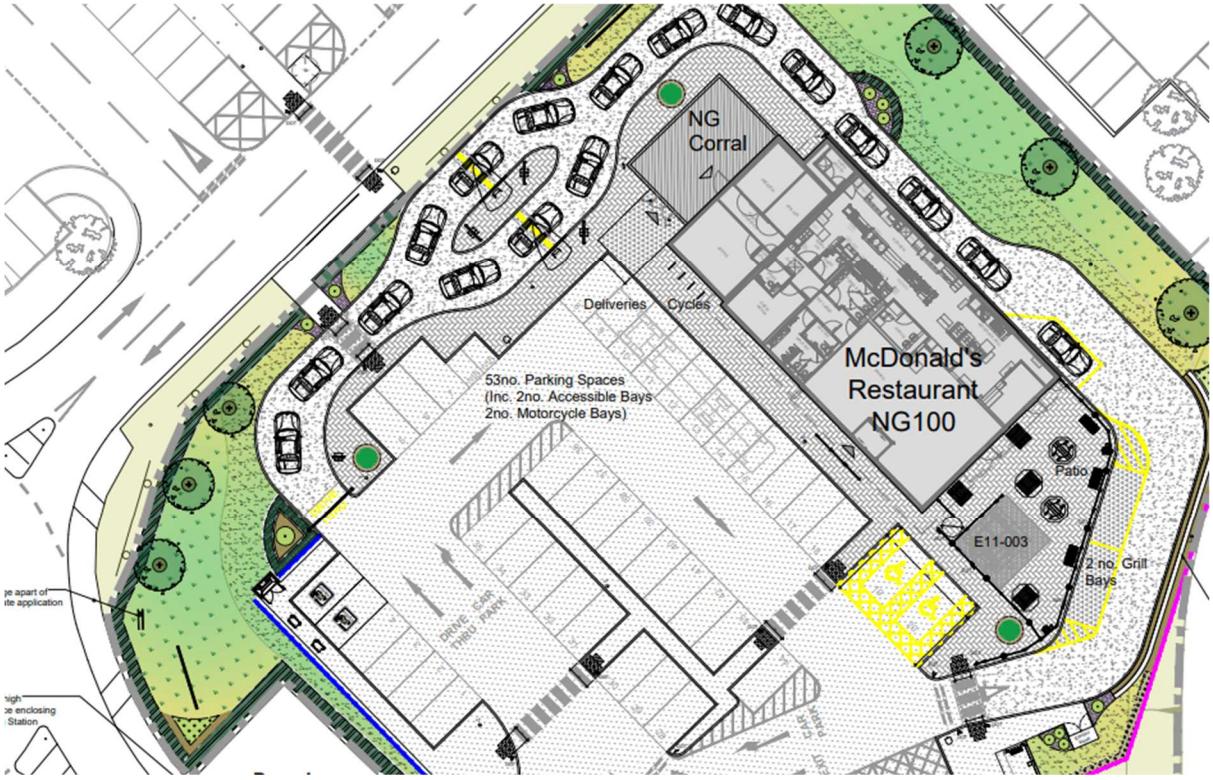
Odour Control Assessment

For

McDonald's Restaurant

Churnet Way, Leek

Rev 00



Client:
McDonalds Restaurants Ltd
11-59 High Road
East Finchley
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Revisions

Reference	Revision	Date

1 Introduction

This report provides an odour risk assessment for the new proposed McDonald's restaurant at Churnet Way, Leek. 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The EMAQ+ Guide was published in 2018 to supersede the original DEFRA (2005) document which was officially withdrawn in September 2017.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 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Technology/NETCEN (EMAQ+) has been published to supersede the original DEFRA (2005) document which was officially withdrawn in September 2017.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however it is widely regarded by Planning Authorities as an acceptable updated alternative to the original withdrawn document.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 Regulation Governing Design and Performance of Ventilation Systems

