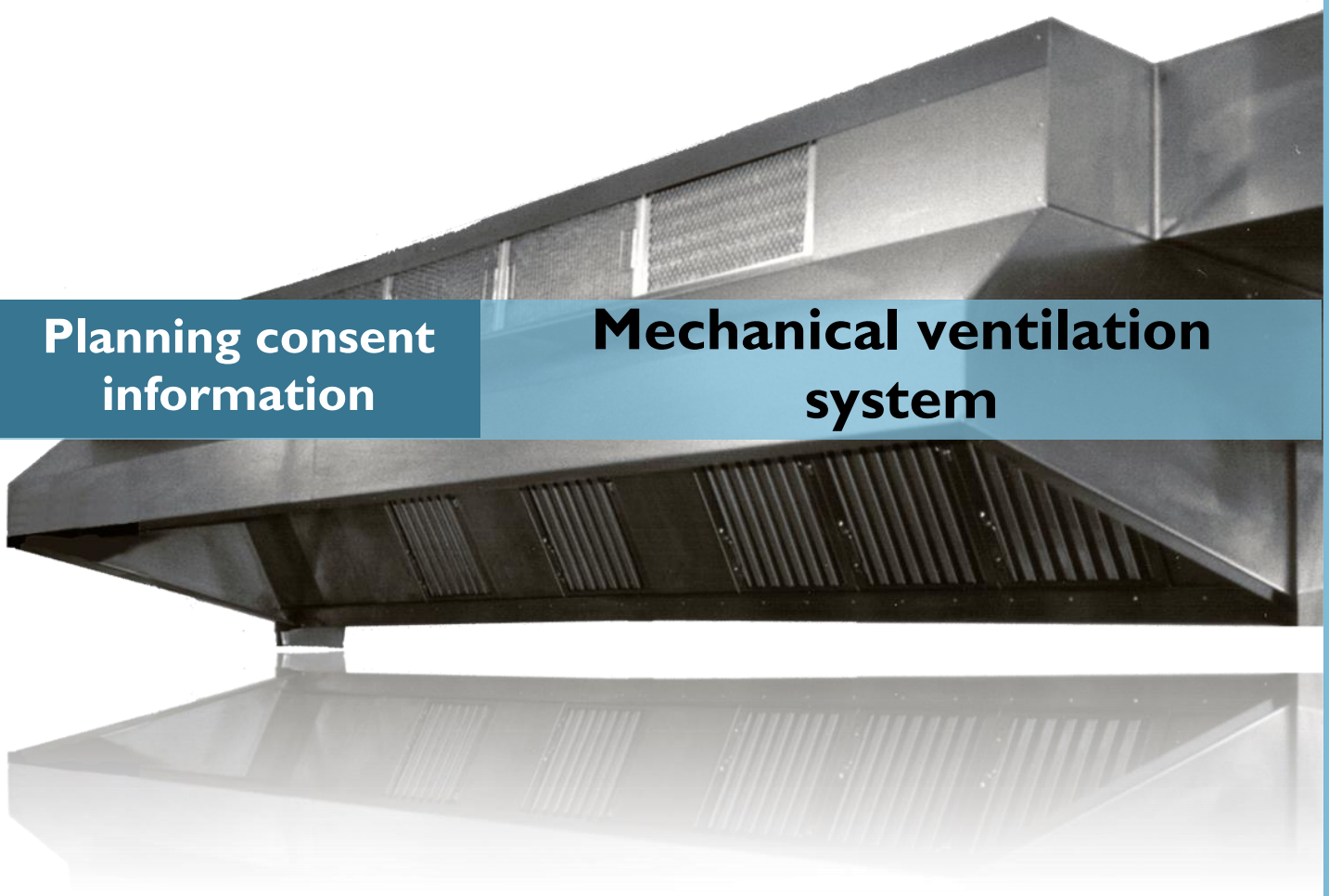
FAR EAST
威遠企業 KITCHEN SOLUTIONS

26 March 2025



Planning consent information

Mechanical ventilation system

Mr Huang

14 Market Street, Huddersfield

EXECUTIVE SUMMARY

A. SITE ADDRESS

14 Market Street, Huddersfield HD1 2ET

Access from Sergeantson Street

B. SURROUNDING AREA

Town centre, commercial with some residential usage. Several kitchen extraction systems in the vicinity.

C. SYSTEM SUMMARY

A high velocity, high dilution system will be utilised as it is the optimum solution for dealing with the high levels of grease laden hot air. The system has design features to minimise its odour, sound and visual footprint on the surrounding area.

Canopies are fitted over all steam, grease and heat producing equipment and fresh air inlets are provided to the kitchen area.

To avoid any odours becoming a nuisance they are first diluted with fresh air and the grease removed from extracted air by means of baffle filters fitted in the canopy. The primary system also utilises an ultraviolet ozonolysis system to neutralise any malodour – the efficacy of O_3 is very high and especially suited to this high air volume application. The secondary system uses activated carbon to absorb malodour as the extract air volumes are lower. Both systems then exhaust vertically 1m above eaves.

To attenuate noise, fans are mounted on anti-vibration rubber mouldings and connected to the ductwork by means of flexible connectors. Silencers are fitted behind the extract fans to prevent noise travelling through the ducting and air stream.

Please see 3) General arrangement for a specification summary of equipment fitted and system diagram

CONTENTS

1) COMPANY INTRODUCTION

Far East Kitchen Solutions was formed in 1983, originally selling catering equipment to the then developing Chinese takeaway and restaurant industry. We've been designing and building extraction systems for highly demanding applications for over 20 years.

We've earned a reputation with local authorities and planning departments for delivering ventilation systems which can meet stringent noise, odour and visual intrusion regulations. Our customers value the careful design and high reliability of our extraction solutions.

Our engineers compute air change needs, model air flow through the kitchen, and then create a high-velocity, high-dilution system (HVHD) which meets environmental requirements, delivers the necessary extraction power and provides high reliability. We then fabricate the canopy and ducting at our factory before installing the system on site.

The majority of commercial kitchens also require a gas interlocking system (G.I.S) by law, which we also implement for both new and existing ventilation systems.

2) SITE DESCRIPTION AND SURROUNDING AREA

14 Market Street is a mirrored L shaped building when viewed from the front elevation and is surrounded by roads on 3 sides. It is located within the town centre of Huddersfield. To its left (South) immediately adjoining is a supermarket with a roof top car park, to it's right (North) is Fox Street where the buildings have a variety of commercial uses. The rear elevation has a car park opening on to Sergantson Street that has a 5 storey commercial building opposite. Directly opposite frontage across Market Street is a signalised road junction with wide visibility splays and 3 storey buildings set back from the road, again the usage here is commercial.

It is a busy area with a high existing background level thanks to motor traffic

3) GENERAL ARRANGEMENT

Because of the high levels of cooking oil vapours and very high temperatures associated with stir-fry cooking, the system requirements can be assumed to be in a class of their own. This is also results in a high ambient temperature within the kitchen.

When designing the extraction system for this particular application, our designers haven take account of the hundred of air changes per hour, how the air flows through the kitchen and the amount of heat it must carry away from the work area.

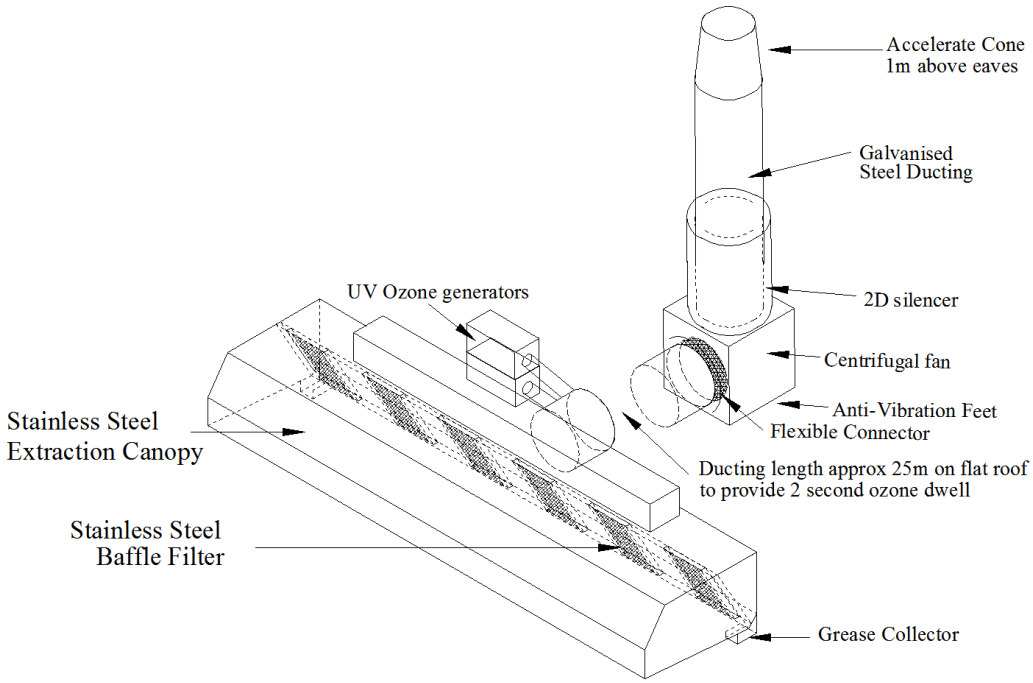
The kitchen area shall have a mechanical forced air system, with a wall mounted canopy arrangement over the main grouped cooking equipment. The extract system shall have an on/off speed controlled sited within the kitchen area to suit site and operatives requirements. The canopy shall be sited over the grouped cooking range of equipment. Front of house has a secondary system utilising an island canopy over the limited cooking equip,ent.

