
Location	Spectrum Offices Baldoyle	
System	CAMFIL Air Purifier CITY M	
Report No.	N/A	Page 1 of 15

CUSTOMER	Spectrum Engineering / Camfil
CONTRACT NUMBER	N/A
REPORT DESCRIPTION	Field testing of effectiveness of CAMFIL Air Purifier CITY M
DATE	05/08/2021



RECORDED BY: ROBBIE COYLE	DATE: 26 August 2021
REVIEWED BY: BRIAN O'CONNELL	DATE: 26 August 2021


 SPECTRUM ENVIRONMENTAL LIMITED Unit 6, 117 Baldoye Ind. Est. Dublin 13 Tel: 00 353 1 8398994 FAX: (01) 8398381 email: info@spectrumenvironmental.ie	Customer	Spectrum Engineering / Camfil	
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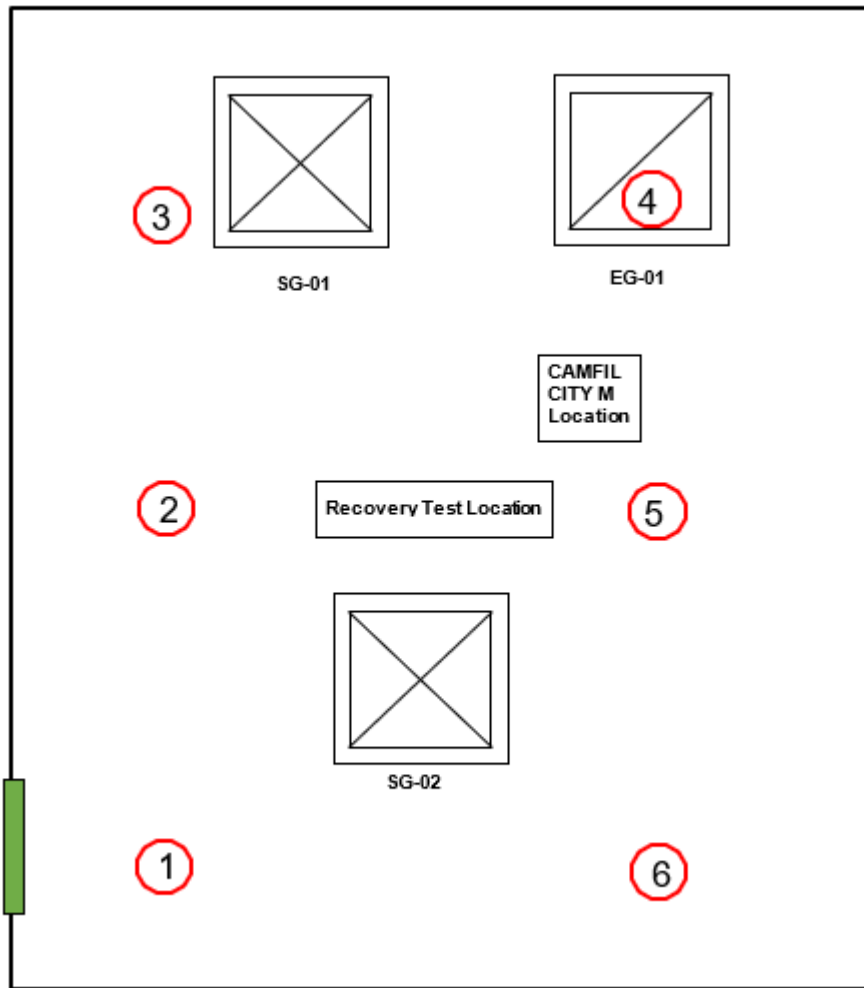
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Sketch, information on room to be sampled



Room Area = 13.67M²

Room Volume = 33.50M³


Total supply = 0.061 M³/s

Total Extract = 0.014 M³/s

Location of Airborne particle counts shown 1-6

Air change rate per hour based on supply air to room = 6.55 air changes per hour

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EXECUTIVE SUMMARY

Purpose

The purpose of this report is to investigate the effectiveness of the CAMFIL air purifier CITY M of removing non-viable particles and potential sources of typical IAQ type complaints in a Field test.

Main activities

In a chosen room in Spectrum Engineerings offices 3 tests were completed before and after the CAMFIL air purifier CITY M unit has been running for 60mins.

The tests carried out were :

1. Airborne Particle counts.
2. Particle count recovery over 20 minutes – A large particle challenge is introduced and particle counts are monitored to see the rate of recovery over 20 minutes.
3. IOQ tests to detect potential sources of typical IAQ type complaints.