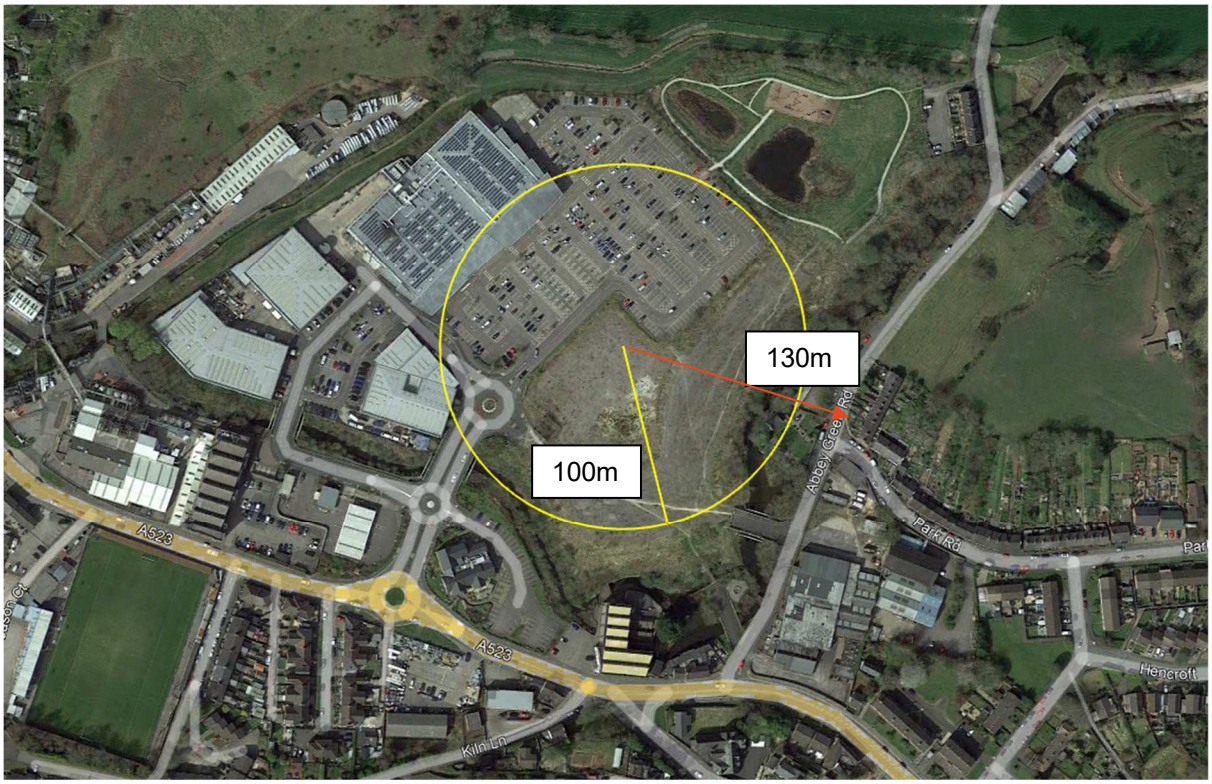
There is no legislation directly governing the design and performance of commercial kitchen ventilation systems. However other regulations do exist protecting the health and safety of the employees, food safety, and local amenity. There are numerous sources of guidance and industry standards available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

The proposed development is located attached to the car park of Sainsbury's superstore in Churnet Way. The closest sensitive receptors are residential properties located at a distance of approximately 130m to the east of the restaurant.

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 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.
- 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 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 10m/s.
- MODERATE (10) – Discharging 1m above eaves at a rate of 10-15m/s.
- GOOD (5) – Discharging 1m above ridge at a rate of 15m/s or more.

These guidance classifications relate to a typical High Street situation with a pitched roof building and the relationship of the point of discharge to the eaves and ridge of the pitched roof. The drivers for these scores are the relationship of the point of discharge to a physical obstruction and the effects on wind generated air movement around the building. A separation of at least 1m from the nearest roof surface is considered sufficient isolation from the wind generated high velocity surface boundary layer. A discharge at least 1m above the ridge is considered also to provide isolation from any negative effects of wind turbulence caused by the obstruction.

The above principles can be applied to the proposed flat roofed building with roof level plant screens by considering the relationship of the point of discharge to the surrounding surfaces and the likely effects on air movement over the building. In comparative terms, the plant screen is considered as the roof ridge and the flat roof at a distance from the plant screen is taken as eaves level.

Air extracted from the kitchen at this restaurant will be discharged vertically via a single high velocity terminal located at least 1m above the flat roof ‘eaves’ level and level with, but at distance from the plant screening. The risk rating for dispersion at the proposed restaurant is therefore described as ‘moderate’.

