Odour Control Assessment

For

McDonalds Restaurant

Owl Lane, Shaw Cross,

Dewsbury WF12

Rev 00

Client:
McDonalds Restaurants Ltd
11-59 High Road
East Finchley
N2 8AW

Prepared By:
CDM Partnership
10A Albion Street
Dunstable
Beds
LU6 1SA

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APPENDICES

Revisions

Reference	Revision	Date

1.0 Introduction

This report provides an odour risk assessment for the new proposed McDonald's restaurant at Owl Lane, Shaw Cross, Dewsbury. The assessment follows the approach described in the EMAQ+, Ricardo-AEA Technology/NETCEN Guidance on the 'Control of Odour and Noise from Commercial Exhaust Systems' (2018) to identify the recommended equipment and techniques to minimise the impact of restaurant kitchen extract system.

The EMAQ+ Guide was been published in 2018 to supersede the original DEFRA (2005) document which was officially withdrawn in September 2017.

References in this report to 'The Guides' can be taken as referring to either or both guide documents.

2.0 Policy Context

The Department for Environment, Food and Rural Affairs (DEFRA) is the government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the UK and Northern Ireland. It provides air quality standards and objectives to reduce concentrations of key pollutants, which are designed to protect health, economic and environmental impacts. Local authorities have a legal responsibility to review and assess the odour and noise control aspects of the planning application. The DEFRA (2005) Guidance on the 'Control of Odour and Noise from Commercial Exhaust System' provided a framework to carry out an odour control risk assessment with the level of information required to support Planning Applications.

An updated report by Ricardo-AEA Technology/NETCEN (EMAQ+) has been published to supersede the original DEFRA (2005) document which was officially withdrawn in September 2017.

The formal status of the new Ricardo-AEA EMAQ+ report is currently ambiguous, as it does not carry the DEFRA accreditation, however it is widely regarded by Planning Authorities as an acceptable updated alternative to the original withdrawn document.

3.0 Regulation Governing Design and Performance of Ventilation Systems

There is no legislation directly governing the design and performance of commercial kitchen ventilation systems. However other regulations do exist protecting the health and safety of the employees, food safety, and local amenity. There are numerous sources of guidance and industry standards available relating to design and performance of ventilation systems.

Building Regulation Part F provides the requirements for ventilation systems. For commercial kitchens, Part F refers to CIBSE Guide B section 3.6 which sets out the requirements for ventilation system in commercial kitchens.

4.0 Site Location

The proposed development is located on a vacant plot on Owl lane, Shaw Cross Dewsbury. The closest sensitive receptors are residential properties located to south east of the development which are at a distance of 12m (approximately) as seen in the image below

Site Location

The nearby receptors will influence the recommended odour control provision.

The proximity of nearest sensitive receptors forms the basis of odour nuisance risk assessment which informs on the recommendations relating to odour control provision.

5.0 Assessment Criteria

The following score methodology derived from defined standardised risk levels is suggested in the original DEFRA report and is unchanged in the new EMAQ+ version as a means of determining odour control requirements using a simple risk assessment approach.

The total 'significance score' is used to determine the recommended odour control measures and techniques to be applied according to the severity of risk.

The risk schedule carries the following sub-note:

> *'Note 1: A Planner may take a pragmatic view when assessing whether certain low risk kitchens require any odour abatement to be fitted. In reaching this decision the Planner may consider the nature of the food being cooked and/or the size of kitchen and/or its location.'*

Table 1: Odour Risk Severity Assessment

Impact Risk	Odour Control Requirement	Significance Score*
Low to Medium	Low level odour control	Less than 20
High	High level odour control	20 to 35
Very High	Very high level odour control	More than 35

* based on the sum of contributions from dispersion, proximity of receptors, size of kitchen and cooking type.

The Defra and EMAQ+ Guides on the 'Control of Odour and Noise from Commercial Kitchen Exhaust Systems' contain an assessment procedure for identifying the potential risk of odour impacts from commercial kitchen operations. The results of this risk assessment can be used to determine a suitable level of odour abatement to be installed into a commercial kitchen.

The risk assessment for odours is split into the following four parts:

- dispersion;
- proximity to receptors;
- size of kitchen; and
- cooking type and grease loading.

Each part is given a risk rating score and the total risk rating denotes the level of odour abatement which is likely to be required to prevent the kitchen from causing odour impacts.

The following sections of this report outline each part of the risk assessment in relation to the proposed McDonald's Restaurant.

6.0 Odour Control Assessment

6.1 Dispersion

The risk rating for dispersion relates to the conditions under which kitchen extraction emissions are discharged. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses.

- VERY POOR (20) – Low level discharge, discharge into courtyard, or restriction on stack;
- POOR (15) – Discharge not low level, but below eaves, or discharge rate below 10 m/s;
- MODERATE (10) – Discharging 1 m above eaves at a rate of 10-15 m/s;
- GOOD (5) – Discharging 1 m above ridge at a rate of 15 m/s or more

At the proposed restaurant, air extracted from the kitchen will be discharged vertically via a single high velocity terminal located level with the top of the plant screen in the location, and level with flat roof, taken as 'eaves' level. The risk rating for dispersion at the proposed restaurant is thus described as **POOR**.

6.2 Proximity to Receptors

The risk rating for proximity to receptors relates to the distance between the point of discharge of kitchen emissions and the nearest sensitive receptor locations. Sensitive receptor locations may be residential properties, commercial premises or frequently used public open spaces. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses

- CLOSE (10) – Closest sensitive receptor is less than 20m from kitchen discharge;
- MEDIUM (5) – Closest sensitive receptor is between 20 and 100m from kitchen discharge;
- FAR (1) – Closest sensitive receptor is more than 100m from kitchen discharge.

The risk rating for the proximity to residential properties is judged to be **CLOSE** as there are residential properties within 20m from the exhaust point as shown in section 4.

6.3 Size of Kitchen

The risk rating for size of kitchen relates to the volume of food prepared by the kitchen and is described in terms of the capacity of the restaurant or take-away. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses

- LARGE (5) – More than 100 covers or a large-sized take-away;
- MEDIUM (3) – Between 30 and 100 covers or a medium-sized take-away;
- SMALL (1) – Less than 30 covers or a small take-away.