See overleaf for specification summary of equipment fitted and system diagram

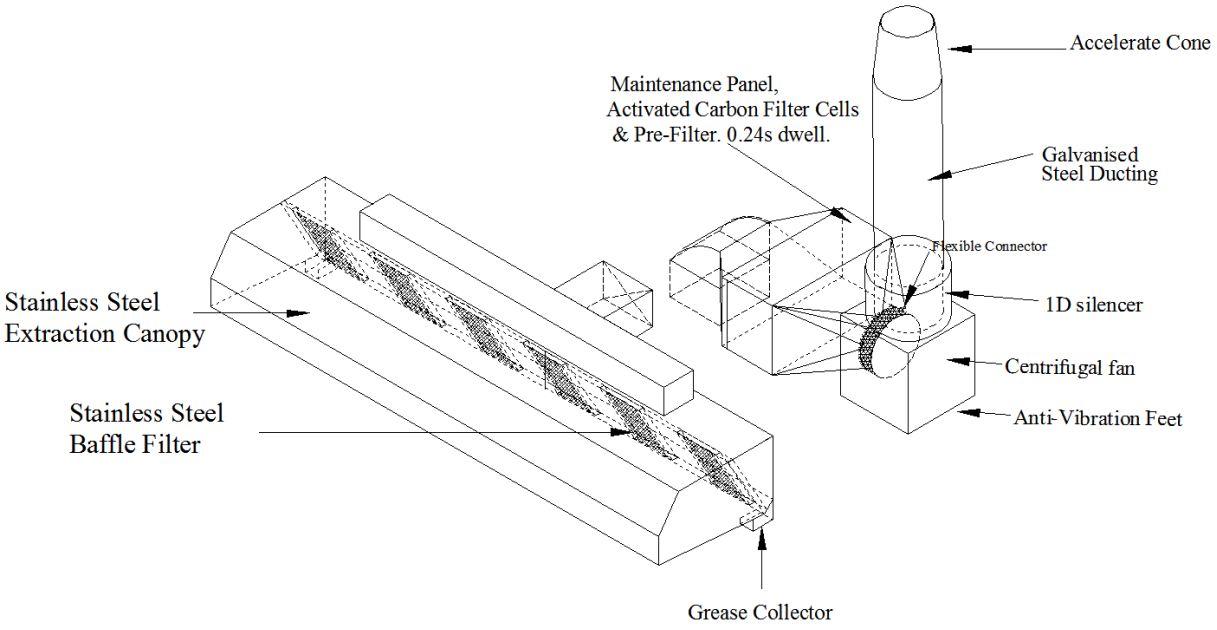
SPECIFICATION SUMMARY FOR BOTH CANOPIES

Dimensions	
Fresh air inlet	2 mechanically assisted
Number of canopies/systems	2
Length of canopies (m)	9.5 prime cooking & 3.5 secondary front-of-house
Number of canopy filters	13 & 5, baffle type
Nominal extract duct Ø (mm)	710 primary, 400 secondary, or rectangular equivalents
Additional odour control	
Primary canopy: 2x UVO1000 Ultraviolet ozone generators (out-of-airstream type) Secondary canopy: 1.5x Activated carbon units with G4 pre-filter providing >0.24s dwell time	
High level discharges with truncation at termination point, 1m above eaves/ridge	
Noise attenuation measures	
Fan mounting type	Rubber-in-shear isolation mounts
Fan connection to ducting	Flexible connectors on intake side of case
Silencers	2 inline cylindrical, 1 mounted aft of each extract fan to match duct or fan outlet
Support brackets	Walls: Cantilevered angle iron with rubber backing, connection with duct ring to use rubber isolation mounts Ceilings: Suspended by screwed rod Roofs: H frame struts on rubber mats
Fire prevention and mitigation features	
Canopy filters	Baffle type, flame arresting to DIN 18869-5 (2007-2008)
Grease drains	Located at each low point of the duct work
Inspection hatches	Every 2 metres
Visual impact reduction	
Duct routing and plant equipment	Across flat roof of ground floor, screened from 3 sides by first floor and pitched roof
For full specifications of the equipment to be installed, please see the relevant sections within this report	

SYSTEM DIAGRAM: PRIME COOKLINE CANOPY



SYSTEM DIAGRAM: SECONDARY FRONT-OF-HOUSE CANOPY



4) GREASE EXTRACTION

A) OBJECTIVES

To provide an acceptable working environment for all kitchen staff by the extraction/removal of heated air, fumes, steam and cooking smells, as well as preventing condensation. The extraction canopies are designed to enable ease of access for cleaning throughout the system and distribution ductwork and primary fan equipment.

I) DW172 METHOD 1 THERMAL CONVECTION

PRIME COOKING CANOPY

Appliance	**Width x Depth = Area**			**x Coefficient**	**Flow rate**
Type	*mm*	*mm*	*m^2*	*m^3/s per m^2*	*m^3/s*
Combi steaming oven (10 grid)	1100	1100	1.21	0.45	0.54
Wok range (3f,2r)	1475	800	1.18	0.9	1.06
Wok range (3f,2r) turbo	1475	800	1.18	1	1.18
Deep fat fryer x4/5 gas	2000	580	1.16	0.75	0.87
Stock pot x2	1200	600	0.72	0.35	0.25
4 ring oven range	600	750	0.45	0.4	0.18
Duck oven	1050		0.87	0.25	0.22
					4.31
Overhead wall canopy open ONE end, factor:				1.2	**5.17**

Minimum canopy width inc. 250 overhangs: 9400

FRONT-OF-HOUSE SECONDARY CANOPY

Appliance	**Width x Depth = Area**			**x Coefficient**	**Flow rate**
Type	*mm*	*mm*	m^2	m^3/s *per* m^2	m^3/s
Dishwasher	600	600	0.36	0.4	0.14
Teppanyaki grill (chrome)	1100	1000	1.10	0.45	0.50
Dim sum warmer (atmopsheric steamer)	1000	1000	1.00	0.35	0.35
					0.99
			Island canopy open both ends, factor:	1.35	**1.34**

Minimum canopy width inc. 250 overhangs: *3200*

B) HIGH VELOCITY, HIGH DILUTION (HVHD)

To solve the problem of filtration and extraction of grease, we will utilise the High Velocity High Dilution (HVHD) approach, as it offers reasonable efficiency and requires only minimal maintenance.

The principle is simple, dilute cooking odours with large amounts of fresh air, pass it through grease filters located in the extraction canopy and then force it in the atmosphere at speed.

With an efficient HVHD system, it is possible to achieve 85% filtration through the initial baffle filter stage, and a further 5 to 10% thanks to the centrifugal action of the fan, which causes vapours to condense on the inside of the ducting and drain back to collection points on the canopy. Therefore, only 5-10% of the grease originally present in the extract air is exhausted in to the outside atmosphere.

C) FRESH AIR INLET

The air extracted from the kitchen via the extraction system will be replaced with approximately 85% of the total airflow through a fresh air inlet, the balance being infiltrated from the adjacent area. It is necessary to retain some negative pressure in the kitchen area to avoid turbulent air currents and eddies, which would result in localised areas not receiving adequate air flow. The lack of a fresh air inlet would also force the extractor fan to work harder, reducing system efficiency and shortening the working life of the motor.

The system will comply with required number of fresh air changes detailed in HVCA DWW172 and DEFRA's "Guidance on the control of odour and noise from commercial kitchen".