6.1 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 this restaurant for the proximity to sensitive receptors is judged to be 'far' as there are no residential or sensitive properties within 100m from the exhaust point.

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.

The number of meals served at this restaurant classifies 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.

Under the current guidance McDonald's Restaurant's would be classified with a score of 10.

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		**26**	

The overall odour risk rating of the restaurant is just within the 'High' category, largely due to the type of cooking and the wish to keep the extract discharge duct no higher than the roof plant screen for aesthetic purposes and not due to the proximity of nearby sensitive receptors. The above score just over the threshold into the high category results in a recommendation of a high level of odour control as defined by the Guides to minimise the risk of odour impacts.

7.0 Guide 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 1m above the roof ridge of any building within 20m 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 Proposed Odour & Grease Abatement Measures

8.1 Context

This section of the report describes the proposed odour control measures for this restaurant with the particular site specific odour risk factors, using the assessment and control techniques from the Guides, to minimise the risk of odour impacts giving cause for complaint at surrounding properties.

Based on the recommendations and approaches identified in section 6 and following discussions with McDonald's Restaurants Limited and their construction development team, the following combination of odour abatement measures have been selected as the most appropriate solution for this situation.

The kitchen extract schematic shows the arrangement of proposed grease and odour control system.

8.2 Canopy Filtration

Each item of cooking equipment (fryers and grilles) has local fume extraction by means of a low level extract canopy containing McDonald's standard built-in 'Hikatch' stainless steel, removable and cleanable grease filters, which remove 98% of airborne grease at source.

Extract air volumes are controlled to within the effective grease removal range of the filters established by tests carried out at McDonald's testing facility in Rugby.

8.3 Odour & Grease Treatment

'High' classification grease and odour removal will be provided with the use of electrostatic precipitation (ESP) filters followed by ozone injection.

Fine filtration will be provided by double banked Purified Air ESP4500 electrostatic precipitator filters. This size of unit in this double banked configuration have a rated extract airflow capacity of 4.2m^3/s, which gives a utilisation factor of 67% to 88% at the actual design air volume flowrate of 2.8m^3/s to 3.7m^3/s. This effective oversizing of the ESP filters results in improved particle removal and retention properties improving the system efficiency and both initially and throughout the operating periods between services.

Ozone injection will be provided with 2No. Purified Air UV-O1000 ozone generator units, with ozone laden air discharged into the exhaust ductwork immediately after the electrostatic precipitator and before the kitchen extract fan. The ductwork will be configured to ensure a minimum 2 second ozone contact period before discharge to atmosphere. The UV-O1000 ozone generators are each rated for a maximum air volume flowrate of 2.0m^3/s. The use of 2 units gives a capacity is excess of that required for the design exhaust air volume flowrate. Each UV-O will be fitted with 2No. 6 lamp modules giving 12 lamps per unit. The units are each capable of accepting 1 or 2 6 lamp modules.