This restaurant has more than 100 covers, classing it as a **LARGE** sized kitchen.

6.4 Cooking Type and Grease Loading

The risk rating for cooking type and grease loading relates to the type of cooking methods employed in the kitchen and the type of food prepared. The relevant risk ratings described in the guidance are shown below. The risk score is shown in parentheses.

- VERY HIGH (10) – Pubs (those serving a high level of fried food), fried chicken, burgers or
- fish and chips;
- HIGH (7) – Kebab, Vietnamese, Thai or Indian;
- MEDIUM (4) – Cantonese, Japanese or Chinese;
- LOW (1) – Most pubs, Italian, French, Pizza or Steakhouse.

The McDonald's Restaurant serves a high level of fried food and would be considered to have a **VERY HIGH** grease loading.

The Defra/EMAQ+ Guides state:

> *'Odour control must be designed to prevent odour nuisance in a given situation. The following score methodology is suggested as a means of determining odour control requirements using a simple risk assessment approach. The odour control requirements considered here are consistent with the performance requirements listed in this report.'*

Table 2: McDonalds Restaurant Kitchen Odour Risk Assessment Summary

Criteria	Score	Score	Details
Dispersion	Very poor	20	Low level discharge, discharge into courtyard or restriction on stack.
	Poor	15	Not low level but below eaves, or discharge at below 10m/s.
	Moderate	10	Discharging 1m above eaves at 10-15m/s.
	Good	5	Discharging 1m above ridge at 15m/s.
Proximity of receptors	Close	10	Closest sensitive receptor less than 20m from kitchen discharge.
	Medium	5	Closest sensitive receptor between 20 and 100m from kitchen discharge.
	Far	1	Closest sensitive receptor more than 100m from kitchen discharge.
Size of kitchen	Large	5	More than 100 covers or large sized take away.
	Medium	3	Between 30 and 100 covers or medium size take away
	Small	1	Less than 30 covers or small take away.
Cooking type (odour and grease loading)	Very high	10	Pub (high level of fried food), fried chicken, burgers or fish and chips.
	High	7	Kebab, Vietnamese, Thai or Indian.
	Medium	4	Cantonese, Japanese or Chinese.
	Low	1	Most pubs, Italian, French, Pizza or steakhouse.
TOTAL		**40**	

The overall odour risk rating of the restaurant is 'very high' and requires a very high level of odour control.

7.0 Recommended Odour Abatement Measures

The Guides define a number of recognised odour abatement measures, to be used individually or in combinations to achieve levels of abatement rated 'None', 'High' or 'Very High', depending on configuration and on sizing and selection.

Table 3: EMAQ+ Guide Abatement Classifications

Abatement Type	Level of Odour Abatement
Panel and Bag	None
Panel, Bag and HEPA	None
Pre, Fine and Carbon Filter	High
Panel, Bag, HEPA and Carbon Filter. *(Note: 'Very High' is the minimum level recommended for fried foods and concentrated cooking of burgers).*	High - 0.1 to 0.2 Seconds dwell Very High - 0.2 to 0.4 Seconds dwell Extreme - 0.3 to 0.8 Seconds dwell
Panel, Bag, HEPA and Carbon Filter (As above)	High to Very High (As above)
ESP and Carbon Filter (As above)	High to Very High (As above)
ESP and Counteractant	Medium to High
ESP and UV/Ozone	High

In addition to the above, whilst the exhaust location is factored into the point scoring assessment method, the guidance additionally states that the discharge should:

1. Discharge the extracted air not less than 1 m above the roof ridge of any building within 20 m of the building housing the commercial kitchen.

2. If 1 cannot be complied with for planning reasons, then the extracted air shall be discharged not less than 1m above the roof eaves or dormer window of the building housing the commercial kitchen. Additional odour control measures may be required.

3. If 1 or 2 cannot be complied with for planning reasons, then an exceptionally high level of odour control will be required

Thus, if the flue cannot be extended to a height of 1m above the tallest building within 20m, then additional odour abatement may be required.

8.0 Odour & Grease Control Measures

8.1 General

The proposed odour and grease abatement system for this restaurant is consistent with the principles for 'very high' category odour control in the Defra/EMAQ assessment guide, but goes further by combining separate treatments from the guide to form a single bespoke comprehensive solution.

This odour and grease control arrangement was trialled in a new McDonald's Restaurant in Leeds City Centre, opened in December 2019, within a prestigious office development where a low level discharge over a pedestrian precinct was necessary.

The kitchen extract at this Leeds store discharges via a shared plenum and sidewall louvre above the street and only the faintest occasional traces of odour are discernible actually within the plenum and none at street level outside.

The success in removing all traces of odour at the trial store has resulted in the decision to apply this system in the most sensitive situations, including those where low level discharge is necessary, with confidence that cooking odours can be effectively contained and controlled and that nuisance from cooking odours will not occur.

8.2 Treatment Stages

Enhanced Efficiency Canopy Filtration

Each item of cooking equipment (fryers and grilles) has local fume extraction by means of a low level extract canopy containing stainless steel removable and cleanable grease filters. In this instance, the standard 'Hikatch' baffle grease removal filters will be substituted with Plasma-clean 'Coil Filters' which have demonstrated improved grease removal efficiencies over the standard filters and have been used in grease and odour sensitive applications.

The superior grease removal efficiency of these canopy filters reduces grease accumulation within the initial ductwork, removing the larger grease particles and leaving only smaller particles to carry on through the system. The remaining smaller grease particles are more effectively neutralised by the following stages than would be the case with the standard canopy filters.

Note that the Leeds trial store did not include the Plasma-clean coil filters, but it has been decided to include them based on separate McDonald's grease control technology trials where they proved to have superior grease removal properties to the standard filters and on previous experience where their implementation has been found to improve the effectiveness of ozone injection odour control treatment.

Electrostatic Precipitator

2No. Purified Air ESP4500 electrostatic filters, in a double banked single pass arrangement, serve as 'fine filtration' for further removal of airborne grease particles which further reduces grease contamination, with only yet smaller grease particles passing through and these very much reduced particles are more effectively oxidised by the subsequent ultra-violet treatment stage than would otherwise be the case.
The ESP4500 filters have a rated capacity of 2.1m^3/s each, giving a total theoretical capacity of 4.2m/s for the two installed in parallel. This over-capacity represents a utilisation of 40% to 86% of maximum rated capacity, depending on system operating point, which enhances the grease removal efficiency over longer time periods. This provides an opportunity to extend the time between service intervals, or to experience enhanced grease arrestance efficiencies whilst maintaining standard fixed service intervals.

