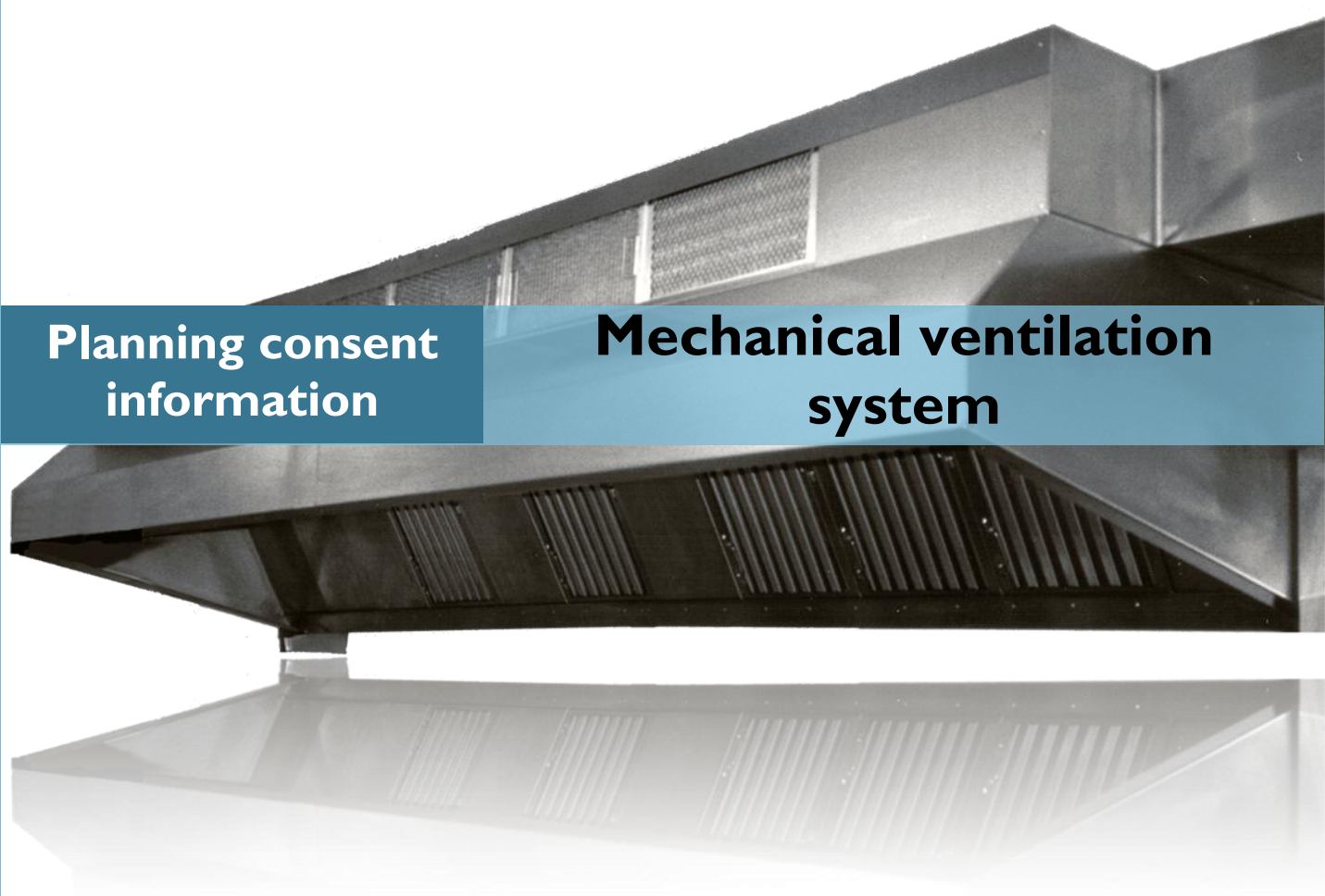


FAR EAST

威遠企業 KITCHEN SOLUTIONS

28 June 2021



**Planning consent
information**

**Mechanical ventilation
system**

Wole Aj

745 Wilmslow Road, Didsbury. M20 6RN

Planning consent information: Mechanical ventilation system

EXECUTIVE SUMMARY

A. SITE ADDRESS

745 Wilmslow Road, Didsbury. M20 6RN

B. SURROUNDING AREA

Mixed used commercial and residential, several kitchen extraction systems already nearby .

