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ACOUSTICS PLUS

Proposed Installation of Mechanical Plant

Sam's Café, 40 Chalcot Road, London, NW1 8LS

Environmental Noise Assessment

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Proposed Installation of Mechanical Plant	
Project Address:	Sam's Café 40 Chalcot Road London NW1 8LS
Project Reference:	103939

Issue/Revision Record			
Issue:	**Date:**	**Remarks:**	**Author:**
1	07/01/2020	First Issue	Phil Huffer

	Signature:	Print:	Title:	Date:
Author:		**Phil Huffer**	**Principal Consultant**	**07/01/2020**
Reviewer:		**Andy Dodd**	**Senior Consultant**	**07/01/2020**

1. INTRODUCTION

1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients. APL is a registered member of The Association of Noise Consultants (ANC) and the author is a corporate member of The Institute of Acoustics (IOA).

1.2 APL has been instructed by Sam's Café, to consider and advise upon the noise implications of the proposed installation of mechanical plant to service a proposed café.

1.3 It is understood the Local Planning Authority (LPA) require further information on noise levels from the proposed installation in order to fully assess the noise impact upon the surrounding neighbourhood. This report provides the response to the LPA, on behalf of the Applicant.

1.4 This report has been prepared by Acoustics Plus Limited (APL) with all reasonable skill, care, and diligence in accordance with generally accepted acoustic consultancy principles and taking account the services and terms agreed between APL and our client.

1.5 Any information provided by third-parties and referred to herein may not have been checked or verified by APL unless expressly stated otherwise. Certain statements made in the report are predictions based on reasonable assumptions and good industry practice.

1.6 Such statements involve risk and uncertainty which could cause measured and predicted results to differ materially. APL does therefore not guarantee or warrant any prediction contained in this report.

2. BASELINE SITUATION

2.1 The Application Site (the "site") is situated at 40 Chalcot Road, London, NW1 8LS. The site is arranged over basement and ground floor levels.

2.2 As part of the refurbishment of the site it is the intention to install a new kitchen supply ventilation system which will require the installation of a supply fan at flat roof level. This will be installed alongside the existing kitchen extract system which will be retained. The existing condenser unit (providing climate control) in the front basement lightwell will also be replaced and therefore need assessing.

2.3 The proposed layout of the first floor flat roof at the rear of the site is shown in Diagram 1 below, with the new items of mechanical plant highlighted.

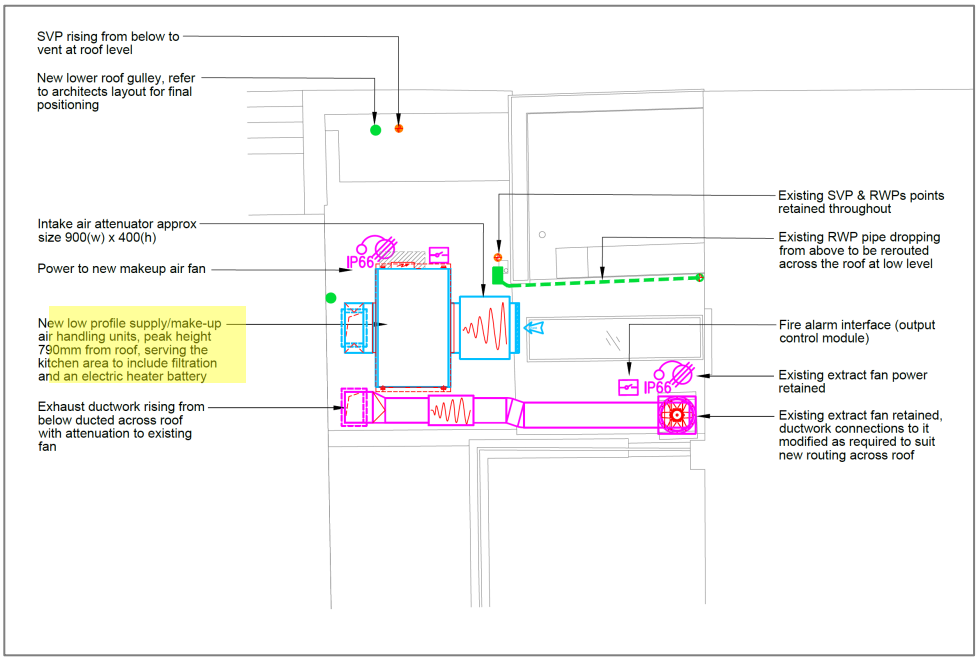


Diagram 1

2.4 The nearest noise sensitive façade to the proposed location of the new supply fan belongs to the rear upper windows of residential accommodation located directly above the ground floor property (see Figures 1 & 5). The distance from the nearest noise sensitive façade to the location of the proposed kitchen supply fan was determined to be approximately 3m.