UV-C In-Duct Ultra-Violet Treatment

2No. Purified Air UV-C 4500 in-duct ultra-violet lamp units, matched and closed coupled to the preceding ESP filters, with 2No. 8 lamp modules per unit are installed to oxidise the very small airborne grease particles having passed through the ESP filters (The number of lamps can be increased to 18 per unit, although 8 per unit was recommended and installed in the trial store). The direct close contact with the high intensity UV lamp sources causes a high oxidation impact on airborne grease particles. The high ozone levels produced by the UV lamps continues to act on any remaining grease particle and odours as they pass along the ductwork system for a minimum 2 second period before reaching the final carbon filter treatment stage.

Experience with ozone injection odour control technologies, without direct lamp contact, has proven them to be significantly more effective when combined with moderately improved upstream filtration. This has been attributed to the fact that the larger grease droplets are removed by the upstream filtration and the ozone works more effectively on the remaining smaller droplet size which have a smaller volume to surface area ratio at these very small sizes and are effectively 'zapped' by the action of the ozone on the droplet surface. With the far higher level ESP 'fine filtration' stage upstream of the UV-C lamp ozone generation, the odour removal effectiveness increases correspondingly.

The extract ductwork is sized and designed to ensure a minimum 2 second 'contact' period, at the maximum design exhaust air volume, between leaving the UV-C unit and reaching the carbon filters, as prescribed by the manufacturer. This contact period will naturally beneficially increase at times when the system operates at reduced air volumes through it's normal load-based control strategy.

Carbon Filters

High concentrations of ozone in an occupied and confined space are hazardous to health, with safety limit guidelines published by the World Health Organisation. Concentration levels decay and dissipate rapidly when ejected to open air in a well ventilated space.
Consideration is given to avoiding the potential for accumulation of discharged ozone in poorly ventilated enclosed wells or spaces. Particularly low lying spaces where accumulation is a possibility due to ozone being heavier than air and liable to migrate to and collect within these areas.

Activated carbon filters are very effective in removing ozone and are employed to remove any traces of unexpended ozone from the airstream following the 2 second contact period stage.

The use of carbon filters is a long established and reliable means of odour mitigation in itself and therefore, in addition to the ozone removal function, it also serves to act on any residual cooking odours that may still be present after the preceding abatement stages.

The Leeds trial restaurant adhered strictly to the Landlord specification requirements with the carbon filters selected to a 0.1 second dwell time which, without the UV treatment would classify the system as 'high level' odour control under the DEFRA/EMAQ+ guide. It has been decided to increase the dwell time to 2 seconds to provide further enhanced protection to 'very high' level classification, even without the UV stage.

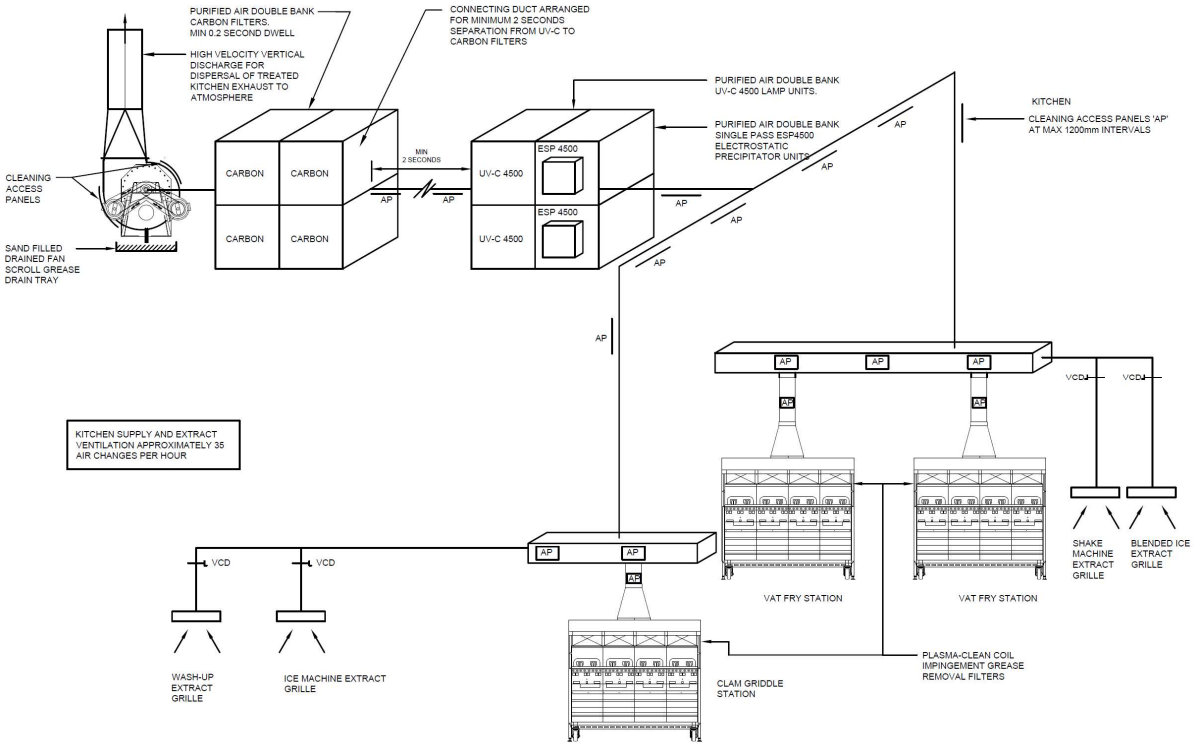
The increase in carbon filter provision will provide further odour control security and prolong filter life.

8.3 Discharge Arrangement

The application of the multi-stage and highly effective odour abatement system allows the discharge of kitchen exhaust air in locations that would otherwise be considered unsuitable, such as above shopfronts over pedestrian pavements and in closer than normal proximity to sensitive receptors, providing the areas concerned are not enclosed and are open and freely ventilated. In addition to being suitable for the most sensitive situations, this system can be applied in less sensitive situations to provide a degree of comfort to interested parties that odour nuisance will not be experienced.