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 a fresh air inlet is provided in 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 system also utilises a ionising odour neutraliser system before the air is exhausted at high velocity.

To attenuate noise, the fan is mounted on anti-vibration rubber mouldings and connected to the ductwork by means of flexible connectors. A double length silencer is fitted behind the fan 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

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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

Wilmslow Road is a retail area, the stretch around Number 745 consists primarily of two and sometimes three storey buildings with commercial shop frontage at street level, many with offices or dwellings above, others with additional seating room. Wilmslow Road busy route that has pedestrian crossing signals immediately out the premises with lorries and buses driving past regularly and thus has high background sound levels that extends into the evenings because of the pubs and bars nearby.

There are many kitchen extract systems already close by, within approximately 30m there are six A3, A4 or A5 premises serving hot food; 741 is *Base + Booch* pizzeria, 743 is *Baity Palestinian Kitchen*, 747 is *Gourmet Burger Inc*, 749 is *Bella Vita Trattoria*, then on the opposite side of the road are two public houses serving hot food, *The Crown* and *Expo Lounge*, plus *Delightful Desserts* at 762. The extract systems of some of these can be seen in the photo appendix. As such, there is a lot of food odour already present in the ambient air, combined with vehicle fumes.

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 also results in a high ambient temperature within the kitchen.

When designing the extraction system for this particular application, our designers have taken 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.

See overleaf for specification summary of equipment fitted and system diagram

Specification summary

Fresh air inlet	1 mechanically assisted, 1 natural draft type
Number of canopies	1
Length of canopy (m)	3.9
Number of canopy filters	6 baffle type
Nominal extract duct Ø (mm)	560 or rectangular equivalent

Additional odour control

Ionising odour counteractant

High level discharge with truncation at termination point, 1m above eaves

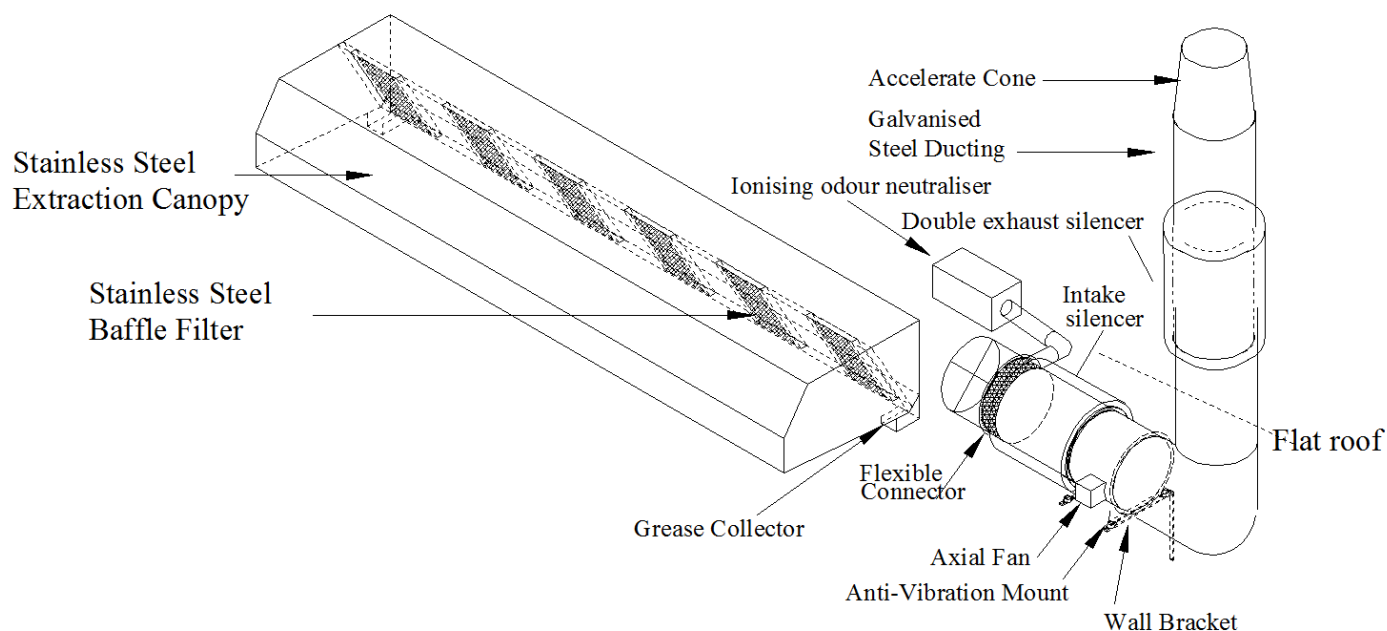
Noise attenuation measures

Fan mounting type	Rubber-in-shear isolation mounts, mounted inside building
Fan connection to ducting	Flexible connectors on intake side of case
Silencer	2 inline cylindrical, 1 double length mounted aft of extract fan,. 1 single length mounted fore of extract fan
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	3, located at each low point of the duct work
Inspection hatches	Every 2 metres