The first-round of tests was performed in a chosen room in Spectrum Engineerings office prior to the CAMFIL air purifier CITY M unit being turned on. The second round of tests was performed in the same room after the CAMFIL air purifier CITY M unit had been running for 1 hour. The CAMFIL air purifier CITY M unit will still be running for the duration of the second round of testing. The CAMFIL unit is running at speed setting 6 which produces airflow of 120L/s or 432M³/hr. Based on a room volume of 33.5M³ the unit can deliver 12.9 Air Changes Per hour in the room tested.

An Indoor Air Quality Test was carried out in 1 location for a duration of 90 minutes using a Graywolf AdvancedSense Pro Environmental Test Meter which produced an average reading for the following parameters :

Ammonia (NH₃).

Nitrogen dioxide (NO₂).

Ozone (O₃)

Total Volatile Organic Compounds (TVOC)

Carbon monoxide (CO)

Formaldehyde (HCHO) was measured using indicating tablets and a photoelectric photometric meter.

In addition, Temperature and Humidity were also recorded.

All tests were performed on 03/08/2021 in Spectrum Engineering offices.

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Document Title	Form No.	Revision	Revision Date	QMS
Report Section Lead	SE010	Rev04	10 Sep 2015	N/A

SECTION	Test 1. Airborne particle count
EQUIPMENT/AREA DESCRIPTION	N/A
CONDITIONS	N/A
TEST	Airborne Particle counts

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Test 1. Data

Airborne Particle counts performed with the CAMFIL air purifier CITY M OFF

CLASS/GRADE	AT REST/IN OPERATION	UPPER LIMIT GUIDE	
		$\geq 0.5 \mu\text{M}/\text{M}^3$	$\geq 5.0 \mu\text{M}/\text{M}^3$
FOR INFO ONLY	AT REST	N/A	N/A


LOCATION	RUNS	AVERAGE PARTICLE COUNT/M ³	
		$\geq 0.5 \mu\text{M}/\text{M}^3$	$\geq 5.0 \mu\text{M}/\text{M}^3$
1	1	29642	140
2	1	31405	258
3	1	30850	259
4	1	27647	155
5	1	26535	153
6	1	26129	152
AVERAGE		28701	186
MAX		31405	259
RESULT		N/A	N/A

Airborne Particle counts performed with the CAMFIL air purifier CITY M ON

CLASS/GRADE	AT REST/IN OPERATION	UPPER LIMIT GUIDE	
		$\geq 0.5 \mu\text{M}/\text{M}^3$	$\geq 5.0 \mu\text{M}/\text{M}^3$
FOR INFO ONLY	AT REST	N/A	N/A

LOCATION	RUNS	AVERAGE PARTICLE COUNT/M ³	
		$\geq 0.5 \mu\text{M}/\text{M}^3$	$\geq 5.0 \mu\text{M}/\text{M}^3$
1	1	14623	59
2	1	14744	52
3	1	13414	29
4	1	13971	90
5	1	14558	96
6	1	13235	85
AVERAGE		14091	69
MAX		14744	96
RESULT		N/A	N/A

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Test 1. Results

The most common particle size tested for are $0.5\mu\text{M}/\text{M}^3$ and $5.0\mu\text{M}/\text{M}^3$, the results are as follows,

For $0.5\mu\text{M}/\text{M}^3$ the average particle result after the CAMFIL air purifier CITY M ran for 1 hour is 37% of the average particle results without the unit running. This gives a **63% improvement** in average number of particles at $0.5\mu\text{M}/\text{M}^3$

For $5.0\mu\text{M}/\text{M}^3$ the average particle result after the CAMFIL air purifier CITY M ran for 1 hour is 49% of the average particle results without the unit running. This gives a **51% improvement** in average number of particles at $5.0\mu\text{M}/\text{M}^3$

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Document Title	Form No.	Revision	Revision Date	QMS
Report Section Lead	SE010	Rev04	10 Sep 2015	N/A

SECTION	Test 2. Particle count recovery testing
EQUIPMENT/AREA DESCRIPTION	N/A
CONDITIONS	N/A
TEST	Airborne particle count recovery testing