In this instance the kitchen exhaust will terminate at the highest point of the building, level with the upper parapet screen, existing via an un-restricted vertical high velocity discharge terminal at a velocity of 15m/s at nominal design air volume flowrate, to provide the best possible effective dispersal of the exhaust air to atmosphere.

8.6 Kitchen Extract Schematic



9.0 Maintenance

McDonald's Standard arrangement for maintenance is for quarterly changing of supply air system filters and six-monthly servicing.

Kitchen extract duct cleaning is carried out in accordance with Building & Engineering Services Association Guide To Good Practice – Internal Cleanliness of Ventilation Systems TR19.

Access doors are provided in the extract ductwork at minimum 1200mm intervals for cleaning purposes.

Electrostatic precipitator filters are serviced every two months.

UV-C lamps are cleaned every 2 months and typically replaced annually.

Second stage carbon filters are typically replaced every six months, with the first stage filters being replaced with the existing stage two filters which are typically less depleted.

Intervals for filter changing and duct cleaning may be increased or decreased depending on the particular store characteristics when they are apparent.

10.0 Conclusion

An assessment has been carried out using the EMAQ+ (Formerly DEFRA) style Odour Risk Assessment method and concluded that the size of restaurant, nature of cooking, proximity of receptors and discharge will require a very high level of odour control.

In recognition of the potentially very sensitive nature of the proposed restaurant location in relation to the nearby housing, it is proposed to provide odour control measures exceeding the assessment conclusions in order to provide a comfortable design margin over and above the minimum recommendations.

The proposed grease and odour control measures exceed the requirements of 'Very High' control band and have demonstrated effective eradication of odours when used previously.

The level of active odour control measures to be employed demonstrates McDonald's Restaurant's intent to adopt a best practice approach to avoiding the causation of nuisance.

APPENDIX 1 – PLASMA-CLEAN COIL FILTER DATA SHEET

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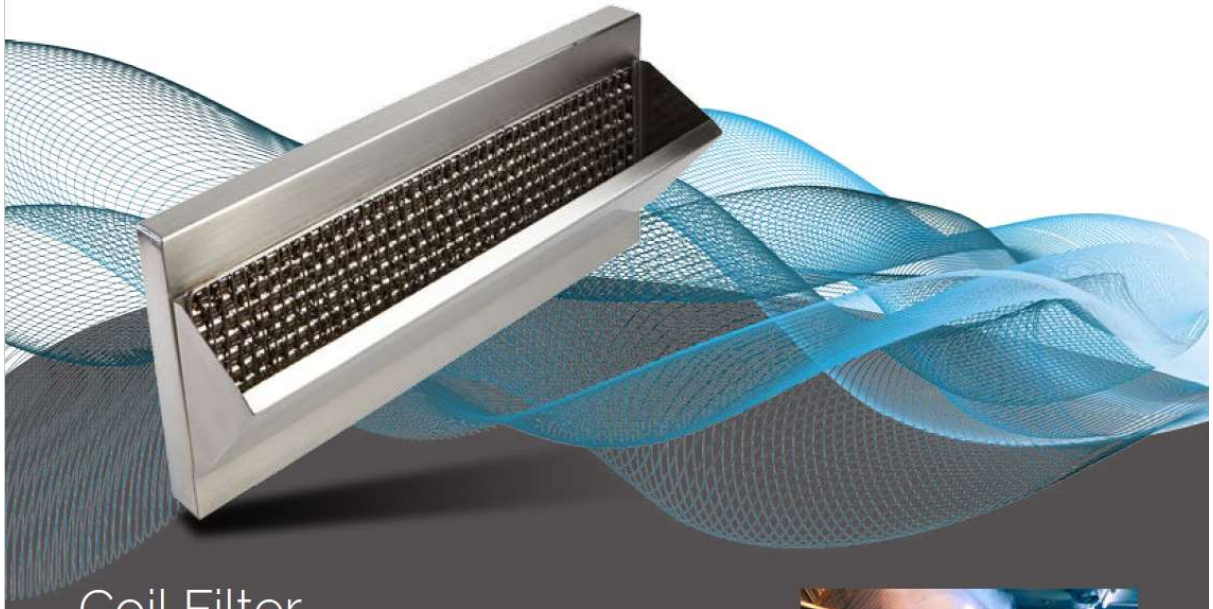
British innovation
Global distribution

plasmaclean
Odour and Infection Control



Coil Filter

Plasma Clean Coil Filters are designed to capture oil and grease in commercial kitchen extraction canopies. The filters are designed to capture 95% of grease particles, in comparison to 20-40% grease capture using the more traditional baffle-type filters.

By preventing oil and grease particles entering into the ductwork using a high efficiency primary grease filter, the number of ductwork cleans is significantly reduced along with downstream equipment maintenance.

Product Specification		
Model	CF 475	CF 375
Volume Flow Rate	0.34 m^3/s	0.24 m^3/s
Weight	3.5Kg	2.8Kg
Dimensions	150H x 495W x 161D mm	150H x 395W x 161D mm
Face Velocity	4-6 m/s	
Pressure Drop	200Pa	
Material	304 Stainless streel	
Noise	50dB	

ROI less than 12 months
Proven grease reduction ability
Excellent barrier against passage of flames
Captured oil can be recycled

Plasma Clean Coil Filter versus traditional baffle-type filters.

- Significantly reduces duct cleaning requirements
- Reduces fire risk
- Simple to clean
- Return on investment is less than 12 months

www.plasma-clean.com ask@plasma-clean.com +44 (0)161 443 4125

APPENDIX 1 – PLASMA-CLEAN COIL FILTER DATA SHEET

www.plasma-clean.com

How the Coil Filter works

The purpose of the Coil Filter is to stop oil and grease from entering into the extraction system. There are four stages to the operation:

Stage 1 - oil vapours condense on the large surface area of the filter coils as heat is transferred from the air.

Stage 2 - the air is spun into a vortex and the droplets of oil and grease continue in a straight line.

Stage 3 - the oil and grease particles then collide with the filter coils, and the oil-coated filter surface traps more oil and grease due to its enhanced viscosity.