For full specifications of the equipment to be installed, please see the relevant sections within this report



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

BE&S (HVCA) DW172:2017 Method 1 air volume calculation, thermal convection coefficient method

Appliance	Width x Depth = Area			x Coefficient	Flow rate
Type	mm	mm	m ²	m ³ /s per m ²	m ³ /s
Deep fat fryer	450	600	0.27	0.4	0.11
Chargrill	600	600	0.36	0.95	0.34
6 ring oven range	900	750	0.68	0.4	0.27
Wok range (3f,1r)	1475	800	1.18	0.9	1.06
					1.78
Overhead wall canopy open one end, factor:				1.20	2.14

Minimum canopy width inc. 250 overhang: 3800

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, the natural draft effect of the extractor fan will be enough to ensure sufficient throughput.

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 deprecated BS 1449 Part 2 specification this was a No 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 through 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.

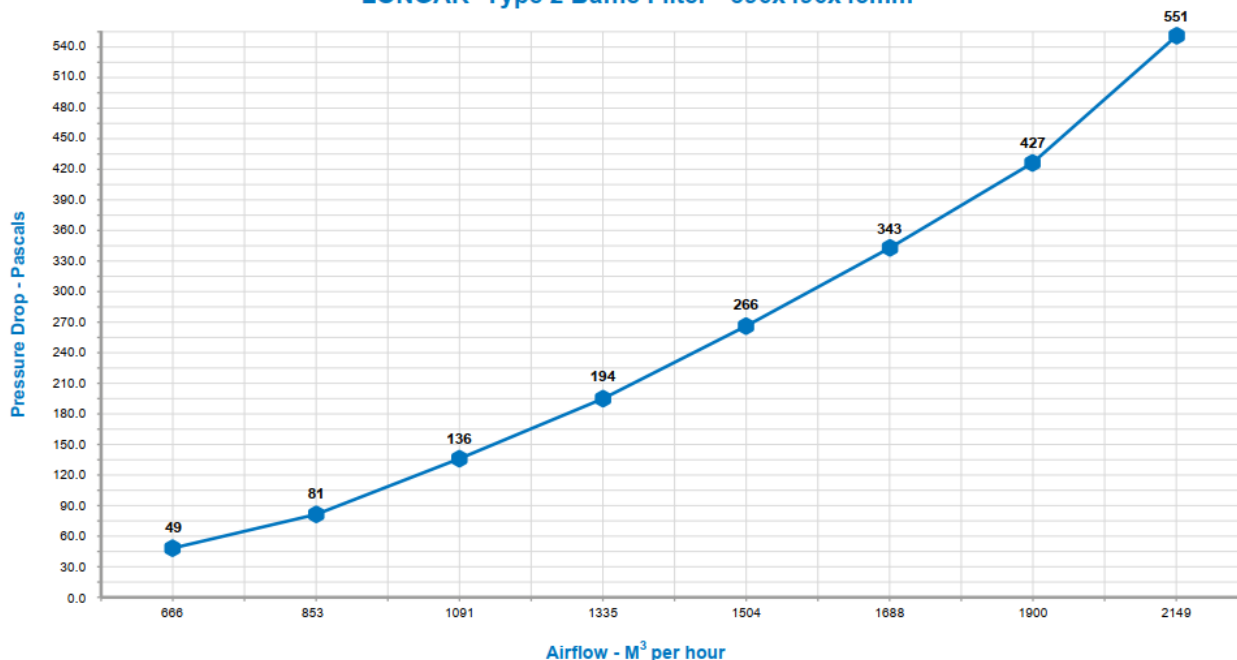
We recommend baffle filters are visually inspected in-situ at the end of each kitchen shift. They should be washed if necessary and always at least weekly.