2.5 The proposed layout of the basement lightwell at the front of the site is shown in Diagram 2 below, with the new items of mechanical plant highlighted.

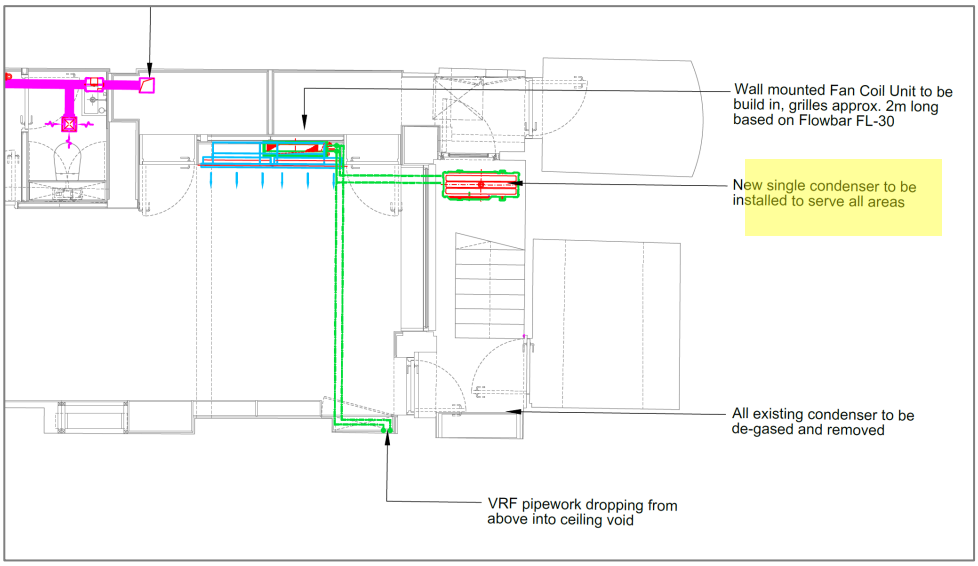


Diagram 2

2.6 The nearest noise sensitive façade to the proposed location of the new condenser unit belongs to the front first floor windows of residential accommodation located directly above the ground floor property (see Figure 7). The distance from the nearest noise sensitive façade to the location of the proposed condenser unit was determined to be approximately 6m.

3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise in the locality of the installation.

3.2 Measurements of background noise were obtained over a 24 hour period at a location deemed representative of background noise levels experienced at the nearest noise sensitive façades. Given the proposed installation of plant is at the front and rear of the site, measurements of background noise were obtained at the rear of the site at flat roof level and at the front of the site at ground floor level.

3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date:	19th – 20th December 2019
Start Time:	11:30 hrs
Location:	first floor flat roof at rear and ground floor at front

3.4 Given the proposed operational hours of the café will be 08:00 until 21:00hrs, minimum background and average noise levels during this time period are shown in Table 1 below. The level vs time history for the same time period is shown in Diagram 3 and 4 (L_{Aeq} and L_{A90}).

Location	Time period 08:00 to 21:00hrs	
	Lowest $L_{A90,15min}$	Average $L_{Aeq,T}$
At rear of site	43dB	55dB
At front of site	44dB	57dB

