13 January 2013

Pollution Check for the CamCleaner 300 'standalone' air filter

Indoor air quality (IAQ) can be worse than outdoor (or ambient) air quality (AAQ) due to the many sources of pollution within buildings and homes. Clean Air in London (CAL) is therefore campaigning to build public understanding of indoor air quality with support from Camfil Farr. The European Commission has declared that 2013 is the 'Year of Air'.

The most common forms of indoor air pollution include: fine combustion particles from traffic and power stations; volcanic dust; bio-aerosols and pathogens like pollen, bacteria, viruses and fungal spores; environmental tobacco smoke; asbestos; and silica dust. Molecular pollutants such as gases and vapours include: carbon monoxide; oxides of nitrogen and sulphur; ozone; radon; and volatile organic compounds. Particles are defined by their maximum diameter in microns e.g. $PM_{2.5}$ or PM_{10}. A human hair is about 70 microns in diameter.

Many buildings are now equipped with some form of mechanical air treatment system. This may be mechanical ventilation, air conditioning (heating/cooling) and/or air filtration or any combination of these (or none of them). A system may service an entire building, or just part of it. The type of filters used in a system will depend upon the level of filtration required. For dust and particles, two filters are typically used: a coarse (lower cost) filter followed by a finer, more expensive filter to remove smaller particles. If filtration of pollutant gases is required a second gas or 'molecular' filter will also be used. In all cases filters need to be regularly maintained in order to perform effectively.

Many buildings have only natural ventilation with openable windows. In these cases, standalone air filters can be an effective way to reduce particles and gases. CAL was introduced by Camfil Farr to its CamCleaner solution which can be used as standalone air filters or as a supplement to existing ventilation systems. Camfil Farr says they can give reduced energy costs, more efficient production and a healthier work environment with less dust and fewer harmful particles.

CamCleaners do not need external ducting and can be connected to a local power source. They vary in capacity from the CamCleaner 300, which may be suitable for small offices or bedrooms or to complement larger air purifiers, through to the CamCleaner 30000 which can be effective in large areas such as large warehouses and industry or in climate chambers with heating and cooling functions.

CAL used its Pollution Check technique to test a CamCleaner 300 which was fitted with an E11 primary filter and a secondary carbon filter. The British and European standard EN 1822 specifies that the overall collection efficiency at the Most Penetrating Particle Size for an E11 filter should be greater than 95% i.e. at the size of the particles that achieve maximum penetration of the filter medium. The CamCleaner 300 has three speeds settings designed for rooms with an area of 30, 50 and 100 square meters (m^2) with an airflow of 82, 119 and 280 cubic metres per hour (m^3/hour) respectively. At the first speed setting, the CamCleaner 300 produces almost no ambient noise.

The Pollution Check test uses a TSI Aerotrak 9306 V2 handheld particle counter to measure particle number concentrations within different size fractions. CAL located the CamCleaner 300 in a home office with approximately 12 m^2 area and 28 m^3 volume and conducted a test before and during the use of the CamCleaner 300 in June 2012 and nearly seven months later i.e. with the original filters.

The door and windows were closed but not 'sealed' and the particle counter was located on the other side of the room. The average temperature and relative humidity were 21-24c and 47-49% respectively in the first test and 19-20c and 49-51% respectively in the second. The tests were conducted on the second speed setting.

Pollution Check for CamCleaner 300 with E11 primary filter and secondary carbon filter

	17 June 2012			**6 January 2013**		
	Particle concentration (number/m^3)			**Particle concentration (number/m^3)**		
Diameter (microns)	**Before**	**After 75 minutes**	**Reduction %**	**Before**	**After 75 minutes**	**Reduction %**
0.3 to 0.4	12,599,647	**724,382**	94.3	18,302,827	728,975	96.0
0.4 to 0.5	2,692,933	**168,905**	93.7	5,943,816	178,799	97.0
0.5 to 1.0	2,796,466	**172,792**	93.8	3,832,155	74,912	98.0
1.0 to 2.5	1,812,014	**90,106**	95.0	1,860,071	11,661	99.4
2.5 to 10.0	609,187	**24,028**	96.1	1,322,615	1,413	99.9
Over 10.0	35,689	**2,473**	93.1	121,908	353	99.7
Cumulative	20,545,936	**1,182,686**	94.2	31,383,392	996,113	96.8

The results on 17 June 2012 showed an average 94.2 % reduction in particle number concentration for particles with a diameter greater than 0.3 microns. Nearly seven months later the same filters removed an average 96.8% of particles with a diameter greater than 0.3 microns. CAL understands that, unlike electrostatic or ultraviolet light filters, CamCleaners may increase in efficiency up to 12 to 15 months due to a slight build-up of particles in the filter. In normal use, CAL would recommend testing, periodically and/or if odour is detected, the output efficiency of such filters and if possible their energy usage. Interestingly, the filter kept the size distribution similar to outdoor air and achieved similar absolute particle number concentrations at smaller diameters despite worse initial ambient air quality in the second test.

CAL considers that standalone air filters can offer an alternative to improve indoor air quality when mechanical ventilation is not available.

Disclaimer: Camfil Farr is a Gold Sponsor of Clean Air in London. Clean Air in London used its reasonable endeavours in undertaking these tests but makes no representations and/or accepts no liability to any other party in respect of the test results or this article.