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 Class G2
- Heat, flame and greaseproof (compliant with DIN 18869-5 (2007-2008))
- Dimensions (HxWxD) 495 x 395 x 45 mm

LONGAR® Type 2 Baffle Filter - 396x496x45mm



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

It shall be noted that kitchen extraction fan is mounted within the building and not externally and is therefore stated on this document for information purposes only.

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 2)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 2)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.

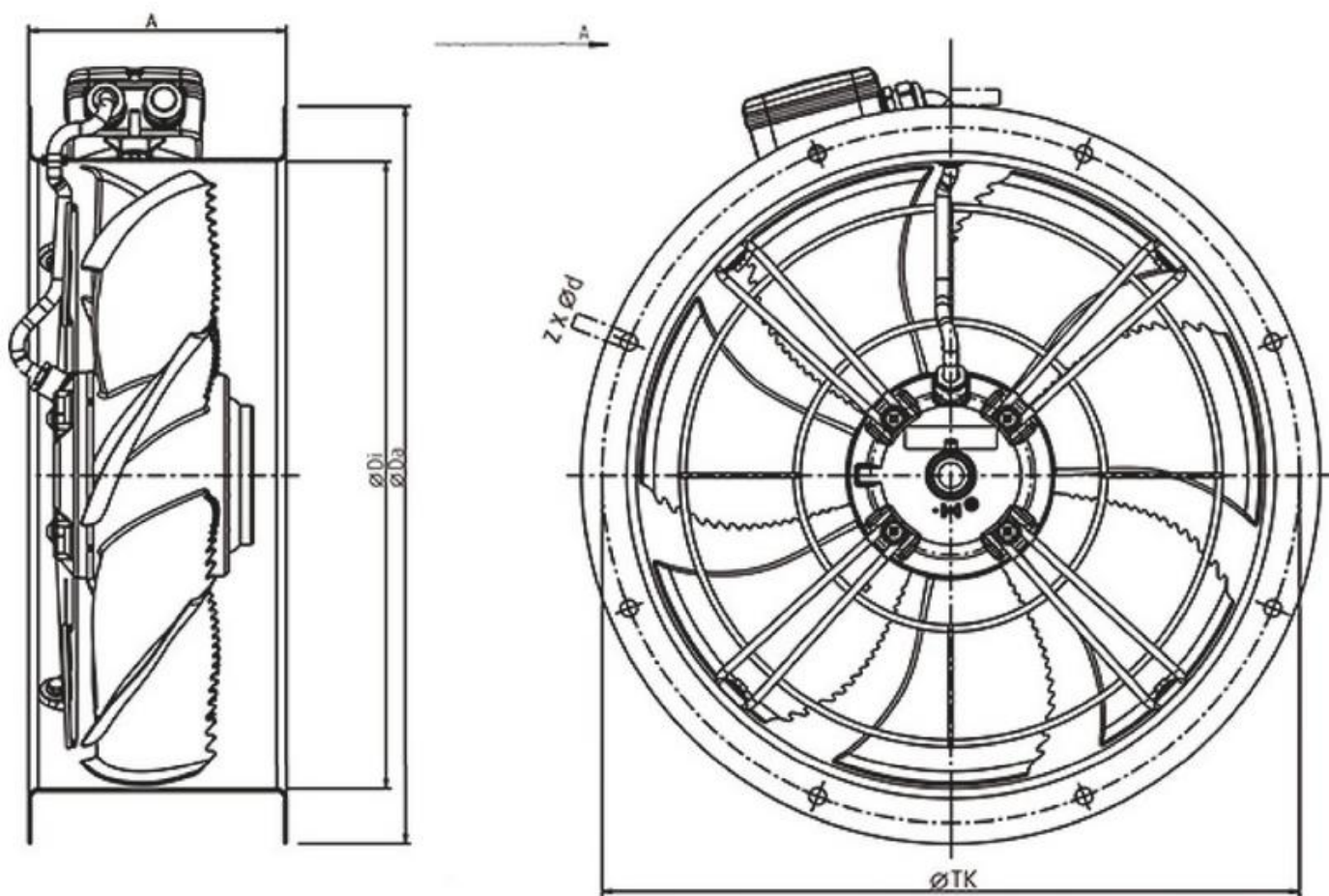
1) SYSTEMAIR AR560E4 SILEO

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 560, short
Speed (rev/min)		1420
Motor type		1φ, 4 pole, 230V
Motor rating (kW)		1.2
Blades		6, sickle
Full load current (A)		5.6
Speed controller		RE14G/RTRE7
Sound level (dB(A) at 1 m from source)		76
m³/s at Pa (static)	0	3.3
	50	3.11
	100	2.83
	150	2.51
	200	1.91



Sound power level	Acoustic filter									
		63	125	250	500	1k	2k	4k	8k	Total
Outlet	No filter v	53	63	69	74	79	81	77	71	85



	A	ØDi	ØDa	ØTK	z x Ød
AR 560 sileo	235	559	650	620	12 x Ø11,5

1) 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 32**.