Table 1

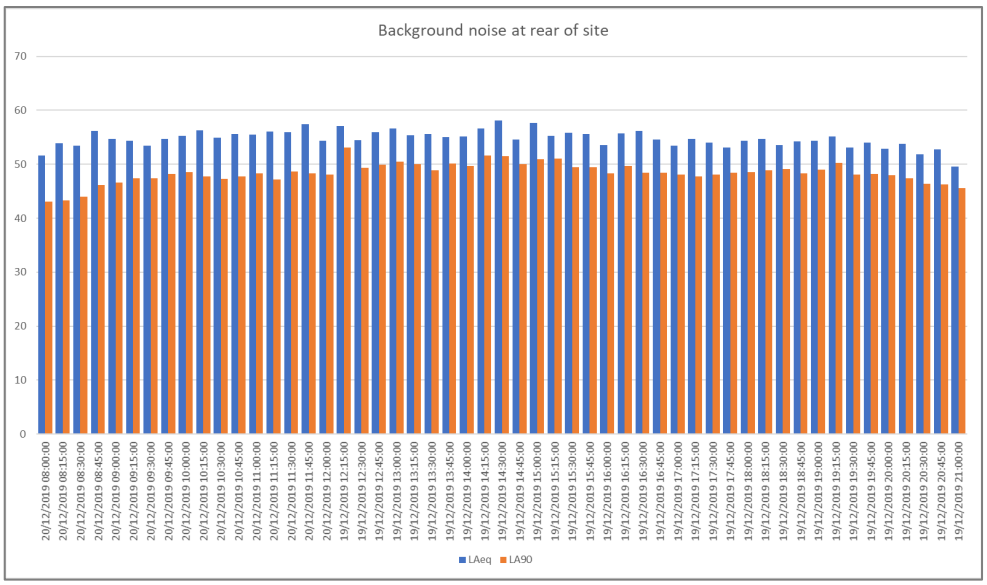
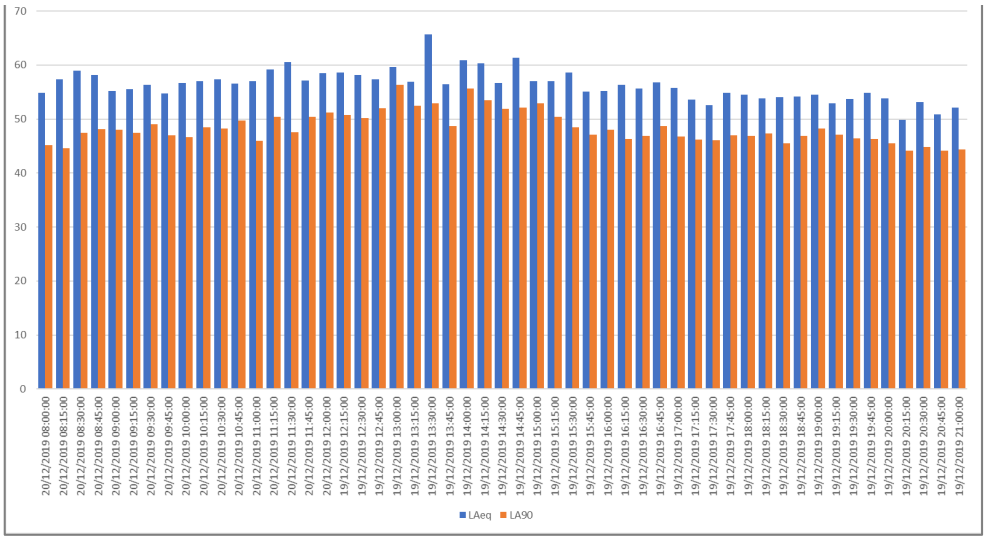


Diagram 3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19/12/2019 20:30:00
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19/12/2019 21:00:00
LAeq
LA90

Diagram 4

4. DESIGN CRITERIA

4.1 Information regarding the noise levels not to be exceeded by the proposed installation was extracted from the LPA (London Borough of Camden) Local Plan Adopted version June 2017 (Appendix 3 Noise thresholds).

Industrial and Commercial Noise Sources

A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion).

Table C: Noise levels applicable to proposed industrial and commercial developments (including plant and machinery)

Existing noise sensitive receptor	Assessment Location	Design Period	LOAEL (green)	LOAEL to SOAEL (Amber)	SOAL (Red)
Dwellings**	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	'Rating level' 10dB* below background	'Rating level' between 9dB below and 5dB above background	'Rating level' greater than 5dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10dB* below background and no events exceeding 57dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57dB and 88dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88dB L_{Amax}

*10dB should be increased to 15dB if the noise contains audible tonal elements. (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

The periods in Table C correspond to 0700 hours to 2300 hours for the day and 2300 hours to 0700 hours for the night. The Council will take into account the likely times of occupation for types of development and will be amended according to the times of operation of the establishment under consideration.

4.2 Since the Camden Local Plan was issued, BS4142:2014 has been revised with additional explanatory information. BS 4142:2014+A1:2019 primarily provides a numerical method by which to determine the significance of sound of an industrial nature (i.e. the 'specific' sound from the proposed development) at residential NSRs (noise sensitive receptors).