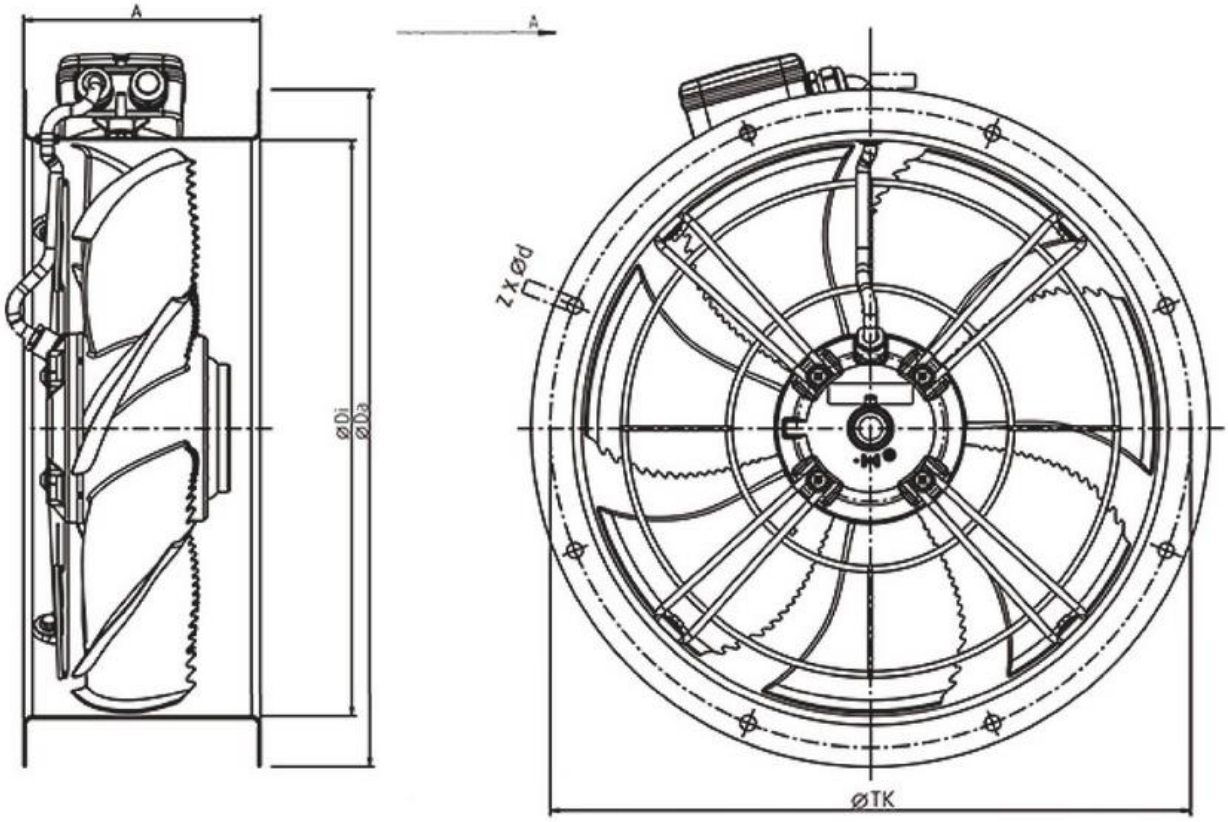
To ensure the quality of fresh air entering the kitchen washable air filters will be installed, to prevent the ingestion of insects, dust, leaves and other detritus in to the kitchen area.

Owing to the accessibility of fresh air for the kitchen, we have elected to use ***an additional fan to mechanically input air to the kitchen***, which will ensure sufficient throughput.

I) INTAKE FAN SPECIFICATION PRIMARY CANOPY: SYSTEMAIR AR630DV SILEO

A short case, axial, sickle bionic serrated aerofoil fan manufactured by Ziehl Abegg. This variant has been specifically selected for its low operating rpm (standard axial fans of this size usually run at ≈3000 rpm), made possible by a 4 pole motor, which reduces operating noise. The casing is powder coated to black RAL9005. It has a maximum operating airflow temperature of 60c°.

Case		Ø 630, short
Speed (rev/min)		1350
Motor type		3φ, 4 pole, 415V
Motor rating (kW)		2.0
Blades		6, sickle
Full load current (A)		3.4
Speed controller		RTRD 7
Sound level (dB(A) at 1 m from source)		78
m^3/s at Pa (static)	**0**	4.42
	50	4.23
	100	3.92
	150	3.6
	200	3.23
	250	2.18
	300	2.23



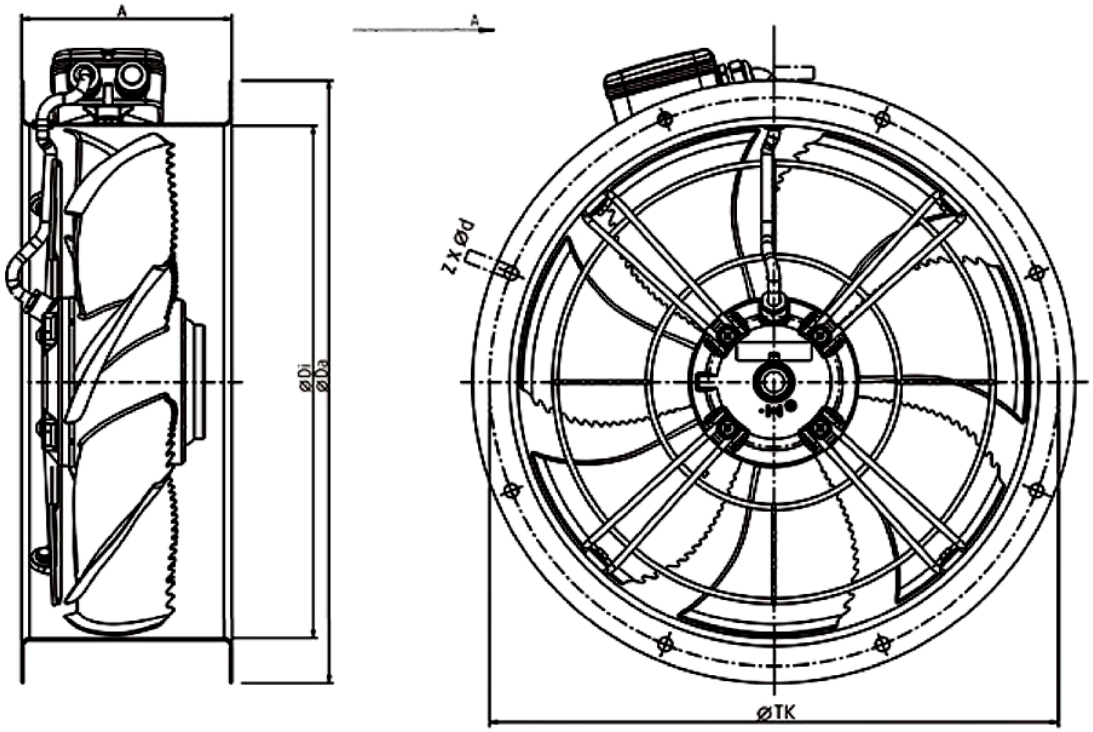
	A	ØDi	ØDa	ØTK	z x Ød
AR 630 sileo	235	634	720	690	12 x Ø11,5

II) INTAKE FAN SPECIFICATION SECONDARY CANOPY: SYSTEMAIR AR500E4 SILEO

A short case, axial, sickle bionic serrated aerofoil fan manufactured by Ziehl Abegg. This variant has been specifically selected for its low operating rpm (standard axial fans of this size usually run at ≈3000 rpm), made possible by a 4 pole motor, which reduces operating noise. The casing is powder coated to black RAL9005. It has a maximum operating airflow temperature of 70c°.

Case		Ø 500, short
Speed (rev/min)		1240
Motor type		1φ, 4 pole, 230V
Motor rating (kW)		0.8
Blades		6, sickle
Full load current (A)		3.2
Speed controller		EFSC6P / RTRE5
Sound level (dB(A) at 1 m from source)		66
m^3/s at Pa (static)	**0**	2.43
	50	2.18
	100	1.65
	150	1.24

Sound power level	Acoustic filter: No filter	63	125	250	500	1k	2k	4k	8k	Total
Outlet	dB	45	53	56	57	60	59	55	50	65



	A	ØDi	ØDa	ØTK	z x Ød
AR 500 sileo	205	503	590	560	12 x Ø12

D) CANOPIES

I) CONSTRUCTION

The extraction canopies shall be constructed from 20 gauge (0.9 mm thickness) stainless steel of type 304. All surfaces are satin polished to a 240 grit silicon finish with a clean-cut grain, resulting in a surface roughness of approximately 0.3µm Ra, which conforms to 2K under BS EN 10088-2 (under the depreciated BS 1449 Part 2 specification this was a № 5 finish). They are polythene protected during installation. All constituent parts are suitable for use in a working kitchen environment.

The canopies are cut, punched, folded into sub sections of up to 2400 mm in length and factory assembled by means of seam welds and non-visible mechanical fixings. All metal edges are rolled smooth and free from any sharp edges or projections.

The canopy's lower edge at each end and the rear is formed in to a condensation channel with inclined internal elevation to simplify cleaning requirements, and the inner edges have a crush folded safety finish.

II) LOCATION

The canopies will be sited over the cooking equipment, or any heat, steam or grease producing equipment.

III) SIZE

The canopies will overhang the cooking equipment by not less than 250 mm and will be mounted at a height no lower than 2000 mm from the finished floor level to the canopy underside. ***The length of the canopies is detailed in 3) General arrangement.***

IV) LIGHTING

The canopy is fitted with vapour proof IP65 rated lamps suitable for use in a damp atmosphere. The lamps are fitted with a tempered glass diffuser which is able to withstand high temperatures. Recessed lighting is preferred to bulkhead fittings, although both types may be utilised. Lighting within the canopy shall provide a minimum of 500 lux at the working surface with a colour temperature of around 4000K.