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.

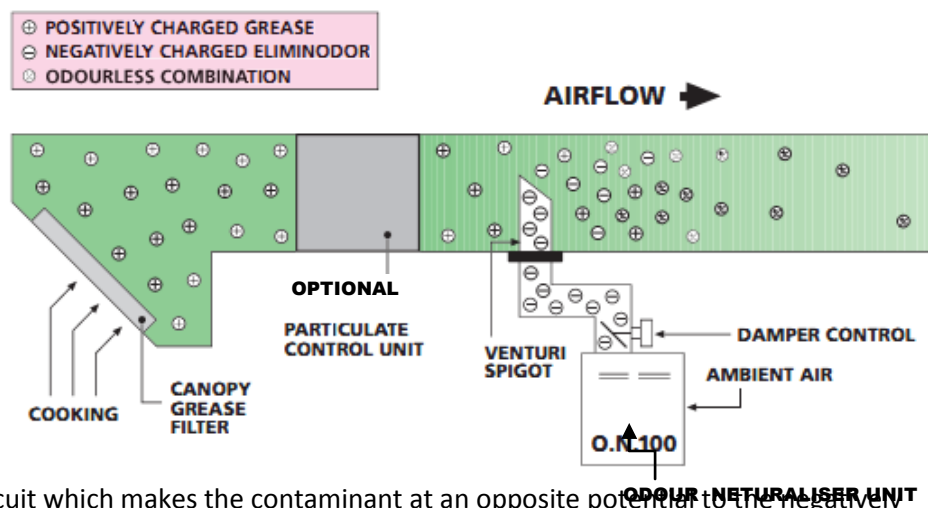
A) ODOUR NEUTRALISER/COUNTERACTANT

According to DEFRA's "Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems", p72, Table 4.14 counteractant systems achieve a medium to high level of odour abatement, and according to EMAQ+'s "Best Practise for Design and Operation of Commercial Kitchen Ventilation Systems: Performance Requirements" it is equivalent to carbon filters at a 0.1 second dwell. Although an activated carbon filter system

would be effective, the high in-duct temperatures mean use of carbon is not optimal (carbon degrades rapidly above 40°C and at relatively humidity above 70% they tend to capture moisture rather than odour, according to EMAQ+'s 4.7.5 p45); the proposed neutraliser allows similar odour control performance to be achieved with less maintenance requirement, thus working for longer without intervention, and also presents less air resistance allowing a smaller and quieter fan to be used.

The airstream is first cleaned of the majority of particulate contaminants made up of hydrocarbons and grease vapour which leaves the gaseous odour to be treated by the odour neutraliser. This is done with the baffle filters in the canopy but can be supplemented with an ESP or similar if cooking is particularly smoke heavy.

Ambient air is drawn into the odour neutraliser unit and mixed with a specially blended neutralising chemical. A vapour is formed which is then ionised to a high voltage negative potential, typically 15,000 volts. The ionised vapour passes along a non-conductive tube and is discharged into the centre of the duct via a venturi spigot, the metal ducting is earthed through the same high tension circuit which makes the contaminant at an opposite potential to the negatively charged vapour. The electrostatic difference between the contaminant and the neutralising vapour causes the two to combine electrically after which a chemical reaction takes place to treat the malodour.



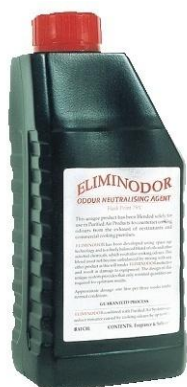
The chemically formulated neutralising agent needs replenishing periodically, depending on the intensity of use and size of unit's reservoir.

1) PURIFIED AIR ON-100

For this application, we have selected the Purified Air ON-100 odour neutraliser.