4.3 The specific sound level may then be corrected for the character of the sound (e.g. perceptibility of tones and/or impulses), if appropriate, and it is then termed the rating level, whether or not a rating level penalty is added.

4.4 The 'residual' sound is defined as the ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

4.5 The specific sound levels should be determined separately in terms of the LAeq,T index over a period of T = 1-hour during the daytime and T = 15-minutes during the night-time. For the purposes of the Standard, daytime is typically between 07:00 and 23:00 hours and night-time is typically between 23:00 and 07:00 hours.

4.6 BS 4142:2014 requires that the background sound levels adopted for the assessment be representative for the period being assessed. The Standard recommends that the background sound level should be derived from continuous measurements of normally not less than 15-minute intervals, which can be contiguous or disaggregated. However, the Standard states that there is no 'single' background sound level that can be derived from these measurements.

4.7 BS 4142:2014+A1:2019 states that measurement locations should be outdoors, where the microphone is at least 3.5 m from any reflecting surfaces other than the ground and, unless there is a specific reason to use an alternative height, at a height of between 1.2 m and 1.5 m above ground level. However, where it is necessary to make measurements above ground floor level, the measurement position, height and distance from reflecting surfaces should be reported, and ideally measurements should be made at a position 1 m from the façade of the relevant floor if it is not practical to make the measurements at least 3.5 m from the façade.

4.8 The background noise levels were assessed using statistical analysis of the measured data, as directed in BS4142. The histogram can be seen in Diagram 3 and shows the statistical analysis of the background noise level that would occur during the operational hours of the units (at any time).

4.9 With regards to the rating correction, paragraph 9.2 of BS 4142:2014+A1:2019 states:

"Consider the subjective prominence of the character of the specific sound at the noise sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention"

4.10 The commentary to paragraph 9.2 of BS 4142:2014+A1:2019 suggests the following subjective methods for the determination of the rating penalty for tonal, impulsive and/or intermittent specific sounds:

Tonality

4.11 For sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a rating penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.

4.12 If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, BS4142:2014 suggests using the one-third octave method and/or the reference methods, as appropriate.

4.13 The ⅓ octave method tests for the presence of a prominent, discrete-frequency spectral component (tone) and typically compares the LZeq,T sound pressure level averaged over the time when the tone is present in a ⅓ octave band with the time-average linear sound pressure levels in the adjacent ⅓ octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the ⅓ octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent ⅓ octave bands by some constant level difference. The level differences between adjacent ⅓ octave bands that identify a tone are:

- *15 dB in the low-frequency one-third-octave bands (25Hz to 125Hz);*
- *8 dB in the middle-frequency one-third-octave bands (160Hz to 400Hz); and*
- *5 dB in the high-frequency one-third-octave bands (500Hz to 10,000Hz).*

Impulsivity

4.14 A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.

Intermittency

4.15 When the specific sound has identifiable on/off conditions, the specific sound level should be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

Other Sound Characteristics

4.16 Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

4.17 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level of the specific sound. In the context of the Standard, adverse impacts include, but are not limited to, annoyance and sleep disturbance. Typically, the greater this difference, the greater is the magnitude of the impact:

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*.

4.18 The background noise levels vary during the day period when the mechanical plant would be operational. The most commonly occurring background noise level during the operational hours (at the rear of the site) was 48dB $L_{A90,15min}$. However, in this instance the level of 47dB $L_{A90,15min}$ is considered a representative background sound level for the assessment of plant noise operational at any time of the cafés trading hours. The background noise varied between $L_{A90,15min}$ 47dB and 50dB for the majority of the proposed trading hours.