Stage 4 – the oil and grease droplets simply settle due to gravity and are collected for recycling.

Installation

Installation is simple, if you are producing a new canopy, let us know and we can advise on the design and dimensions of the Coil Filter mounting plate.

If you have an existing canopy, then an adaptor plate is available to enable the Coil Filters to be installed into existing kitchen canopies, replacing existing low efficiency baffle type filters.

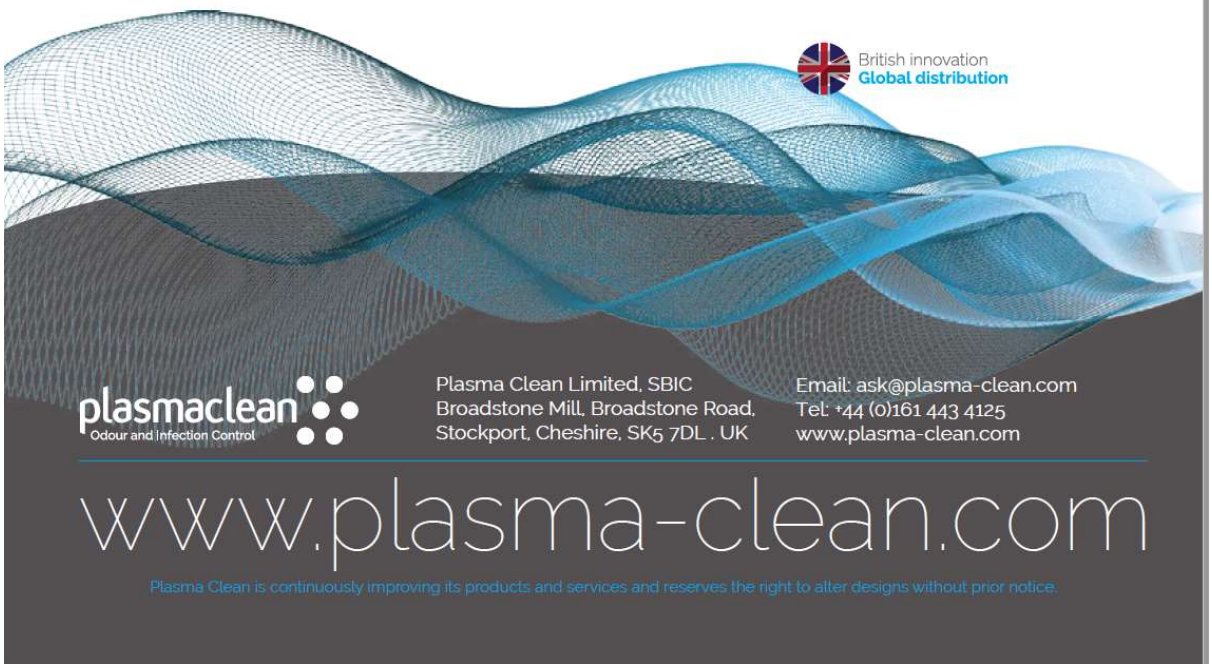
Care

Oil and grease arrested by the unit is collected in the filter cup at the front of the unit, and can be recycled along with the spent oil from the frying range. The stainless steel filter can then be washed in warm soapy water or in the dishwasher. Depending on the level of cooking, the system can be washed daily or as part of a weekly cleaning routine. Remember that the oil trapped by the Coil Filter would otherwise have found its way into the ductwork, requiring routine duct cleaning.

Any questions?

Contact one of our engineers who will be at hand to advise on the most appropriate odour control solution.

Email: ask@plasma-clean.com
Tel: +44 (0)161 443 4125



APPENDIX 2 – PURIFIED AIR ESP DATA SHEET

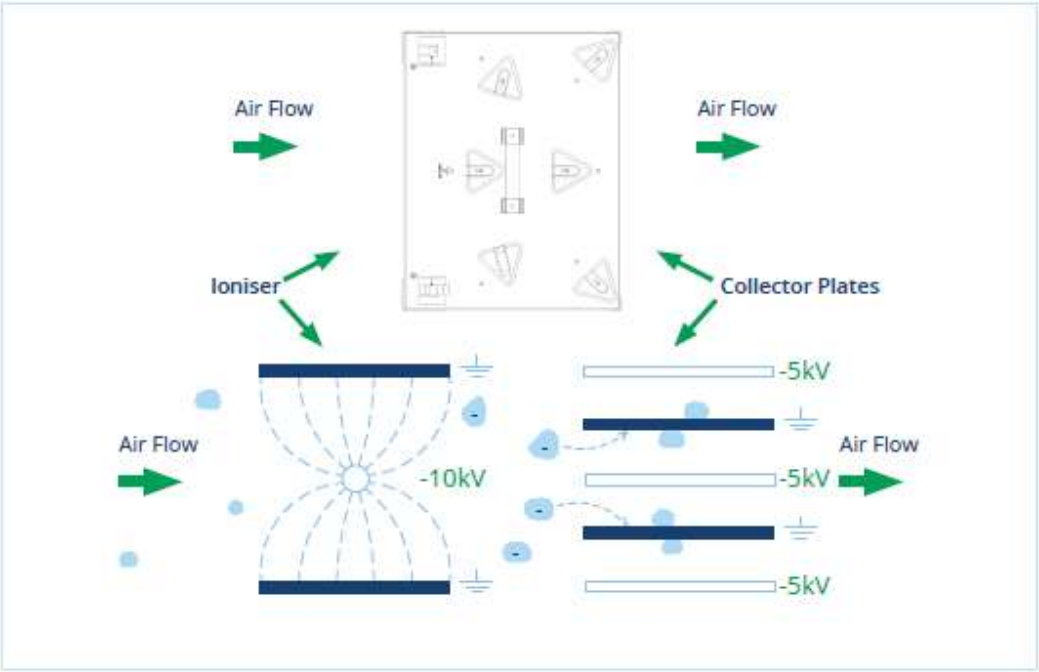
Our ESP Range

ESP 4500

- ESP 1500E which can handle up to 0.7m³/sec of air flow
- ESP 3000E which can handle up to 1.4m³/sec of air flow
- ESP 4500E which can handle up to 2.1m³/sec of air flow
- ESP 6000E which can handle up to 2.8m³/sec ofair flow

Our ESP's have been specifically designed for kitchen extract systems; they have integral sumps to collect the oil, grease and smoke particles filtered out of the exhaust. This not only simplifies servicing but eradicates potentially dangerous spillage from the bottom of the units and greatly cuts down on build-ups of grease within the ducting.