- Instant control of odours
- Efficiency up to 90%
- Neutralising agent level indicator
- Fully adjustable
- Easy and economical to maintain
- No resistance to airflow
- User friendly, with quick release locks

Purified Air ON-100 odour neutraliser			
Electrical supply	230 V, 50 Hz		HEIGHT A 500 mm WIDTH B 400 mm DEPTH C 200 mm
Power consumption	40 W		
Weight	12.25 kg		
Capacity	15,000 m ³ /hr exhaust air		
Ionisation voltage	15 kV negative		



ELMINODOR fluid supplied by the manufacturer must be used with this unit; it has been blended solely for use in Purified Air units to counteract cooking odours from the exhaust of restaurants and commercial cooking premises. It is a finely balanced blend of oils and other chemicals which neutralise cooking odours. This blend must not become unbalanced by mixing with any other products as this will render it ineffective and result in damage to the equipment.

Purified Air guarantee that the ON-100 used with Elminodor fluid can reduce nuisance caused by cooking odours by up to 90%.

Only minimal quantities are required for optimum results. **We recommend the unit is dosed at one litre per three weeks under normal conditions.** Refilling is done by undoing two quick release locks on the front of the unit, and then unscrewing the cap over the filling spout. Liquid is poured in until it reaches the upper red line on the level indicator.



B) 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)

W (m/s) efflux speed at chimney top	11.0
U (m/s) wind speed at the height of the stack	2
d (m) internal stack diameter	0.56
Plume rise above discharge in metres, $\Delta H=3W.d/U$	9.2

There is no weather cowl 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.

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.

2) NOISE ABATEMENT

A) OBJECTIVE

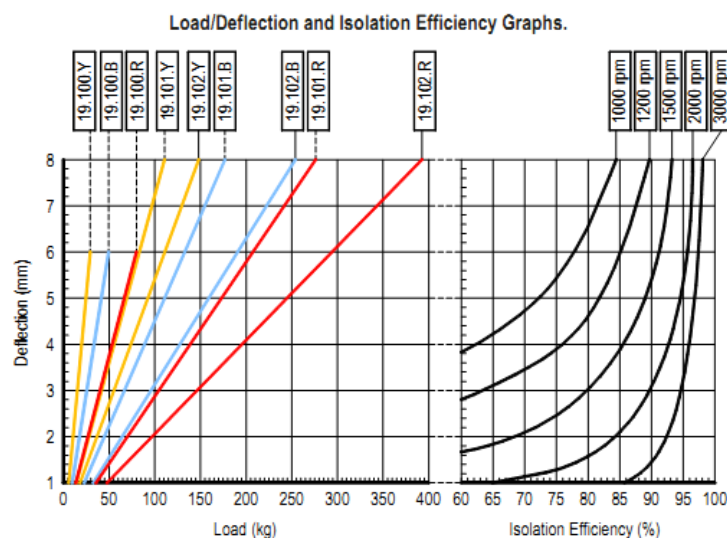
All fan equipment, duct work and filter housings will be mounted and installed so as not to give rise to a noise nuisance, when measures are rated in accordance with BS 4142:2014, entitled Methods for rating and Assessing Industrial and Commercial Sound.

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 ATTENUATION 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
560	560	2	4	7	14	14	9	10	7
560	1120	3	5	9	19	18	14	12	11

3) 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.

FAR EAST

威遠企業 KITCHEN SOLUTIONS

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Telephone (Mon-Fri, 0900-1700)

Parts and service: 01246 251177

Sales and enquiries: 01246 251188

Facsimile

01246 251199

Website

www.FarEastWok.com

E-mail

info@FarEastWok.com

Postal

Far East Kitchen Solutions, Coney Green Farm, Lower Market Street, Clay Cross, Derbyshire.
S45 9NE



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Head office: Far East Europe Ltd, Coney Green Farm, Lower Market Street, Clay Cross, Chesterfield. S45 9NE

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APPENDIX A - SYSTEM CALCULATION