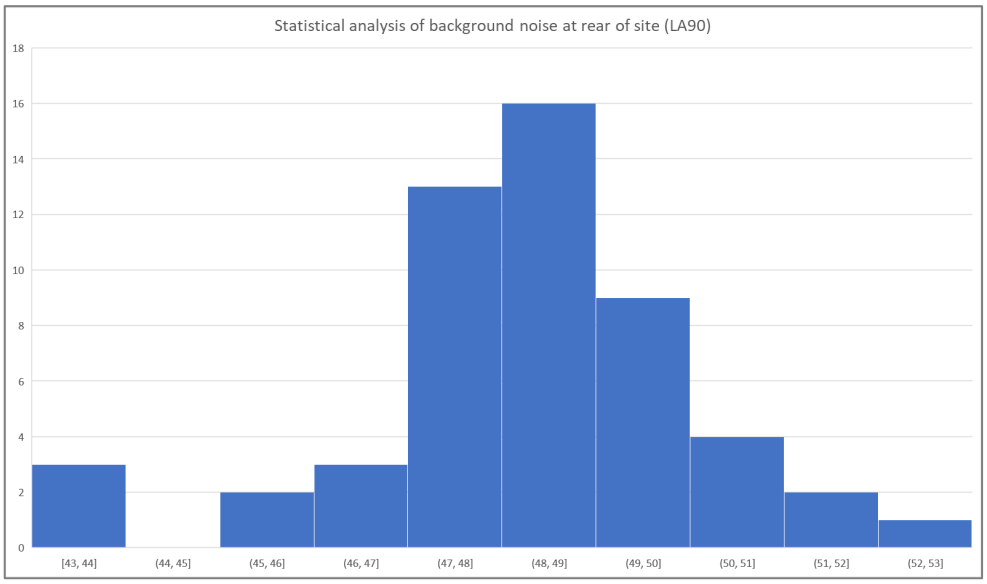


Diagram 5

4.19 The most commonly occurring background noise level during the operational hours (at the front of the site) was 46dB $L_{A90,15min}$. In this instance this level of 46dB $L_{A90,15min}$ is considered a representative background sound level for the assessment of plant noise operational at any time of the cafés trading hours.

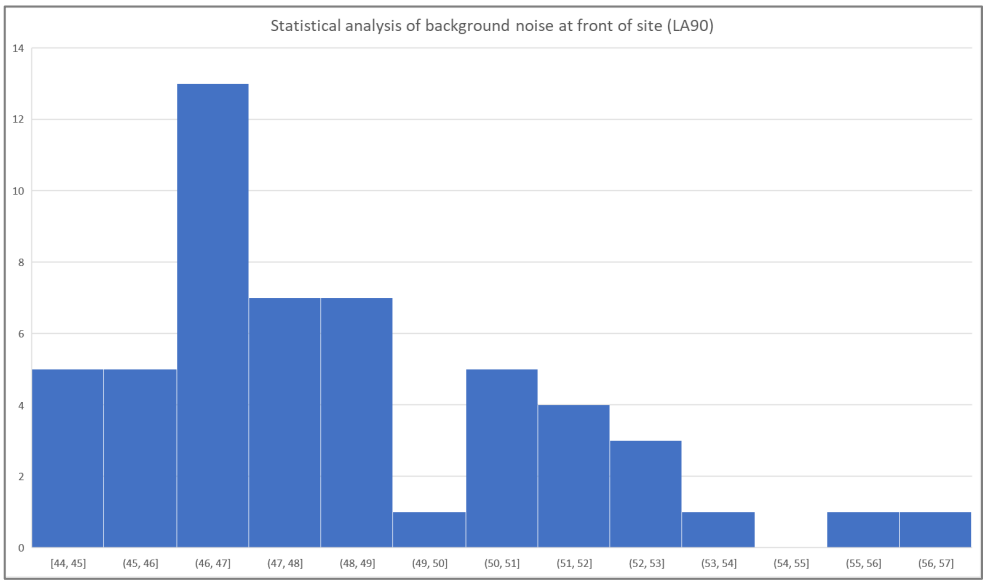


Diagram 6

4.20 The plant noise emission criteria that should not be exceeded is therefore based on Diagram 5 and 6 and is shown in Table 2 below. This level should not be exceeded at the nearest noise sensitive façade and is indicative of being 10dB less than the considered measured background noise. At such a level, there is an indication that the specific sound source will have a low impact.

Noise emission rating limit for mechanical plant	
Front of site L_{Aeq} ≤36dB	Rear of site L_{Aeq} ≤37dB

Table 2

4.21 The proposed equipment list is itemised below. Technical data sheets are contained in Appendix A. As the kitchen extract fan is an existing installation that is not being replaced or relocated, this has not been considered in the assessment.