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Test 2. Data

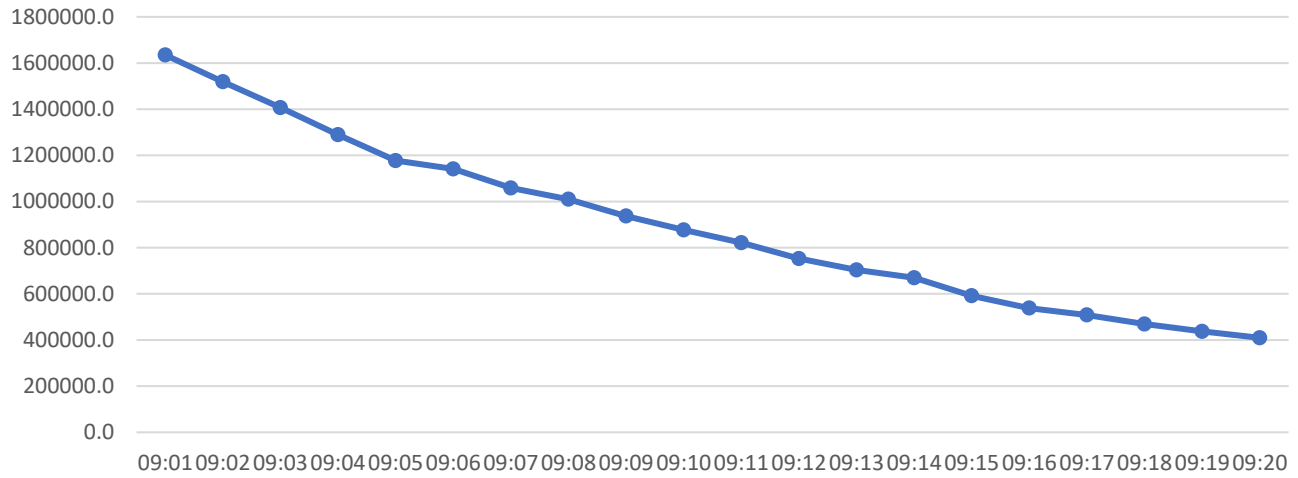
Particle counts recovery performed with the CAMFIL air purifier CITY M OFF

Date/Time	Sample number	0.5/ft ³
04/08/2021 09:01	1	1634731
04/08/2021 09:02	2	1518825
04/08/2021 09:03	3	1406709
04/08/2021 09:04	4	1289144
04/08/2021 09:05	5	1177095
04/08/2021 09:06	6	1140924
04/08/2021 09:07	7	1058655
04/08/2021 09:08	8	1009612
04/08/2021 09:09	9	936986
04/08/2021 09:10	10	876878
04/08/2021 09:11	11	821394
04/08/2021 09:12	12	752717
04/08/2021 09:13	13	703305
04/08/2021 09:14	14	669339
04/08/2021 09:15	15	591292
04/08/2021 09:16	16	538123
04/08/2021 09:17	17	508174
04/08/2021 09:18	18	469043
04/08/2021 09:19	19	437189
04/08/2021 09:20	20	409401

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0.5/ft³



Test 2. Data

Particle counts recovery performed with the CAMFIL air purifier CITY M ON

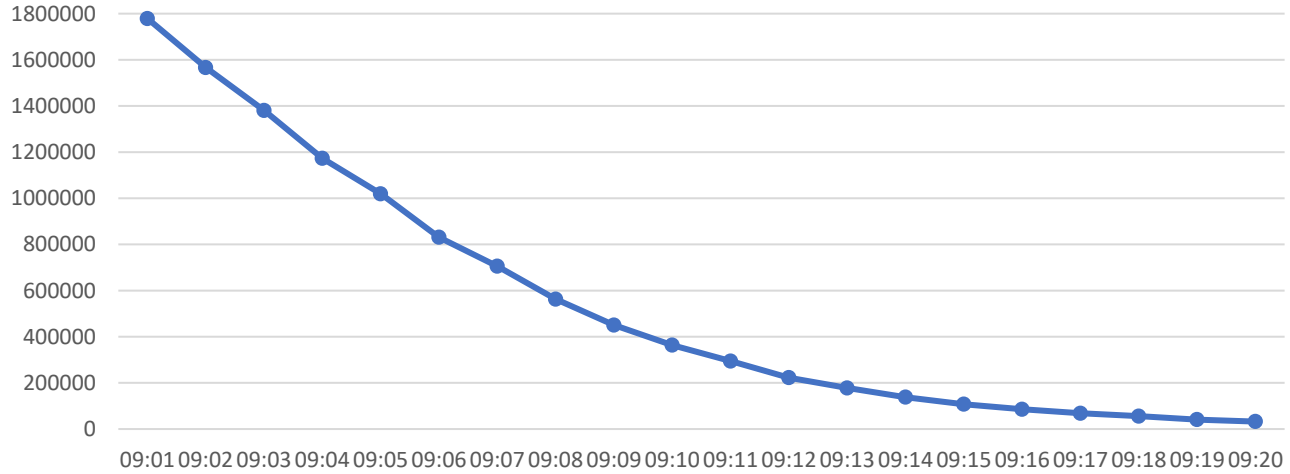
Date/Time	Sample number	0.5/ft ³
04/08/2021 10:06	1	1778789
04/08/2021 10:07	2	1566451
04/08/2021 10:08	3	1380659
04/08/2021 10:09	4	1172853
04/08/2021 10:10	5	1019180
04/08/2021 10:11	6	830880
04/08/2021 10:12	7	705539
04/08/2021 10:13	8	562974
04/08/2021 10:14	9	450597
04/08/2021 10:15	10	363446
04/08/2021 10:16	11	294343
04/08/2021 10:17	12	222512
04/08/2021 10:18	13	177874
04/08/2021 10:19	14	138068
04/08/2021 10:21	15	107478
04/08/2021 10:22	16	85727
04/08/2021 10:23	17	68391
04/08/2021 10:24	18	55651
04/08/2021 10:25	19	40809