The ionisation voltage has been designed to run at a negative potential which enhances the ionisation of particles and also produces more ozone which is helpful in reducing cooking odours.



The above diagram shows, in a basic visual, how an electrostatic precipitator works. As air passes into the combined ioniser / collector cell, the particulates in the air stream are polarised to a negative potential. As they continue through the ioniser and between the collector cell plates, the polarised particulates are repelled away from the negatively charged plates and attracted to the earthed plates where they stick and so are filtered out of the air flow.

APPENDIX 2 – PURIFIED AIR ESP DATA SHEET

Our ESP units fit in-line with the kitchen ducting and can be configured modularly to cope with all extract volume requirements.

1. Cooking particulates and odours
2. Canopy Grease Filter
3. ESP - Particulate Control Unit
4. Airflow

KEY FEATURES

- Eliminates up to 98% of oil, grease and smoke particles
- Filters particles down to sub-micron levels
- Produces Ozone to help reduce malodours
- Designed with an integral sump
- Modular in design
- Specifically designed for commercial kitchen application
- Energy efficient: - uses no more than 50W
- Greatly reduces grease build-up within the duct run

3 ESP Units Stacked in modular formation

4 ESP Units Stacked in modular formation with a double pass

Technical Specification

	ESP 1500E	ESP 3000E	ESP 4500E	ESP 6000E
Electrical Supply	220/240V 50Hz	220/240V 50Hz	220/240V 50Hz	220/240V 50Hz
Power Consumption	20 Watts	30 Watts	40 Watts	50 Watts
Max Air Volume	up to 0.7m³/sec	up to 1.4m³/sec	up to 2.1m³/sec	up to 2.8m³/sec
Dimensions W/H/D	450mm/630mm/ 640mm	900mm/630mm/ 640mm	1350mm/630mm/ 640mm	1800mm/630mm/ 640mm
Weight	55Kg	85Kg	118Kg	153Kg

purifiedair since 1984

Purified Air Limited, Lyon House, Lyon Rd, Romford, Essex RM1 2BG England
T: 01708 755 414 | F: 01708 721 488
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PERMANENT SUSPENSION MODULES

GENERAL DESCRIPTION

These filters are manufactured for ease of installation and incorporation into ducted air systems. They can be used on both supply for purifying incoming air, and can be used on the extract to remove toxic gasses and odours generated within a process.

Construction

The modules are manufactured by mounting a series of panel filters within a sealed case. The airflow is optimized by presenting the filtering surfaces in a "V" formation.

Each panel is sealed into the filter case so as to ensure no air can bypass the bonded granules.

The panels are manufactured using long established bonding techniques which hold the granules in a in a rigid biscuit. The biscuit is encapsualted in a carbon impreganted cloth which prevents any leakage of granules or powder.

The unique bonding method used by Purified Air ensures that the panels will remain intact and rigid even if wet.

Available with Mixed Media, 207c Carbon or Stock Grades of Carbon

208 - Good general Carbon grade suitable for many applications

209 - Copper Coated Carbon for use in Mueums and archives

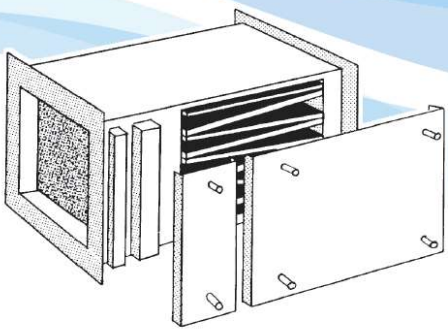
KI - For enhanced garlic odour removal

Typical Applications include:

- Elimination of Cooking Odours
- Removal of Kerosene Exhaust Fumes
- General Odour Removal
- Smoke Removal
- Neutralisation of Ammonia and its Derivatives
- Removal of Formaldehyde
- Removal of Airborne Pollutants and Contaminants
- Removal of Acid Gases

OTHER PRODUCTS IN OUR RANGE INCLUDE

- **Bag Filters**
- **Disposable Panels**
- **Washable Panels**
- **Grease Filters**
- **Grease Filter Casings**
- **Cleaning Products**
- **Pad Frames**
- **Filter Media**
- **Pad Holding Frames**
- **Absolute (HEPA) Filters**
- **Front & Side Access**
- **Frames & Casings**