E) BAFFLE FILTERS

The main feature of HVHD systems is the grease separation qualities of the stainless steel baffle filters in the extraction canopy. Baffle filters enable the grease to be separated from the air stream efficiently using centrifugal force and then allow the accumulated oil to drain off to collection points at either end of the extraction canopy. Furthermore, they are easily accessed and removed for washing, sized to fit within a dishwasher for easy cleaning and durable enough to be used over many years. This ensures a high level of performance is retained throughout the life of the system.

The canopies will be fitted internal extract plenum(s) with grease filter cells

across their width. The filters are of sufficient size and number to ensure that the velocity though them does not lead to grease “carry over” in to the ductwork and onto the extraction fan.

The baffle filters have rigid frames in stainless steel and fit correctly into the holding frames to eliminate any extracted air passing around them. The location of the filters is such that they are not affected by the heat of wall mounted equipment, such as grills.

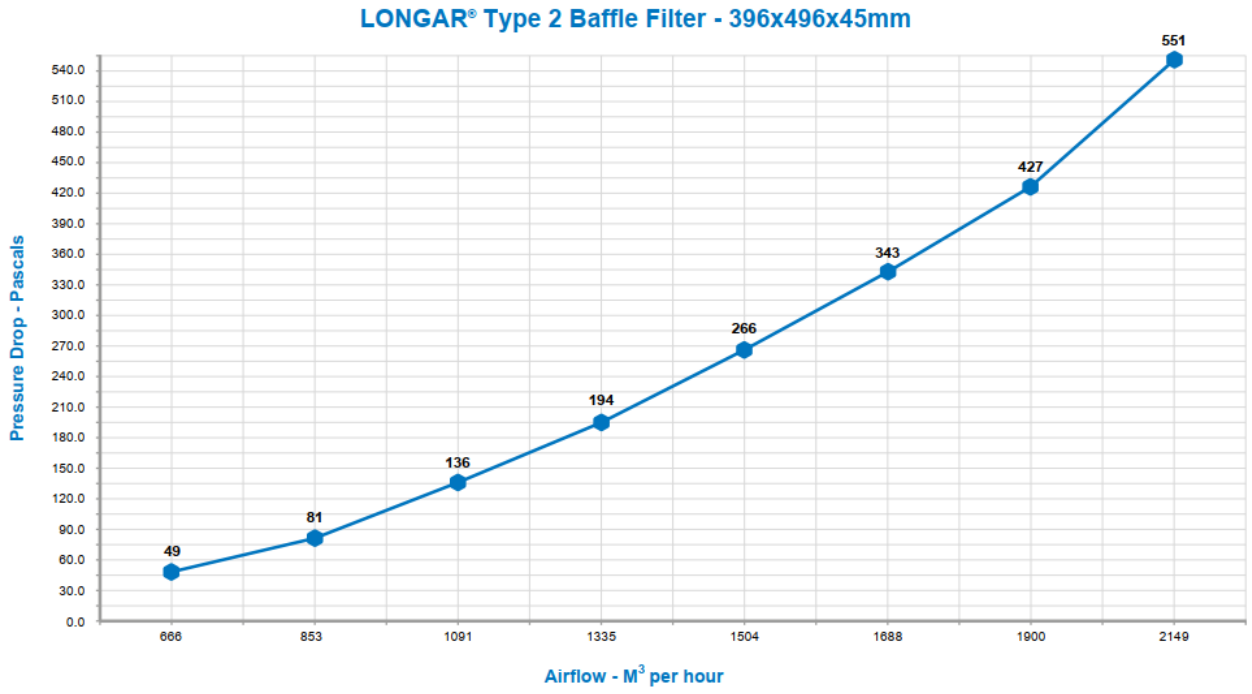
The baffle filters shall be flame-arresting and of filter class G2 or better.

We recommend baffle filters are visually inspected in-situ at the end of each kitchen shift. They should be washed if necessary and always at least weekly.

I) LONGAR AIRGARD TYPE 2 PREMIUM BAFFLE FILTER

The number of Longar Airgard Type 2 baffle filters fitted is detailed in 3) General arrangement

- Rolled 430 polished stainless steel section with a polished finish, safety edge on frame and blades
- Fully welded construction, suitable for operation up to 400°c.
- Folding handles to assist in removal and installation
- Dishwasher safe
- Grease drainholes to stop the build-up of grease in the filter
- High grease filtration efficiency thanks to blade design and spacing achieving Clsas G2
- Heat, flame and greaseproof (compliant with DIN 18869-5 (2007-2008))
- Dimensions (HxWxD) 495 x 395 x 45 mm



Part Number	Actual Size HxWxD	Nominal Size HxWxD	Weight	Filter Free Area
TYPE2ST20X16X2	496 x 395 x 45mm	508 x 406 x 50mm	1.93kgs	0.12m²
	19.53 x 15.55 x 1.77"	20 x 16 x 2"	4.25lbs	1.32ft²

F) DISTRIBUTION DUCTWORK

Kitchen canopy exhaust work will be constructed and installed in accordance with BESA DW/172. Ductwork will be routed to the external environment in the shortest possible route, without excessive use of bends and horizontal ductwork installation.

Ductwork will be suitable for kitchen extraction systems, with smooth internal surfaces that facilitate the easy removal of grease deposits.

G) EXTRACT FAN SPECIFICATION

The fan has been selected on the basis of the system pressure/resistance and volume/rate required to attain sufficient air flow in the kitchen area against the restrictions created by odour and noise control measures, which are detailed further on within this report.

Fan motors are fully enclosed, air cooled, class F rated with motor protection and sealed to IP55 or better. All single-phase motors have “sealed for life” bearings and an operating temperature from -40°c to +50°c.

All fans will be provided with suitably rated on/off variable speed controllers, and all fan equipment will have local isolators. Fans will be fitted with the necessary resilient mounting to prevent noise and vibration transfer to the kitchen ***(see 6)b)Anti-vibration mountings****),* other rooms and the external environment in accordance with this report. The fan casing is connected to the ductwork using flexible connectors, ***see 6)c)Flexible connectors.***

We have ensured that the fans specified herein are capable of producing the required air volumes as calculated ***(see Appendix A, System Calculation)***. All fan and motor arrangements are capable at running at 10% over the maximum specified duty. The construction of the fan is such that it is capable of withstand the pressures and stresses experienced under continuous operation.

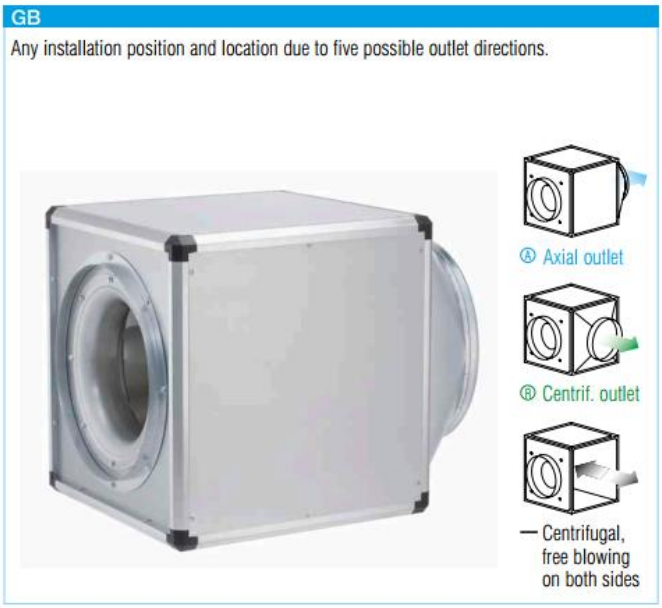
Fan casings are constructed such that access can easily be gained to motors and impellers, and that these can be removed if required for maintenance or replacement.

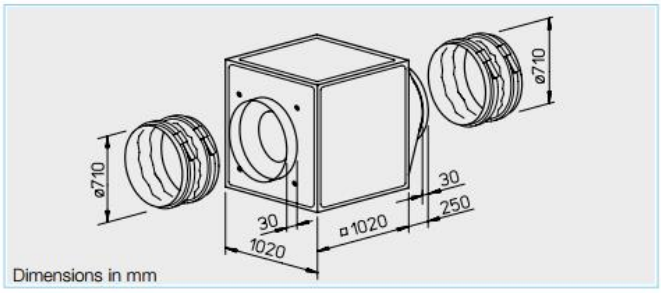
I) PRIMARY CANOPY: HELIOS GIGABOX GBW 710/4

A square cased fan, with high output backward curved centrifugal impeller, manufactured by Helios Ventilation Systems and recommend by them for kitchen extract applications.