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04/08/2021 10:26	20	32415
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0.5/ft³



Test 2. Results

With the CAMFIL air purifier CITY M **not running** in the room the test area recovered from a challenge of 1,634,731 particles of size 0.5µM/ft³ to 409,401 particles of size 0.5µM/ft³.

This equates to a **75.0% reduction** in particles over the 20 minutes period with still 25.0% of the change remaining after 20 minutes.

With the CAMFIL air purifier CITY M **running** in the room the test area recovered from a challenge of 1,778,789 particles of size 0.5µM/ft³ to 32,415 particles of size 0.5µM/ft³.

This equates to a **98.2% reduction** in particles over the 20 minutes period with still 1.8% of the change remaining after 20 minutes.

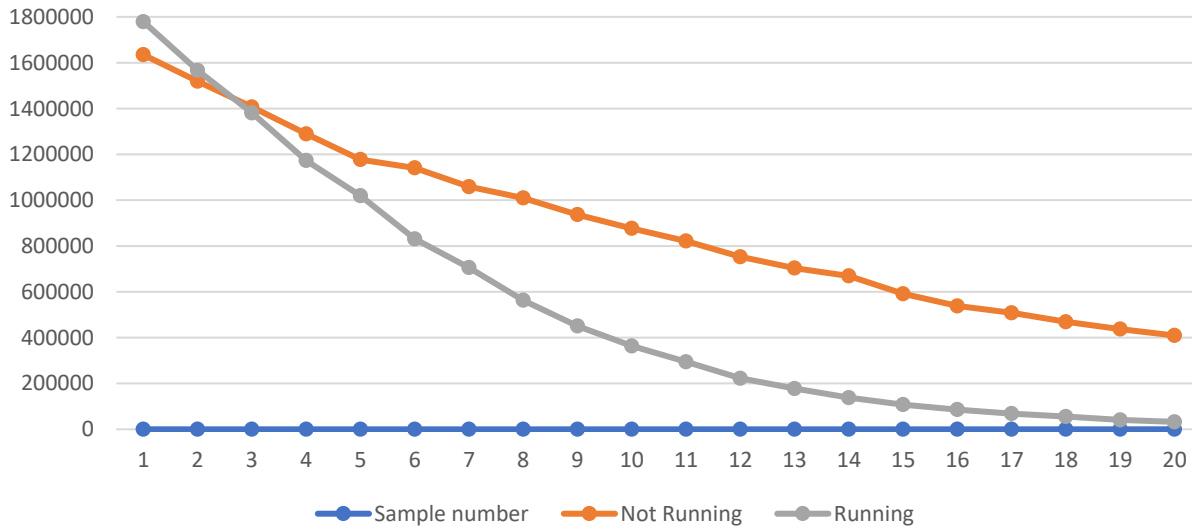
See table below for results.