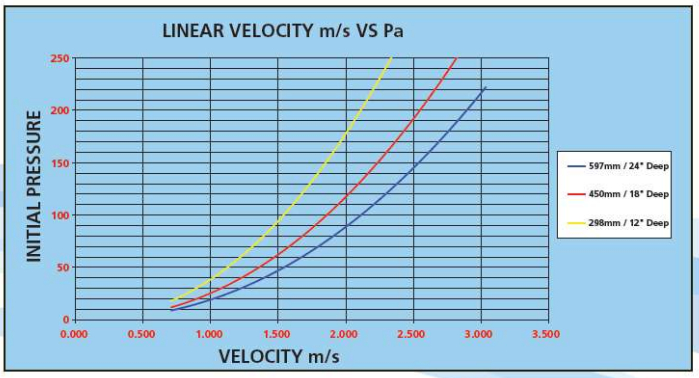


Mixed Media / Carbon Filter

STANDARD SIZES

No.	Nominal Size (Inches)	Height (mm)	Width (mm)	Depth (mm)	Weight of Carbon (Kg)	Cell Weight (Kg)	Capacity @ 0.1 Second Dwell Time m³/s
PA-CF1-7C	24 x 24 x 8	594	594	197	10	22	800
PA-CF1-HALF-7C	24 x 12 x 8	594	291	197	5	11	400
PA-242412/8-7C	24 x 24 x 12	594	594	292	13	24	990
PA-121212-7C	12 x 12 x 12	297	297	297	6	12	450
PA-181812-7C	18 x 18 x 12	445	445	297	13	25	990
PA-241212-7C	24 x 12 x 12	594	297	297	13	25	990
PA-242412-7C	24 x 24 x 12	594	594	297	25	36	1900
PA-CF2-7C	24 x 24 x 16	594	594	397	18	34	1370
PA-CF2-HALF-7C	24 x 12 x 16	594	291	397	9	18	685
PA-WA15-208	24 x 6 x 18	144	600	440	7	13	533
PA-121218-7C	12 x 12 x 18	292	292	451	10	15	761
PA-181818-7C	18 x 18 x 18	445	445	451	19	26	1445
PA-241218-7C	24 x 12 x 18	594	297	451	18	26	1369
PA-242418-7C	24 x 24 x 18	594	594	451	36	52	2740
PA-121224-7C	12 x 12 x 24	292	292	597	13	19	990
PA-181824-7C	18 x 18 x 24	445	445	597	25	36	1900
PA-241224-7C	24 x 12 x 24	594	297	597	25	36	1900
PA-242424-7C	24 x 24 x 24	594	594	597	50	61	3800

Note: - Linear Velocity = Volume (m³/s) ÷ Filter Cross Sectional Area



Take your design airflow and select a filter or combination of filters from above for 0.1 seconds dwell time. For greater dwell times divide your airflow by 2 for 0.2 seconds by 3 for 0.3 seconds and so on and reselect the filters.

For increased dwell times filters can be used in series or parallel, when used in parallel pressure drop decreases and in series it increases.

MIXED MEDIA & CARBON FILTER SOLUTIONS

ACTIVATED CARBON

Activated carbon has been utilised for many years to reduce fumes and gases from the air. Currently, a wide range of carbons is available for this purpose in the continuous battle against the emission of unpleasant or even dangerous odours and fumes from a wide variety of sources. The ever-increasing awareness of this problem by public health authorities and environmentalists has resulted in a corresponding increase in the use of activated carbon filters.

The type of carbon most commonly used in the H & V Industry is grade 207C. A large variety of other activated carbons are available some of which are specially impregnated for particular applications.

APPLICATIONS

Media adsorption filters are desirable in many installations where airborne odours, chemical or toxic fumes are present and need to be reduced or eliminated. The carbon and other medias will adsorb the chemical molecules in the airstream in varying degrees according to the particular contaminants involved and the type of filter material utilised. It may be interesting to note that, when activated, one gram of carbon can have a surface area of approximately 1000 sq.m.

Incoming air at city offices, industrial plants, airports, art galleries, museums etc., can be purified by passing it through carbon units fitted in the system. Also air from kitchens, industrial processes, sewage plants etc., can be extracted through activated carbon before entering the atmosphere, greatly reducing its impact on the environment and enabling it to comply with pollution regulations or focal authority requirements.

PERMANENT SUSPENSION

Activated carbon and other media in loose form can present problems in any installation since there is a tendency for the granules to move against each other causing bedding down, which produces dust and can also allow by-pass to take place. However, permanent suspension panels that are utilised throughout our range have the granules held together by a patented bonding process, and incorporate a non-woven fabric on both faces. This construction eliminates the problems described above, and produces a homogeneous biscuit of consistent quality with dimensional stability, thus producing an even resistance across the panel.

DESIGN CRITERIA

In order that a media filter may operate satisfactorily certain criteria have to be met which do not apply to particulate filters. The most important aspect is the dwell time (i.e. the period of time the air is in contact with the media) which in many applications is recommended to be at least 0.1 seconds. This equates to a face velocity of 38 fpm

(0.19 g m/s) when using a standard 1" (25mm) nominal thickness panel. However, the dwell time can vary with different applications and in some cases needs to be considerably increased. As can be seen from the face velocity quoted above, a much larger panel area is required for a given air volume than is needed for a particulate filter. For this reason carbon / mixed media cells, rather than panels, are nearly always required in order to maintain a reasonable duct size in relation to the air volume being handled. The cells contain a number of panels in 'V' formation to give an extended surface area.

As far as possible water vapour should be removed from the airstream to eliminate possible condensation within the filter that could cause porous blockage and possible breakdown of the biscuit. Porous blockage will tend to nullify the adsorption effect and cause a dramatic increase in air resistance (this also applies to media in loose form). However, conditions as high as 80% RH are normally acceptable provided no interstitial condensation takes place.

Airstream temperatures entering the filter in excess of 40C (104F) should be avoided if possible. If temperatures in excess of this figure are anticipated, steps should be taken to reduce the temperature to an acceptable level e.g. with fresh air bleed, cooling coil or heat exchanger, to prevent any regeneration taking place.

NOTES ON USE AND SELECTION OF MEDIA PANELS AND UNITS

(a) Permanent suspension panels are normally supplied fitted with an aluminium frame and can be made to any reasonable size to replace existing panels of all makes.

(b) As a guide, a 1" nominal thickness panel should be selected to have a window velocity not exceeding 38 fpm (0.19 m/s) i.e. a 24" x 24" x 1" nominal panel will handle up to l32cfm (0.06m/s).

(c) Some processes give off large amounts of smoke, which is extremely detrimental if allowed to reach the media filters. In many cases this can be overcome by the use of a good quality pre-filter. This will also protect the media from particulates that will block the microporous structure and prevent adsorption taking place.

(d) Modules can be 'tailor-made' to any reasonable size to fit ducting, air-handling units etc.

PRE-FILTERS

Since carbon and other media filters remove odours by adsorption, any build-up of dirt or grease on the filter face will result in the blanking or encapsulation of the open porous structure and will inhibit or totally destroy the process.

It is therefore essential that a suitable pre-filter is provided to protect the media filters, and this should be of the highest grade economically viable.

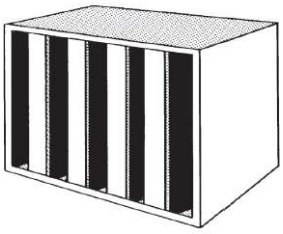
The pre-filter would normally be a panel or bag with a minimum performance of EU3 to Eurovent 4/5 (although an absolute or electrostatic filter may be required in some applications). We do not consider a glass panel to be suitable.

In kitchen extract or similar applications where grease is present, a high efficiency or electrostatic filter should be fitted before the media system, which should be as far as possible from the air inlet. All pre-filters should be checked regularly and replaced if necessary.