This variant has been specifically selected for its low noise output, thanks to a slow operating rpm (axial fans of this size usually run at ≈3000 rpm), made possible by a 4 pole motor, and double-skinned casing panels filled with 20 mm thick mineral wool for noise and heat insulation; this results in case breakout noise of less than 44 dB(A) at 4 metres. This model is suitable for installation outside. We recommend using a centrifugal discharge, as there is performance penalty of approximately 7% for an axial discharge.

Type		GBD 710/4
Case (mm)		1020 square
Speed (rev/min)		1465
Motor type		3ϕ
Motor rating (kW)		5.67
Blades		Centrifugal
Full load current (A)		10.2
Speed controlled(A)		
Speed controller		
Breakout sound (dB(A) at 4 m from source)		51
m^3/s at Pa (static)	0	
	50	
	100	
	150	
	200	5.3
	300	5.2
	400	5.0
	500	4.8
	600	4.6



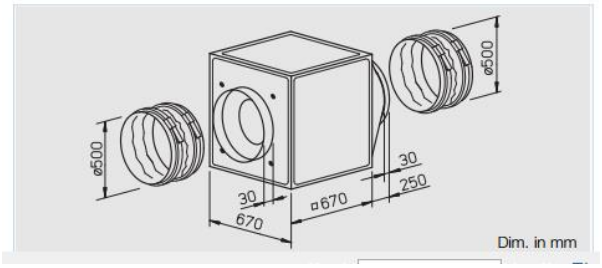


II) SECONDARY CANOPY: HELIOS GIGABOX GBW 500/4/4

A square cased fan, with high output backward curved centrifugal impeller, manufactured by Helios Ventilation Systems and recommend by them for kitchen extract applications.

This variant has been specifically selected for its low noise output, thanks to a slow operating rpm (axial fans of this size usually run at ≈3000 rpm), made possible by a 4 pole motor, and double-skinned casing panels filled with 20 mm thick mineral wool for noise and heat insulation; this results in case breakout noise of less than 45 dB(A) at 4 metres. This model is suitable for installation outside. We recommend using a centrifugal discharge, as there is performance penalty of approximately 7% for an axial discharge.

Type		GBW 500/4/4
Case (mm)		670 square
Speed (rev/min)		1340
Motor type		3ϕ
Motor rating (kW)		1.45
Blades		Centrifugal
Full load current (A)		2.8
Speed controlled(A)		2.9
Speed controller		RDS 7.0
Breakout sound (dB(A) at 4 m from source)		45
m^3/s at Pa (static)	0	2.464
	50	2.367
	100	2.278
	150	2.189
	200	2.097
	250	2.006
	300	1.903
	400	1.664
	500	1.369
	600	1.047



5) ODOUR CONTROL

In addition to the basic HVHD principle and baffle filtration, detailed above, additional odour control measures will be fitted, as described forthwith.

According to DEFRA's "Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems" Annex C, p95 and EMAQ+ "Control of Odour and Noise from Commercial Kitchen Exhaust Systems" Appendix 3: Risk Assessment for Odour, p76 the **impact risk score is 24.**

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:

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 10 m/s.
	Moderate	10	Discharging 1m above eaves at 10 -15 m/s.
	Good	5	Discharging 1m above ridge at 15 m/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 sized 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 & chips.
	High	7	Kebab, Vietnamese, Thai or Indian.
	Medium	4	Cantonese, Japanese or Chinese.
	Low	1	Most pubs, Italian, French, Pizza or steakhouse.

A) ACTIVATED CARBON UNIT WITH PRE-FILTRATION

Activated carbon is the industry standard for eliminating toxic fumes or offensive odours. They are used in sewerage works, hospitals, slaughter houses, restaurant kitchens, toilets, office blocks and laboratories. It uses dates back to the WW1 where it was used in gas masks to remove chlorine. The mechanism of action is known as absorption and is relies on entrapment by the large surface area of the carbon's porous granules.

The amount of contact time with the carbon required varies depending on the intensity/concentration of the odour. We appreciate the odour sensitivity of the surrounding area and the intensity of odour within the extracted air, and therefore the system has been engineered to provide a contact time in excess of 0.2 seconds, which provides a high level of odour control according to DEFRA and and EMAQ+ "Control of Odour and Noise from Commercial Kitchen Exhaust Systems" Table 13: Required residence times for various cooking processes, p45.

For this type of application, ***we recommend the carbon is replaced every 3 months***, in order to retain the odour entrapment qualities. Owing to the levels of vapours and oils present in this style of cooking, ***we recommend the disposable pre-filters are replaced every fortnight***, and at times of intense usage, every week.

PRE-FILTRATION

Carbon filters are unable to handle fine particulates and dust. If left unprotected, the life of the carbon is severely reduced and so they are protected by pleated and bag filters within the system enclosure.

We specify filters rated to BS EN 779 G4 such as *HVDS Pleated Panel Filters PP4 HC4* or *Longar G4 Pleated Panel Type II*. These have a low pressure drop, long service life and consist of a profile pleated synthetic media laminated on to an expanded oxidation-proof metal grid with a moisture-resistant card surround.

G4Pleated pre-filter					
Width (mm)	Depth (", mm)	Height (mm)	Pleats per foot/300mm	Flow (m^3/s)	Pressure loss (Pa)
596 full	2, 47	596	10-15	0.92	65
287 half	2, 47	596	10-15	0.45	65

ENCLOSSURE ACCESS

The housing for the pre-filters and activated carbon has a removable side panel, allowing easy access to the filters for replacement. The replacement schedule for the filters is detailed above.

A) HVDS MCCRB4 MULTI CELL CARBON RIGID BAG

- Small granules of carbon are in two layers of non-woven fabric
- The special pleating allows an elevated filtering surface with long clogging time
- Deodorises air by absorbing gaseous pollutants and organic vapours of different origin
- Rigid plastic frame for quick and easy exchange
- Higher than normal working temperature of 50°c for enhanced life in

kitchen extract

For this type of application, ***we recommend the carbon is replaced every 3 months***, in order to retain the odour entrapment qualities.

Model	Width (mm)	Depth (mm)	Height (mm)	Filter media (kg)	Flow (m^3/s)	Pressure loss (Pa)	Working temperature (°c)	Contact time (s)
MCCRB412	287 half	290	592	3.1	0.55	100	50	0.24
MCCRB424	592 full	290	592	4.4	1.11	100	50	0.24

The number of HVDS MCCRB4 units to be installed is detailed in 3) General arrangement

B) ULTRAVIOLET UV-C OZONE GENERATOR (OUT OF AIRSTREAM)

Ambient air is drawn into the unit through a pre-filter and then passes through a bank of high output UV lamps.

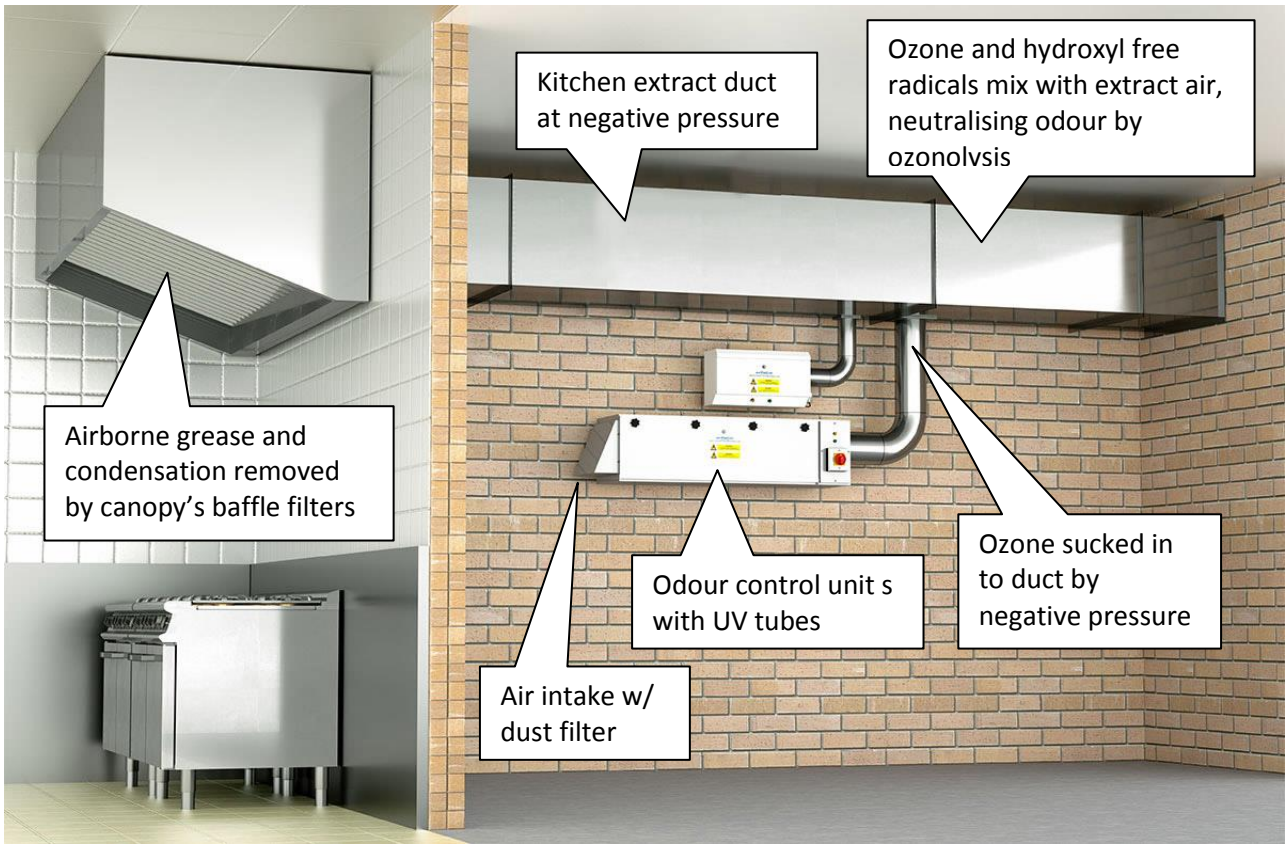
Some of these lamps produce UV light at 185nm, which converts oxygen (O_2) present in the air to ozone (O_3). Ozone is a highly reactive oxidant which interacts with most contaminates and allergens it encounters rendering them harmless, and thus removes odours.