CAMFIL CITY M OPERATION	INITIAL CHALLENGE	RESULT AFTER 20 MINUTES	% REMOVED IN 20 MINUTES	% REMAINING AFTER 20 MINUTES
Not Running	1,634,731	409,401	75.0%	25.0%
Running	1,778,789	32,415	98.2%	1.8%

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Overlay of CAMFIL unit running V's not running



Document Title	Form No.	Revision	Revision Date	QMS
Report Section Lead	SE010	Rev04	10 Sep 2015	N/A

SECTION	Test 3. IAQ (Indoor Air Quality) testing
EQUIPMENT/AREA DESCRIPTION	N/A
CONDITIONS	N/A
TEST	IAQ testing

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Test 3. Data


Site Summary

Site: Spectrum Offices

Site Summary Table: CAMFIL air purifier CITY M before versus after 1 hour 20 minutes running

Location	Date/Time	HCHO	TVOC µg/m3	Ammonia ppm
AFTER FILTRATION	03-Aug-21 04:50:58 PM to 03-Aug-21 06:27:29 PM	<0.01 ppm	185	0.0
BEFORE FILTRATION	03-Aug-21 01:00:48 PM to 03-Aug-21 03:29:17 PM	<0.01 ppm	320	0.0

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Location	Date/Time	Carbon Monoxide ppm	Ozone ppm	Nitrogen Dioxide mg/m3
AFTER FILTRATION	03-Aug-21 04:50:58 PM to 03-Aug-21 06:27:29 PM	1.3	0.00	0.77
BEFORE FILTRATION	03-Aug-21 01:00:48 PM to 03-Aug-21 03:29:17 PM	1.6	0.00	0.76


Location	Date/Time	Relative Humidity %RH	Temperature °C
AFTER FILTRATION	03-Aug-21 04:50:58 PM to 03-Aug-21 06:27:29 PM	53.2	21.9
BEFORE FILTRATION	03-Aug-21 01:00:48 PM to 03-Aug-21 03:29:17 PM	59.8	20.4

NOTE – The IAQ monitoring is a 90-minute test, above are the averages of the measured parameters over the 90 minutes. The ‘BEFORE FILTRATION’ was ran prior to running the CAMFIL air purifier CITY M, after the 1 hour 20 minutes filtration using the CAMFIL air purifier CITY M the ‘AFTER FILTRATION’ test was performed. The CAMFIL air purifier CITY M was running for the duration of the ‘AFTER FILTRATION’ test.

Test 3. Results

PARAMETER TESTED	RESULTS BEFORE FILTRATION	RESULTS AFTER FILTRATION	% REDUCTION
Formaldehyde (HCHO)	<0.01 ppm	<0.01 ppm	N/A
Ammonia (NH ₃).	0.0 ppm	0.0 ppm	N/A
Nitrogen dioxide (NO ₂).	0.76 mg/M ³	0.77 mg/M ³	-1
Ozone (O ₃)	0.0 ppm	0.0 ppm	N/A
Total Volatile Organic Compounds (TVOC)	320 mg/M ³	185 mg/M ³	42
Carbon monoxide (CO)	1.6 ppm	1.3 ppm	19

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There was a notable **reduction in Total Volatile Organic Compounds (TVOC's)** from the before and after results, all of the results before filtration were within the guidelines so the area did not have any issues to start with. Some general guidelines are noted below,

Carbon monoxide

The HSA Code of practice Chemical Agent Regulations list CO levels as 20 ppm OELV (8-hour reference period) and 100 ppm OELV (15-minute reference period). U.S. authorities typically limit the value to 9 ppm

Nitrogen dioxide

The HSA Code of practice Chemical Agent Regulations list NO₂ levels as 5 mg/M³ OELV (8-hour reference period) and 9 mg/M³ OELV (15-minute reference period). OSHA list the limit as 5ppm (9mg/M³) NO₂ levels were very similar and were all below 1 mg/m³.

Ammonia

The HSA Code of practice Chemical Agent Regulations List Anhydrous Ammonia levels as 14 mg/M³ (20 ppm) OELV (8-hour reference period) and 36 mg/M³ (50 ppm) OELV (15-minute reference period). Ammonia levels were below the detection limit of the NH₃ sensor of 1 ppm.

Formaldehyde

The HSA Code of practice Chemical Agent Regulations List Formaldehyde levels as 2.5 mg/M³. The measured level was undetectable <0.008mg/M³ and below the limit.

TVOC

There are no hard and fast guidelines for TVOC levels. Research generally seems to agree that <500 µg/M³ represents an "acceptable" TVOC level and that >3000 µg/M³ represents a "hazardous" TVOC level. LEED levels for a new building are <500 µg/M³. Both before and after results <500mg/M³

Ozone

The occupational exposure limit for ozone levels listed by the UK EHS40 and OSHA of the USA is no greater than 0.4 mg/M³ (400 µg/M³, 0.2ppm). The EPA European Air Quality target level is 120 µg/M³ which is approximately 0.06 ppm. No ozone was detected before or after filtration.

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