(a) Kitchen supply fan – Soler & Palau UTBS PRO-REG

(b) Climate control condenser unit – Mitsubishi PUMY-SP140VKM

5. EQUIPMENT

5.1 All background noise measurements were obtained using the following equipment:

- Svantek Svan 971 Class 1 Serial No. 51704
- Svantek Svan 958 Class 1 Serial No. 45530
- Rion Calibrator Type NC-74 Class 1 Serial No. 00410215

5.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

6. CALCULATIONS

6.1 A prediction exercise was undertaken. The calculation exercise utilised information provided by equipment manufacturers. The manufacturers data sheets are contained within Appendix A. The following noise impacts were considered:

(a) Noise impact of condenser unit at front of site

(b) Noise impact of supply fan at rear of site

NOISE IMPACT (A)

6.2 In order to predict the noise impact of the operation of the condenser, consideration has been given to noise egress to the nearest noise sensitive façade. In considering the propagation of noise from the condenser, consideration was given to point source propagation.

6.3 Noise leaving the condenser unit was propagated over 6m to the nearest noise sensitive façade at first floor level.

6.4 The following corrections were accounted for to determine a rating level:

Results	Correction	Relevant clause	Commentary
On time correction	-3dB	7.3.14	The condenser is likely to switch on and off as required on a demand for cooling basis. The condenser is assumed to be operating for half the assessment period
Acoustic feature corrections	+2dB +3dB	9.2 9.2	Just perceptible tonality Just perceptible intermittency

Table 3

6.5 A further correction to account for building edge diffraction of -10dB was assumed. This was extracted from the Department of Energy and Climate Change Planning Standard MCS020. This was due to the location of the condenser unit below the external stairs and a proposed screen cover above the condenser.

6.6 The planning standard MCS020 states the following (Note 5):

"Note 5: Barriers between the heat pump and the assessment position (STEP 5)
A correction should be made for attenuation due to barriers between the air source heat pump and an assessment position. A correction will be necessary if an installer is unable to see an assessment position from the top edge of the air source heat pump. Use the following instructions to determine whether a correction is appropriate:

- *For a solid barrier (e.g. a brick wall or a fence) that completely obscures an installer's vision of an assessment position from the top edge of the air source heat pump attenuation of -10 dB may be assumed.*
- *Where a solid barrier completely obscures an installer's vision of an assessment position from the top or side edges of the air source heat pump, but moving a maximum distance of 25 cm in any direction to the air source heat pump allows an assessment position to be seen, attenuation of -5 dB may be assumed.*
- *If it is possible for an installer to see any part of an assessment position from the top or side edges of the air source heat pump no attenuation may be assumed. "*

6.7 The calculation exercise is shown in Table 4.

Calculation steps	L_p dBA
1no. Mitsubishi PUMY-SP140 (cooling)	54
Distance attenuation (6m)	-16
Reflective plane correction (x2)	+6
Building edge correction (no line of sight)	-10
BS4142 acoustic feature corrections	+2 [-3+2+3]
Rated noise level at nearest noise sensitive façade	**36** dBA

Table 4

6.8 In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant should not exceed a level of 36 dBA at 1m from the nearest noise sensitive façade.

6.9 The calculated noise impact is 36dBA. The calculation exercise (Table 4) demonstrates that the proposed installation meets the LPA criteria.

NOISE IMPACT (B)

6.10 Where necessary, mitigation measures have been incorporated into the calculation exercise to ensure that compliance with the LPA criteria is obtained. These mitigation measures are identified separately in the body of the report and are an essential requirement in meeting the LPA criteria.

6.11 The calculation exercise utilised fan/silencer selection information provided by the client's mechanical engineer (copy of the data sheets is provided in Appendix A).

6.12 Throughout the calculation exercise, guidance and formula were extracted from the authoritative publication *"Noise Control in Building Services" (published by SRL)*.

6.13 The ductwork system attenuation was calculated by considering the attenuation of sound energy produced by each component of the ductwork system. The mitigating duct components are a matched S&P attenuator UTBS-8 (Length 1100mm). Detailed calculations are contained in Appendix B.

6.14 Noise leaving the ductwork system at the duct inlet was propagated to the nearest noise sensitive façade using point source propagation. The calculation exercise (attached as Appendix B) provided the following result at the nearest noise sensitive façade:

Source of noise egress	L_p dBA @ noise sensitive façade
Kitchen supply fan	37dB

Table 5

6.15 Given the noise spectrum of the fan unit, no further corrections to account for tonality or intermittency were required. The total rating level can therefore be calculated as 37dBA. In order to comply with the requirements of the LPA, any noise from the proposed installation of mechanical plant that will be operated during trading hours should not exceed a rated level of 37 dBA at 1m from the nearest noise sensitive façade.

6.16 The calculated noise impact is 37dBA. The calculation exercise demonstrates that the proposed installation meets the LPA criteria.