The remaining lamps produce UV light at 254nm, the most efficient UV-C wave length, which converts the ozone to hydroxyl free radicals. Free radicals are natural air cleansing agents and are strong oxidants. They are significantly more powerful than plain ozone.

The ozone and free radical laden air is then drawn in to the extract ducting through a spigot, where it then mixes with kitchen extract air, reacts with it and oxidises gaseous odour in a process known as ozonolysis.

According to DEFRA's "Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems", p72, Table 4.14 ultraviolet systems achieve a high level of odour abatement; this makes them as effective as activated carbon filtration systems, but with much less air resistance (meaning smaller and quieter fans), much less frequent maintenance requirements, cheaper running costs, more compact and most importantly will tolerate the high in-duct temperatures that will be encountered on this installation (carbon filters degrade rapidly above 40°c 70% relatively humidity and thus would be inappropriate, according to EMAQ+'s "Best Practise for Design and Operation of Commercial Kitchen Ventilation Systems: Performance Requirements" 4.7.5 p45). They are however more expensive to install initially and thus represent a significant capital investment in odour control.

It is accepted that UV lamps in the main extract duct are theoretically more effective at controlling odour, but the lamps are rapidly covered with dust and grease which prevents them functioning properly and can fail altogether in high duct temperatures. The lamps also cause significant air resistance which can require the fan to be upsized, thus producing more noise, as can the required particulate control such as ESP. Placing the UV lamps out of the main extract airstream prevents these problems and greatly reduces maintenance requirements, ensuring odour control remains effective for longer and means ESP or other high level particulate control is no longer required.



I) PURIFIED AIR UVO ODOUR CONTROL

For this application, we propose utilising Purified Air's UVO units, which meet the above technical description. These units also feature a photo-catalytic liner, which enhances the production of hydroxyl free radicals. They are attached via a spigot to the negative pressure part of the system (before the fan intake) so the suction of the main extract fan draws ambient air through the unit.

To prevent exposure to UV light or ozone, the unit is interlocked with the extract fan and an air pressure switch. The system will also shut down if any of the access panels are unlocked. To prevent a build up of ozone, any system which uses ozone odour control must not discharge in to an enclosed space. The UVO can be mounted indoors or outside and each unit produces up to 10 grams of ozone per hour which will react and neutralise the odour present in $2m^3$ of air within 2 seconds. The UV lamps last at least 12 months and the system will remain effective in the event of individual bulb failure, therefore ***we recommend the unit is serviced once per year by a specialist engineer. The intake filter will need exchanging quarterly***.

Purified Air UVO1000 Ultraviolet odour control	
Electrical Supply:	240V 50Hz
Max Power Consumption:	700 W (10 lamps)
Max Air Volume:	$2m^3/s$
Dimensions:	H 350mm / W 1568mm / D 363mm
Weight:	50 Kg
Outlet spigot diameter:	147 mm

The number of Purified Air UVOs to be installed is detailed in 3) General arrangement

C) HIGH LEVEL DISCHARGE WITH ACCELERATION CONE

Any exhausted air, and any residual odour within it, should be pushed as far away from the surrounding area as possible to ensure a low concentration dispersal over a wide area.

To achieve this, we propose construction of a high level discharge, with the exhaust flue terminating nominally 1 metre above eaves level, and mounted at the rear of the building, well away from street level.

In addition, an acceleration cone is fitted near the flue's termination point. The exhausted air is forced to significantly increase in velocity (between 15% and 20%) as the same volume of air must pass through a smaller surface area. The acceleration cone may be achieved through an external tapering of the ducting, or by the installation of a truncated cone within the duct work.

Plume rise (add to termination height to give effective stack height as per DEFRA p60 section 4.7.8 and EMAQ+ 4.7.9 p47) **Primary canopy**	
W (m/s) efflux speed at chimney top	15.0
U (m/s) wind speed at the height of the stack	2
d (m) internal stack diameter	0.71
Plume rise above discharge in metres, ΔH=3W.d/U	**16**

There is no weather cowling or other restriction fitted to the flue termination that could generate turbulence or deflect the exhausted air, so it continues to travel upwards in to the atmosphere once it has exited the duct work, meaning the actual dispersal altitude is significantly higher than roof ridge level.

Plume rise (add to termination height to give effective stack height as per DEFRA p60 section 4.7.8 and EMAQ+ 4.7.9 p47) **Secondary canopy**	
W (m/s) efflux speed at chimney top	13.4
U (m/s) wind speed at the height of the stack	2
d (m) internal stack diameter	0.41
Plume rise above discharge in metres, ΔH=3W.d/U	**8.2**

Testing with smoke generators indicates that with this discharge design, dispersal begins to occur approximately 6 metres beyond the end of the flue.

Additionally, the vacuum generated by the acceleration cone is used to suck in fresh air from outside the ducting, which forms a thin blanket of cooler, slower moving air surrounding the fast and warm extracted air, which serves to assist in reducing exhaust noise. The principle is the same as that applied to high-bypass turbofan jet engines fitted to modern airliners.

6) NOISE ABATEMENT

A) OBJECTIVE

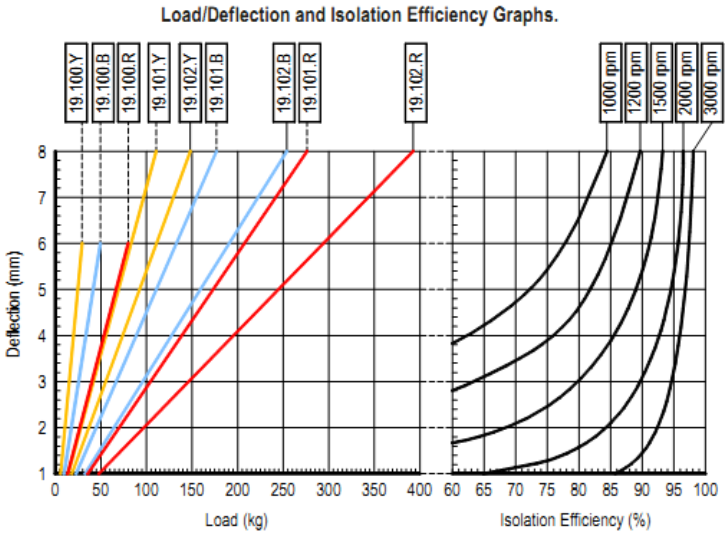
All fan equipment, duct work and filter housings will be mounted and installed so as not to give rise to a noise nuisance. Any noise generated by the extraction or supply systems as a whole shall not exceed the pre-existing hourly background noise level at the nearest sensitive receptor, when measures are rated in accordance with BS 4142:2014, entitled Methods for rating and Assessing Industrial and Commercial Sound

Full details of the system sound output can be found in ***Appendix B, Sound Signature.***

B) ANTI-VIBRATION MOUNTINGS

Industry standard rubber in shear vibration isolators will be used to damp out any oscillation of the fan casing which could generate a noise nuisance. We utilise compact designs offering high vertical deflections, which can be loaded in compression, shear and bending to provide damping in all 3 dimensions.

For this application we propose installation of Christie & Grey's Type 19.101.R rubber turret mountings, which support a load of 35-280 kg. These provide for static deflection of up to 8 mm and gives superior attenuation of medium to high frequency vibration and noise emanating from the fan. High resilience rubber with low dynamic to static stiffness ratio ensures maximum efficiency, good creep performance and long service life.



Isolation efficiency is based on dynamic rather than static stiffness for accurate calculation of system performance.