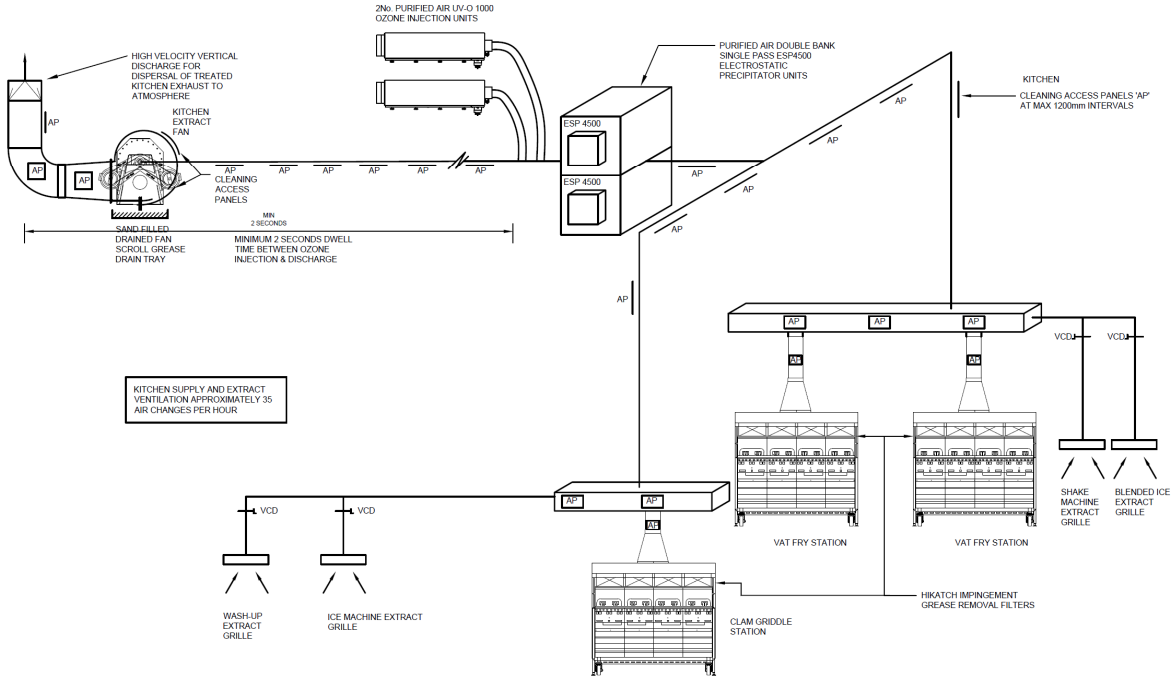
An ESP common fault alarm will be provided to indicate an ESP or ozone generator fault via building's BMS controls system and with an audible mutable alarm in the manager's office.

8.4 Discharge Arrangement

A common ducted extraction system is connected to a backward curved centrifugal extract fan which discharges to atmosphere via an un-restricted vertical high velocity discharge at 15 m/s at nominal design air volume flowrate, to provide effective dispersal of the exhaust air.

The discharge point will be in excess of 1m above eaves level and level with, but at a distance from, the top of the roof screening to achieve good dispersion without being impacted by any wind generated high velocity surface boundary layer effects whilst keeping the discharge duct below the level sightline.

8.5 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.

Ozone generators are serviced annually,

Electrostatic precipitator filters are serviced every two to three months.

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 in this situation a 'High' level of odour control is recommended as defined by the EMAQ+ Guide.

The proposed grease and odour control measures meet the requirements of the 'High' classification control band, with active control systems selected comfortably within their recommended operating capacity ranges.

APPENDIX 1 – PURIFIED AIR ESP DATA SHEETS

Our ESP Range

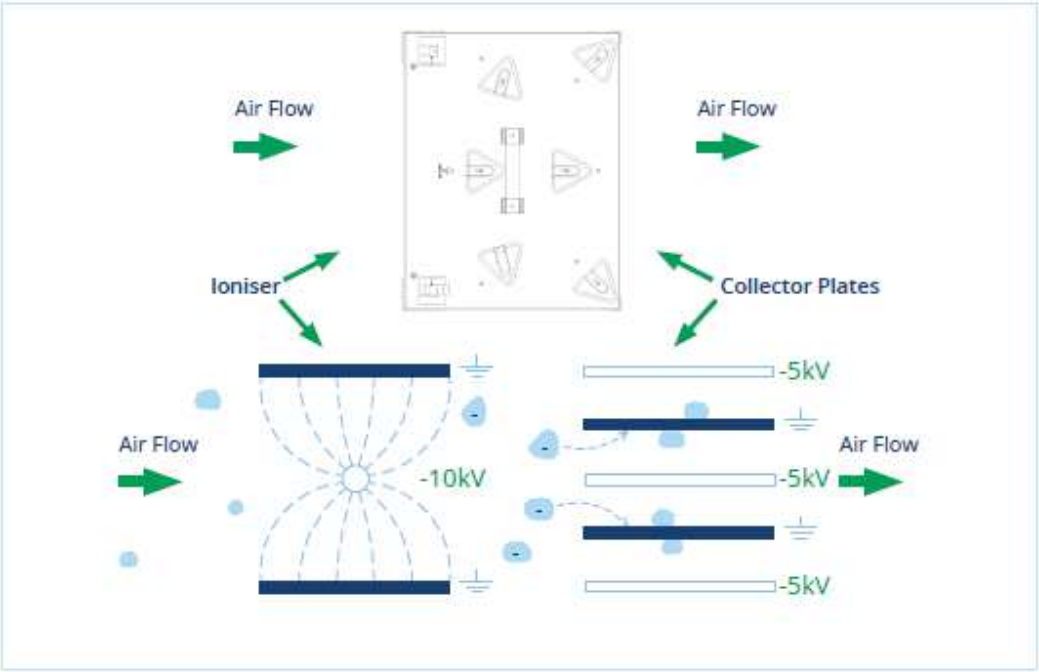


ESP 4500

- 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 1 – PURIFIED AIR ESP DATA SHEETS