Canopy length	13	<i>ft</i>	3.96	<i>m</i>	
System rating	103	<i>%</i>			
Duct diameter	22	<i>"</i>	559	<i>mm</i>	
Ducting length	10	<i>m</i>	32.8	<i>ft</i>	
K factor	3.5				
No. of canopy filters	6				
Canopy filter type	2	85	(1 = Mesh, 2 = Baffle)		
Odour neutraliser	Y				
Air flow required	4686.5	<i>cfm</i>			
Velocity	1782.3	<i>ft / min</i>	9.05	<i>m / s</i>	
Duct area	2.6	<i>sqft</i>	2.18		
Velocity pressure	49.2	<i>Pa</i>			
Exhaust velocity	11.0	<i>m / s</i>	(inc. accel. cone)		
Static pressure	50.0	<i>Pa</i>			0.197464387
Velocity pressures	34.1	<i>Pa</i>			
Filter pressure	95.1	<i>Pa</i>	Filter Pressure O.K		
Odour neutraliser pres.	30.0	<i>Pa</i>			0.136472645
Total system pressure	209.3	<i>Pa</i>			
Fan duty required:					
	4686.5	<i>ft³/min</i>	@	209.3	<i>Pa</i>

2.21 *m³/s* 7956 *m³/hr*

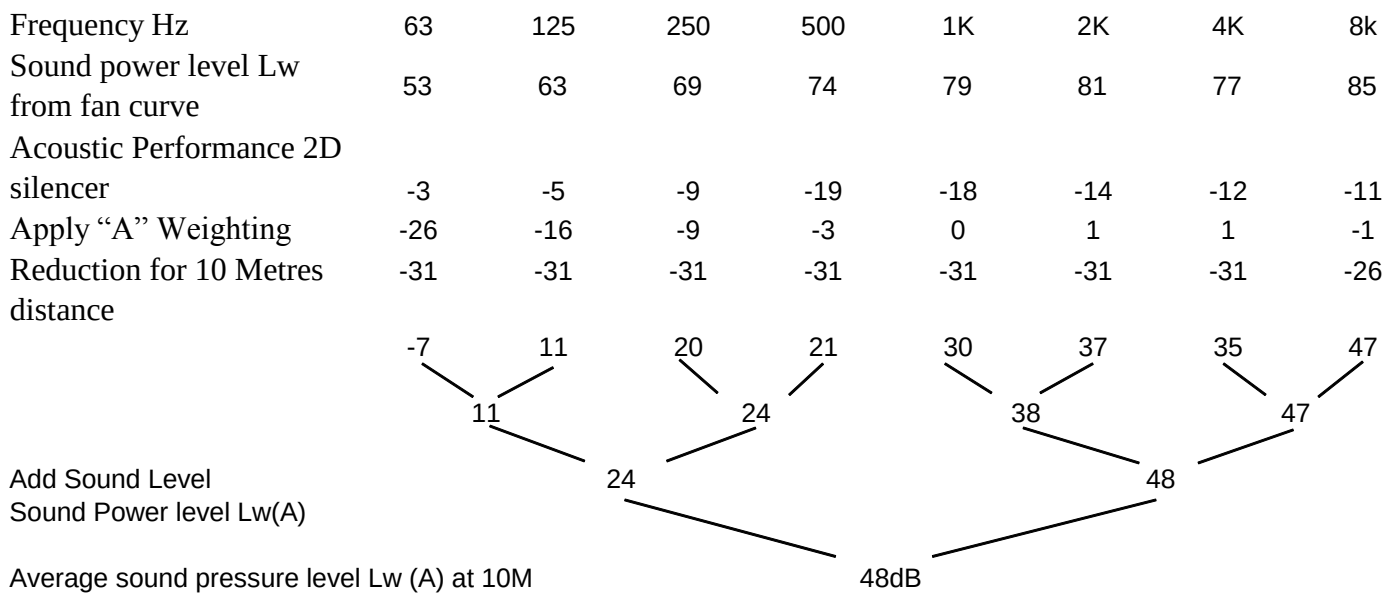
Selected fan (marked with cross)				X	
Type		GBW 500/4	GBW 560/4	AR560 E4	GBD 630/4/4
Case (mm)		670 cube	800 cube	Ø560 x 235	800 cube
Speed (rev/min)		1350	870	1424	1380
Motor type		1φ	1φ	1φ, 4 pole, 230V	3φ
Motor rating (kW)		1.38	2	1.2	3.65
Blades		Centrifugal	Centrifugal	6, sickle	Centrifugal
Cost inc. controller		1117 (T120+287)	1171 (no T120)	779	1814 (T120+323)
Full load current (A)		6.4	8.7	5.5	6.6
Speed controlled(A)		8.2			7.9
Speed controller		TSW11	TSW 14	RE14G/RTRE7	RDS 11
Breakout sound (dB(A) at 4 m from source)		45	44	66	48
m³/s at Pa (static)	0	2.3	2.8	3.3	4.2
	50	2.2	2.7	3.11	4.1
	100	2.1	2.6	2.83	4
	150	2	2.5	2.51	3.9
	200	1.9	2.4	1.91	3.8
	250	1.9	2.3		3.7
	300	1.7	2.2		3.6