C) FLEXIBLE CONNECTORS

Flanges and flexible connectors supplied by the fan manufacturer will be fitted on both the intake and exhaust ends of the fan casing, which in conjunction with the aforementioned anti-vibration mountings serve to acoustically decouple the fan from the rest of the duct work; this will stop any resonant noise and also the transmission of vibrations beyond the fan case. To ensure durability and longevity, they are nominally rated to 110°c.

D) WALL AND CEILING BRACKETS

Will be backed with strips of heavy duty EPDM rubber where they attach to the wall or ceiling to prevent the transmission of vibration.

E) SILENCERS

Noise can also travel within the air stream and in order to attenuate this, an inline cylindrical type silencer is to be placed within the ducting, aft of the fan. In addition, another silencer is fitted before the fan, to reduce noise levels within the kitchen area.

I) FLAKT WOODS TYPE B DYNAMIC ATTENTUATION CYLINDRICAL SILENCER

For this project we specify Flakt Woods' Type B dynamic attenuation cylindrical silencer, which will be placed inline. The absorbent material is acoustic grade mineral fibre with an erosion resistant facing, it is protected and contained by a pre-galvanised perforated steel sheet formed to match the fan diameter. They are finished in a galvanised zinc coating to BS 2989 Z2.

These type B silencers are suitable for air pressures up to 1000 Pa and temperatures from -40 to +200°c, which this extraction system falls within the range of.

Acoustic performance of Type B dynamic attenuation silencer (to BS848 standards)									
Bore Ø (mm)	Length (mm)	Octave-band mid frequency (Hz)							
		63	125	250	500	1K	2K	4K	8K
400 or 500	400/500	2	3	6	13	14	10	10	5
710	1420	4	6	9	19	17	13	12	11

7) FIRE PREVENTION AND MITIGATION MEASURES

A) BAFFLE FILTERS

The baffle filters detailed Section 4)e) act as a fire barrier, preventing flames from cooking travelling in to the extraction canopy and ducting. They are compliant with the European flame arresting standard for oil barriers detailed in DIN 18869-5 (2007-2008).

B) GREASE DRAINAGE

The system will be fitted with grease drains at the low points of the ducting, which is where oil vapour which has condensed on the interior walls naturally runs to. The drains are protected by a screw cap; when opened the collected grease drains away via gravity. Where appropriate, some grease drains may be fitted with a external collection pot instead of a screw cap. ***It is our recommendation the grease drains are emptied and inspected every week***, as over an extended period of time, the oil may build up to such a level that it presents a fire risk.

Grease collection and drainage measures are also fitted to the canopy, for further details please see *4)d)i) Construction and 4)e) Baffle filters.*

C) INSPECTION HATCHES

The system has an inspection hatch near the main fan which will allow access to the duct work and fan assembly for cleaning purposes. Further hatches are provided every 2-3 metres, both fore and aft of the extraction fan, to allow uncompromised access to all the ducting. ***It is our recommendation that the fan and ductwork are inspected and thoroughly cleaned once a year*** to prevent the build up of significant quantities of grease, which will impair the efficiency and reliability of the extraction system. If left unattended, a large build up of grease within the ducting may also constitute a fire risk.

8) VISUAL IMPACT

We appreciate the surrounding area and the building itself are noted for their aesthetics and historical significance. Therefore we have minimised the visual impact of the system whilst remaining within the required extraction performance, odour control and noise footprint.

A) LOCATION OF PLANT EQUIPMENT AND DUCT ROUTING

We understand the need to be sensitive in the placing of plant equipment so it is not a detriment to the building's aesthetic. Therefore the majority of plant equipment is located on the flat roof of the ground floor, screened from 3 aspects by the first floor of the building. It shall only be visible from the rear car park where is already other plant visible such as air conditioning compressors.

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APPENDIX A - SYSTEM CALCULATION PRIMARY CANOPY

Canopy length	**31**	*ft*	9.45	*m*	
System rating	**100**	*%*			
Duct diameter	**28**	*''*	711	*mm*	
Ducting length	**25**	*m*	82	*ft*	
K factor	**6.5**				
No. of canopy filters	**13**				
Canopy filter type	**2**	85	(1 = Mesh, 2 = Baffle)		
UV odour control	**Y**				
Air flow required	10850.0	*cfm*			
Velocity	2547.4	*ft / min*	12.94	*m / s*	
Duct area	4.3	*sqft*	3.69		
Velocity pressure	100.5	*Pa*			
Exhaust velocity	15.0	*m / s*	**(inc. accel cone)**		
Static pressure	125.0	*Pa*			0.403375589
Velocity pressures	264.4	*Pa*			
Filter pressure	108.6	*Pa*	**Filter Pressure O.K**		1.05762713
Odour control pressure	**30.0**	*Pa*			
Total system pressure	528.0	*Pa*			
Fan duty required:	**10850.0**	*ft³/min*	@	**528.0**	*Pa*
	5.12	*m3/s*	18432	*m3/hr*	

Selected fan		**X**			
Type		**GBD 710/4**	**GBD EC 710 B**		**GBD 630/4/4**
Case (mm)		1020	1020		800
Speed (rev/min)		1465			1380
Motor type		3φ	940		3φ
Motor rating (kW)		5.67	2.65		3.65
Blades		Centrifugal	Centrifugal		Centrifugal
Full load current (A)		10.2			6.6
Breakout sound (dB(A) at 4 m from source)		51	48		48
m³/s at Pa (static)	**0**				4.2
	50				4.1
	100				4
	150				3.9
	200	5.3	4.8		3.8
	250	5.3	4.6		3.7
	300	5.2	4.4		3.6
	350	5.1	4.2		3.5
	400	5.0	3.9		3.4
	500	4.8	3.3		3.2
	600	4.6			3

APPENDIX B - SYSTEM CALCULATION SECONDARY CANOPY

Canopy length	**11**	*ft*	3.35	*m*	
System rating	**73**	*%*			
Duct diameter	**16**	''	406	*mm*	
Ducting length	**7**	*m*	23	*ft*	
K factor	**5.5**				
No. of canopy filters	**4**				
Canopy filter type	**2**	85	(1 = Mesh, 2 = Baffle)		
Carbon filter system	**Y**				
Air flow required	2810.5	*cfm*			
Velocity	2020.8	*ft / min*	10.27	*m / s*	
Duct area	1.4	*sqft*	1.07		
Velocity pressure	63.2	*Pa*			
Exhaust velocity	13.4	*m / s*	**(inc. acceleration cone)**		
Static pressure	35.0	*Pa*			0.253845524
Velocity pressures	88.6	*Pa*			
Filter pressure	77.0	*Pa*	**Filter pres. lower bnd**		0.354406526
Carbon filter sys. Pres.	**130.0**	*Pa*			
Total system pressure	330.6	*Pa*			
Fan duty required:	**2810.5**	*ft³/min*	@	**330.6**	*Pa*
	1.33	*m3/s*	4788	*m3/hr*	

Selected fan (marked with cross)		**2nd**	**1st**		
Type		**GBW 500/4**	**GBD 500/4/4**	**GBW 450/4**	**63JM/20/4/6/16**
Case (mm)		670	670	670	Ø 630, long
Speed (rev/min)		1350	1340	1270	1420
Motor type		1φ 4 pole	3φ	1φ 4 pole	CT9: 1φ, 4 pole
Motor rating (kW)		1.38	1.45	0.76	0.97
Blades		Centrifugal	Centrifugal	Centrifugal	6, 16° aerofoil
Full load current (A)		6.4	2.8	3.5	6.7
Speed controlled(A)		8.2	2.9	3.5	13.5
Speed controller		TSW11	RDS 7	TSW 5	ME1.6
Breakout sound (dB(A) at 4 m from source)		45	45	40	61
m³/s at Pa (static)	**0**	2.3	2.46	1.514	3.12
	50	2.2	2.367	1.433	2.98
	100	2.1	2.278	1.36	2.8
	150	2	2.189	1.29	2.58
	200	1.9	2.097	1.217	2.3
	250	1.9	2.006	1.122	1.95
	300	1.7	1.903	1.006	1.38
	350	1.6	1.789	0.867	
	400	1.5	1.664	0.69	
	500	1.2	1.369	0.08	

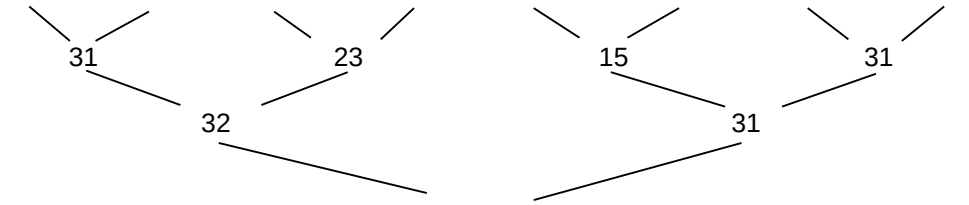
APPENDIX C – SOUND SIGNATURE PRIMARY

Comparison of Overall Sound Power Level and "A" Weighted Sound Power Level in free field conditions at the fan exhaust, distances given from the fan exhaust, **actual levels will be lower because of attenuation within the duct**. Sound power levels taken from manufacturer's specification sheet using LWA Extract values for GBD 710/4 fan. **Sound pressure level for case breakout is 51 dB(A) at 4m,**