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

purified air since 1984

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UV-O Range

Unlike other UV-C systems, our UV-O units are located outside of the kitchen extract duct and are connected via a spigot and spiral ducting.



KEY FEATURES

- Easy to install
- Can be retro-fitted into existing duct
- Virtually no pressure loss
- No monthly maintenance needed

Our UV-O range includes:-

- UV-O 500 which handles up to 1 m^3/sec of air flow
- UV-C 1000 which handles up to 2 m^3/sec of air flow

The UV-O 500 has been designed for smaller capacity commercial kitchens.

The UV-O range uses UV-C technology to produce ozone and hydroxyl free radicals to oxidise cooking odours through a process of ozonolysis.

Unlike other UV-C systems, our UV-O units are located outside of the kitchen extract duct and are connected via a spigot and small diameter ducting.

Although it is widely accepted that the best way to apply UV-C light is directly in-line with the air stream itself, performance will be impacted as the lamps get dirty.

With our UV-O units the air flow does not come from the exhaust duct but from the ambient air around the unit, which is filtered on entry. This means that it is able to provide a uniform supply of ozone and hydroxyl free radicals into the extract system with an extremely low pressure loss.

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.

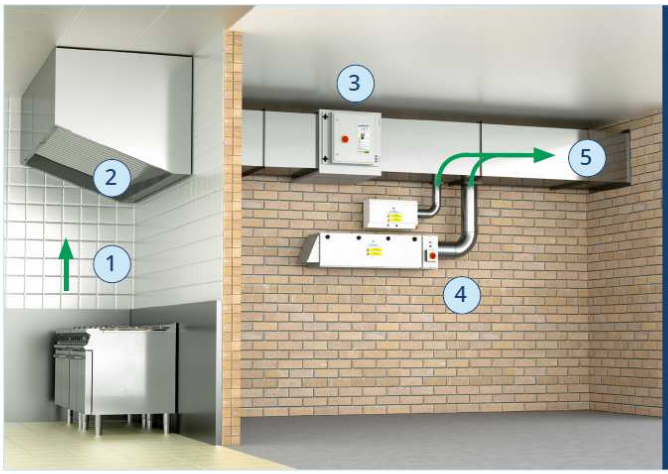


UV-O 500 Unit



UV-O 1000 Unit

APPENDIX 2 – PURIFIED AIR UV-O DATA SHEETS



1. Cooking particulates and odours
2. Canopy Grease Filter
3. ESP - Particulate Control Unit
4. UV-O 500 (above)
   UV-O 1000 (below)
   Odour Control Units
5. Ozone joins airflow

Technical Specification

	UV-O 500	UV-O 1000
Electrical Supply	220/240V 50Hz	220/240V 50Hz
Power Consumption	120 Watts	700 Watts
Max Air Volume	up to 1m³/sec	up to 2m³/sec
Dimensions	W 605mm H 300mm D 200mm	W 1568mm H 350mm D 363mm
Weight	10.5Kg	50Kg

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 may not have been granted. After extensive research and development Purified Air are able to devise the best combination of lamps to provide the most effective odour control.

Safety

Ultra-Violet band C light is the most powerful of the three bands, it is a very strong oxidant and as such exposure to UV-C light is dangerous. To ensure safety the UV-C lamps are secured behind locked panels and the system has been engineered to shut down automatically when these panels are unlocked. However, since the lamps typically have a minimum life of twelve months and with the system able to operate at optimum efficiency even if one lamp fails it is unlikely that, apart from routine servicing by experienced engineers, that the system will ever need to be opened.

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APPENDIX 3 – INDICATIVE ODOUR CONTROL LAYOUT DRAWINGS