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 unfiltered LWA Extract values for fan Systemair Sileo AR560 E4. **The fan is mounted internally so breakout sound should largely be contained within the room.**

Frequency Hz	63	125	250	500	1K	2K	4K	8k
Sound power level L_w from fan curve	53	63	69	74	79	81	77	85
Acoustic Performance								
2D silencer	-3	-5	-9	-19	-18	-14	-12	-11
Apply "A" Weighting	-26	-16	-9	-3	0	1	1	-1
Reduction for 6 Metres distance	-26	-26	-26	-26	-26	-26	-26	-26
	-2	16	25	26	35	42	40	47
		16		29		43		48
			29			49		
Add Sound Level								
Sound Power level $L_w(A)$								
Average sound pressure level $L_w(A)$ at 6M					49dB			

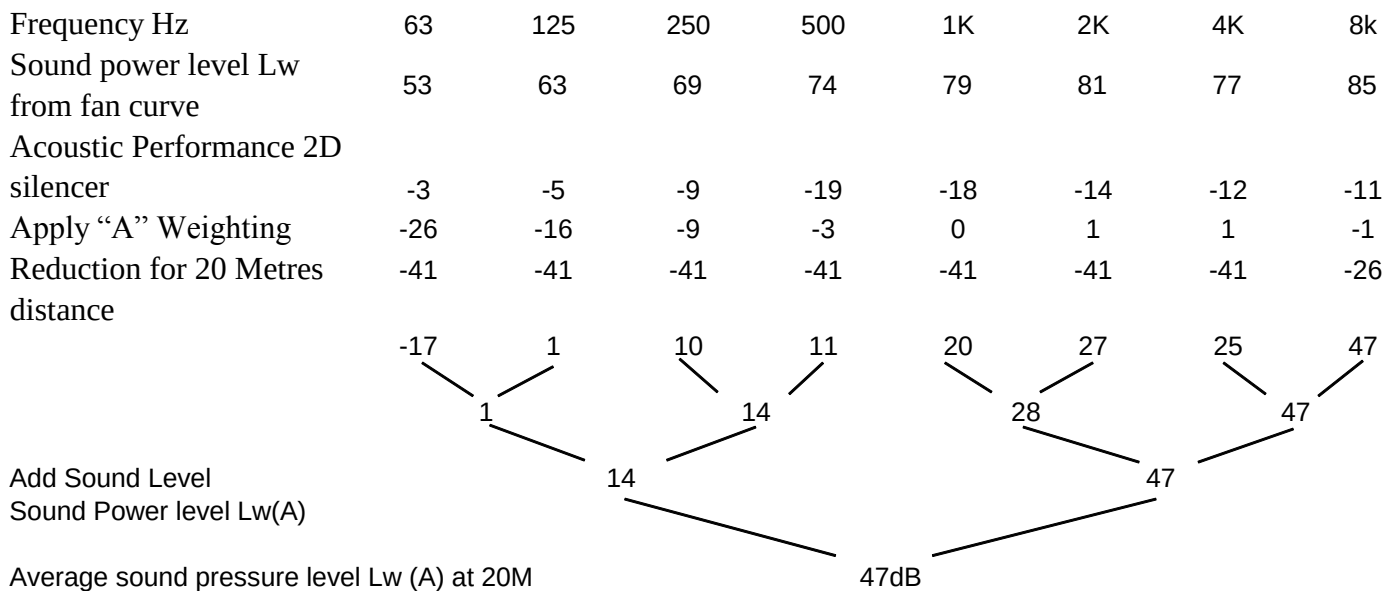
THE SOUND PRESSURE LEVEL AT A DISTANCE 10 METRES

With 2-D Type B Dynamic Attenuation Silencer



THE SOUND PRESSURE LEVEL AT A DISTANCE 20 METRES

With 2-D Type B Dynamic Attenuation Silencer



APPENDIX C – SITE PHOTOGRAPHS



Above: Existing rear elevation



Above: Neighbouring extract flues showing discharge below eaves with downward deflecting hat cowlings



Above: Rear fire escape