THE SOUND PRESSURE LEVEL AT DISTANCE 3 METRES BEHIND 4MM SINGLE GLAZING

With 2-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	71	71	73	83	84	81	73	63
Acoustic Performance 2D silencer	-4	-6	-9	-19	-17	-13	-12	-11
Reduction for 4mm glazin	-15	-23	-21	-29	-34	-36	-31	0
Reduction for 3 Metres distance	-21	-21	-21	-21	-21	-21	-21	-21
	31	21	22	14	12	11	9	31



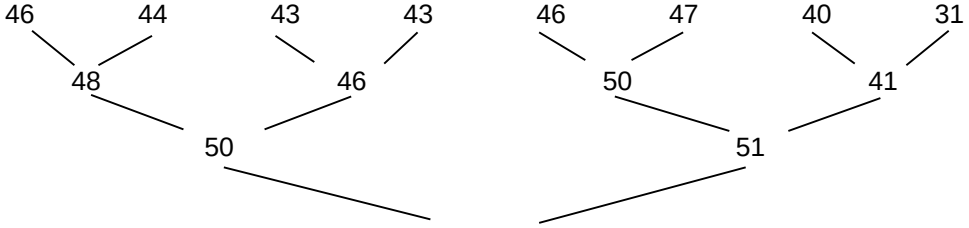
Add Sound Level

Average Sound Power level Lw(A) 3M 35dB

THE SOUND PRESSURE LEVEL AT DISTANCE 3 METRES

With 2-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	71	71	73	83	84	81	73	63
Acoustic Performance 2D silencer	-4	-6	-9	-19	-17	-13	-12	-11
Reduction for 3 Metres distance	-21	-21	-21	-21	-21	-21	-21	-21
	46	44	43	43	46	47	40	31



Add Sound Level

Average Sound Power level Lw(A) 3M 54dB

THE SOUND PRESSURE LEVEL AT A DISTANCE 6 METRES

With 2-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	71	71	73	83	84	81	73	63
Acoustic Performance 2D silencer	-4	-6	-9	-19	-17	-13	-12	-11
Reduction for 6 Metres distance	-26	-26	-26	-26	-26	-26	-26	-26
	41	39	38	38	41	42	35	26
		43		41		45		36
Add Sound Level Sound Power level Lw(A)			45				46	
Average sound pressure level Lw (A) at 6M				49dB				

THE SOUND PRESSURE LEVEL AT A DISTANCE 10 METRES

With 2-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	71	71	73	83	84	81	73	63
Acoustic Performance 2D silencer	-4	-6	-9	-19	-17	-13	-12	-11
Apply “A” Weighting	-26	-16	-9	-3	0	1	1	-1
Reduction for 10 Metres distance	-31	-31	-31	-31	-31	-31	-31	-26
	10	18	24	30	36	38	31	25
		19		31		40		32
Add Sound Level Sound Power level Lw(A)			31				41	
Average sound pressure level Lw (A) at 10M				41dB				

THE SOUND PRESSURE LEVEL AT A DISTANCE 20 METRES

With 2-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	71	71	73	83	84	81	73	63
Acoustic Performance 2D silencer	-4	-6	-9	-19	-17	-13	-12	-11
Apply "A" Weighting	-26	-16	-9	-3	0	1	1	-1
Reduction for 20 Metres distance	-41	-41	-41	-41	-41	-41	-41	-26
	0	8	14	20	26	28	21	25
		9		21		30		26
Add Sound Level Sound Power level Lw(A)				21			31	
Average sound pressure level Lw (A) at 20M					31dB			

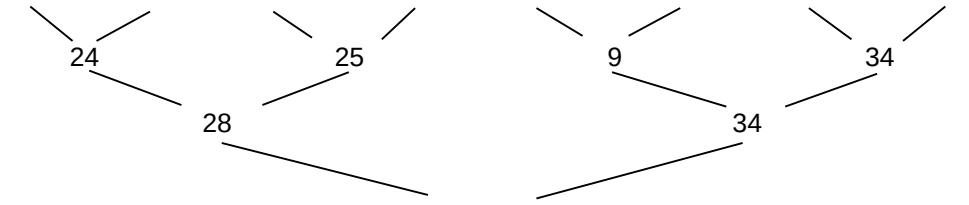
APPENDIX D – SOUND SIGNATURE SECONDARY

Comparison of Overall Sound Power Level and "A" Weighted Sound Power Level in free field conditions at the fan exhaust, distances given from the fan exhaust, **actual levels will be lower because of attenuation within the duct**. Sound power levels taken from manufacturer's specification sheet using LWA Extract values for GBD 500/4/4 fan. **Sound pressure level for case breakout is 45 dB(A) at 4m**

THE SOUND PRESSURE LEVEL AT DISTANCE 3 METRES BEHIND 4MM SINGLE GLAZING

With 1-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	61	61	73	74	74	73	69	60
Acoustic Performance 1D silencer	-2	-3	-6	-13	-14	-10	-10	-5
Reduction for 4mm glazin	-15	-23	-21	-29	-34	-36	-31	0
Reduction for 3 Metres distance	-21	-21	-21	-21	-21	-21	-21	-21
	23	14	25	11	5	6	7	34



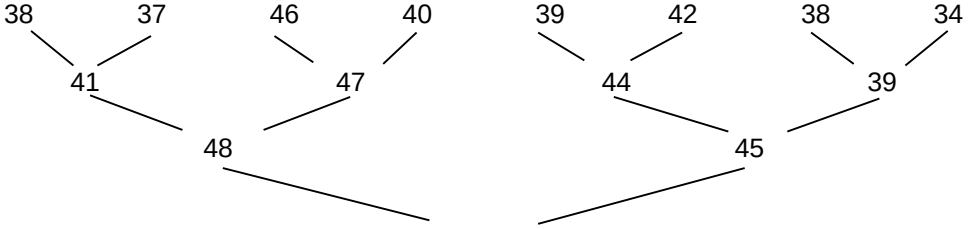
Add Sound Level

Average Sound Power level Lw(A) 3M 35dB

THE SOUND PRESSURE LEVEL AT DISTANCE 3 METRES

With 1-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	61	61	73	74	74	73	69	60
Acoustic Performance 1D silencer	-2	-3	-6	-13	-14	-10	-10	-5
Reduction for 3 Metres distance	-21	-21	-21	-21	-21	-21	-21	-21
	38	37	46	40	39	42	38	34



Add Sound Level

Average Sound Power level Lw(A) 3M 50dB

THE SOUND PRESSURE LEVEL AT A DISTANCE 6 METRES

With 1-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	61	61	73	74	74	73	69	60
Acoustic Performance 1D silencer	-2	-3	-6	-13	-14	-10	-10	-5
Already A weighted Reduction for 6 Metres distance	-26	-26	-26	-26	-26	-26	-26	-26
	33	32	41	35	34	37	33	29
		36		42		39		34
Add Sound Level Sound Power level Lw(A)				43				40
Average sound pressure level Lw (A) at 6M					45dB			

THE SOUND PRESSURE LEVEL AT A DISTANCE 10 METRES

With 1-D Type B Dynamic Attenuation Silencer

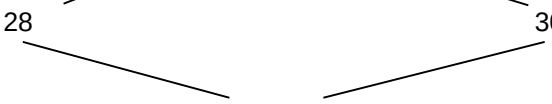
Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	61	61	73	74	74	73	69	60
Acoustic Performance 1D silencer	-2	-3	-6	-13	-14	-10	-10	-5
Already A weighted Reduction for 10 Metres distance	-31	-31	-31	-31	-31	-31	-31	-26
	28	27	36	30	29	32	28	29
		31		37		34		32
Add Sound Level Sound Power level Lw(A)				38				36
Average sound pressure level Lw (A) at 10M					40dB			

THE SOUND PRESSURE LEVEL AT A DISTANCE 20 METRES

With 1-D Type B Dynamic Attenuation Silencer

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level Lw from fan curve	61	61	73	74	74	73	69	60
Acoustic Performance 1D silencer	-2	-3	-6	-13	-14	-10	-10	-5
Already A weighted Reduction for 20 Metres distance	-41	-41	-41	-41	-41	-41	-41	-26
	18	17	26	20	19	22	18	29

Add Sound Level Sound Power level Lw(A)



Average sound pressure level Lw (A) at 20M

APPENDIX E – SITE PHOTOGRAPHS

It is proposed to place plant equipment and ducting on the flat roof of the first floor shown in the below photos, note the area is screened from 3 sides and even somewhat to the rear owing to the staircase

Image 1, above, rear three quarter elevation

Image 2, above, side elevation

Image 3, flat roof above proposed ground floor kitchen, looking from front to rear.