NOTE: We cannot stress sufficiently that every effort should be made to ensure that grease and smoke particles are prevented from reaching media filters.

METAL CASED 'MODULES'

The metal cased 'Module' cells have the highest possible loading with heavy duty panels permanently sealed into a galvanised sheet steel casing. This construction gives a very strong unit capable of handling large air volumes, or where conditions dictate, increased contact time. The advantage of this unit is that with the panels sealed in, there is no possibility of air leakage within the cell.



Also, these units can be manufactured to almost any reasonable size, the limiting factors being overall weight for handling purposes, and the size of individual panels. They can therefore be 'tailor-made' to fit air handling unit's etc. When the unit has finished its useful life it is discarded and replaced with a complete new cell.

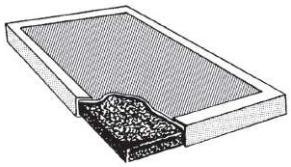
Where points of discharge from extract systems are in critical locations with regard to surrounding buildings, consideration should be given to increasing dwell time accordingly.

Notes: Modules should be installed with panels vertical. For larger air volumes multiple cells should be used. 'Modules' with reduced carbon weights can be provided to match the carbon content of other manufacturers units where required. Non-standard sizes: These units can be manufactured to any reasonable size to suit individual requirements.

Module selection data

Application	Capacity
Canteens, normal kitchens and restaurants.	0.1 second dwell time
Kitchens producing large amounts of fried foods or concentrated cooking of burgers.	0.2 seconds dwell time.
Indian restaurants etc.(i.e. curry, spices etc.)	0.2 to 0.4 seconds dwell time.
Excess of onions or garlic smells from cooking	0.2 to 0.4 seconds dwell time
General air conditioning	0.075 to 0.1 seconds dwell time
Specialised applications (chemicals, etc.)	Refer to PA. Obtain concentrations and chemical details (formulae) where possible

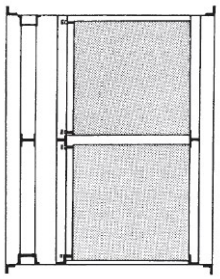
CARBON PANELS



Our unique patented bonding system produces carbon biscuits of consistent quality which are dimensionally stable and dust free. The biscuits incorporate a non-woven fabric on both faces and all edges, are normally supplied fitted into an aluminium channel frame.

Galvanised or stainless steel frames can be provided if required, or the biscuit can be supplied unframed. These panels can be manufactured to any reasonable size and in a range of densities and thickness'.

SIDE ACCESS CASINGS ('MODULES')



Side access casings to house 'Modules' are available for single or multiple cell applications, with access on one or both sides as required.

For single cell installations, the casing consists of a galvanised sheet steel casing with either sheet or proprietary type flanges. E.g. -MEZZ' or 'Ductmate'.

The cell sits against an angle frame within the casing, which is fitted with a neoprene seal. An additional frame at the inlet to the filter has jacking bolts to push and hold the 'Module' against the seal. Pre-filter slides are also provided where required. For multiple cell installations we recommend that, due to the weight of the 'Modules', a heavier construction casing is provided.

Our standard multiple unit consists of 1.5mm GSS casing with a standard mez type flanging system on each end. Flanges are: 20mm, 30mm or 40mm depending on size of unit all built to DW144 with a 3mm thick rigid shelf welded to the casing. This gives a very rigid internal structure which avoids distortion of the casing.

The shelf is provided with 'jacking' bolts to push the 'Module' against the sealed frame on the outlet. Pre-filter slides are provided when required. On multiple cell casings separate access doors for the 'Module' and pre-filters are normally provided.

UV-C Range

Our UV-C (short-wavelength ultraviolet radiation) technology is based on the synergy which occurs when ozone and ultra violet light are combined.

KEY FEATURES

- High efficiency UV-C technology
- Reduces the need for duct cleaning
- Can reduce cooking odours by up to 90%*
- Designed to complement our ESP system

Each individual unit sits directly in the air stream of the kitchen extract duct and can feature from 8 to 24 high output UV-C lamps supplied in modules of 8.

The number of moduals specified will be dependent on the cooking process coupled with the air flow volume which will dictate the amount of ozone needed.

The ozone combined with hydroxyl free radicals, both highly reactive oxidants, act to oxidise odours and grease, permanently destroying and altering the molecular structure of the compounds.

Our UV-C range incorporates:

- UV-C lamps shielded by their module to reduce the collection of grease on their surface thus extending their optimum efficiency.
- The ability to provide the units in simple format or fully monitored with each module of lamps able to provide a local alarm or a BMS signal if in fault.
- Exact sizing in line with our ESP range so that they can be bolted together for a uniform modular appearance.

Technical Specification

	UV-C 1500	UV-C 3000	UV-C 4500
Electrical Supply	220/240V 50Hz	220/240V 50Hz	220/240V 50Hz
Power Consumption *	560 Watts	560 to 1120 Watts	1120 to 1680 Watts
Max Air Volume	up to 0.7m³/sec	up to 1.4m³/sec	up to 2.1m³/sec
Dimensions	450 L 630 H 640 W	900 L 630 H 640 W	1350 L 630 H 640 W
Weight	43kg (APPROX)	66Kg (APPROX)	89Kg (APPROX)

**Each rack is 560W (8 lamps)*

APPENDIX 4 – PURIFIED AIR UV-C DATA SHEET

Grease, Smoke and Odour

For optimum performance we would recommend between 2 & 6 seconds of dwell time to allow the ozone to work effectively upon the malodorous gasses within the duct.

When installed correctly our UV-C systems can reduce cooking odours by up to 90%**

This unit's tried and tested UV-C technology allows for the siting of commercial kitchens in locations such as residential areas and shopping centres, where previously planning permission would not have been granted. After extensive research and development Purified Air are able to devise the best combination of lamps at different wave lengths, which when combined with the photo catalytic liner provides the most effective odour control.

*** With high thresholds of odour, high levels of odour control are only achieved by using good quality particulate control systems (ESP's) as well as supplementary odour control systems.*

purified air since 1984

Purified Air Limited, Lyon House, Lyon Rd, Romford, Essex RM1 2BG England
T: 01708 755 414 | F: 01708 721 488
enq@purifiedair.com | www.purifiedair.com