6.17 Noise breakout from the casing of the fan is reported as 33dBA at 3m. This is 14dB below the representative background noise level and readily meets the LPA criteria without further mitigation.

7. CONCLUSION & MITIGATION MEASURES

7.1 The foregoing assessment indicates that the proposed installation will meet the requirements imposed by the LPA. Further mitigation measures, other than those identified, will not be required. The mitigation measures that must be implemented are as follows:

- *Acoustic attenuator on inlet side of air supply fan (UTBS series 1100mm length).*
- *Building edge diffraction is provided by screening the line of sight between the condenser unit and the residential façade above. This will occur due to the location of the condenser unit below the external stairs.*

7.2 If an alternative supplier or manufacturer of condenser or supply fan is chosen, the acoustic performance should be checked prior to installation to ensure that the installation will still meet the requirements imposed by the LPA.

7.3 It is also recommended that the condensing unit is positioned on vibration isolation mounts to minimise structural borne vibration and re-radiated noise into the adjacent building. Rubber turret mounts are suitable for this kind of application, available from the following, as shown in Diagram 7 below.

	Christie & Grey Limited Morley Road, Tonbridge, Kent, TN9 1RA, United Kingdom T: +44 (0)1732 371100 F: +44 (0)1732 359666 E: sales@christiegrey.com OR Mason UK Ltd Unit 6 Abbey Business Park Monks Walk Farnham Surrey GU9 8HT Tel: (01252) 716610 Fax: (01252) 716630 info@masonuk.co.uk

Diagram 7

Figures

40 Chalcot Road, London, NW1 and surrounding neighbours


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5

Figure 6

Figure 7

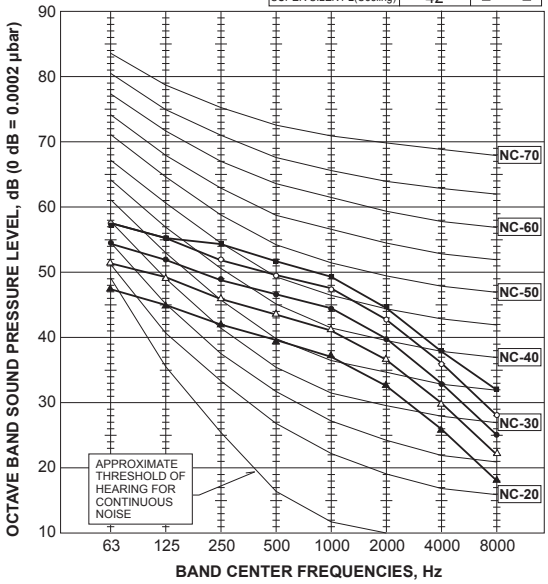

Figure 8

Appendix A

4-6. NOISE CRITERION CURVES

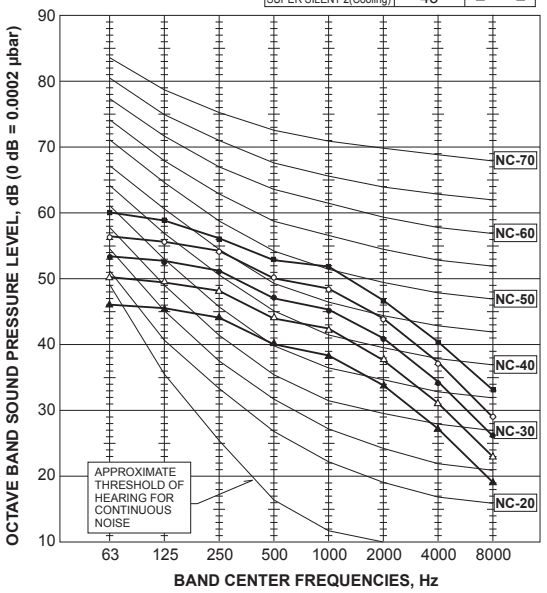
PUMY-SP112VKM.TH(-BS)
PUMY-SP112VKMR1.TH(-BS)
PUMY-SP112YKM.TH(-BS)
PUMY-SP112YKMR1.TH(-BS)

MODE	SPL(dB)	LINE
HEATING	54	■—■
COOLING	52	○—○
SILENT(Cooling)	49	●—●
SUPER SILENT 1(Cooling)	46	△—△
SUPER SILENT 2(Cooling)	42	▲—▲



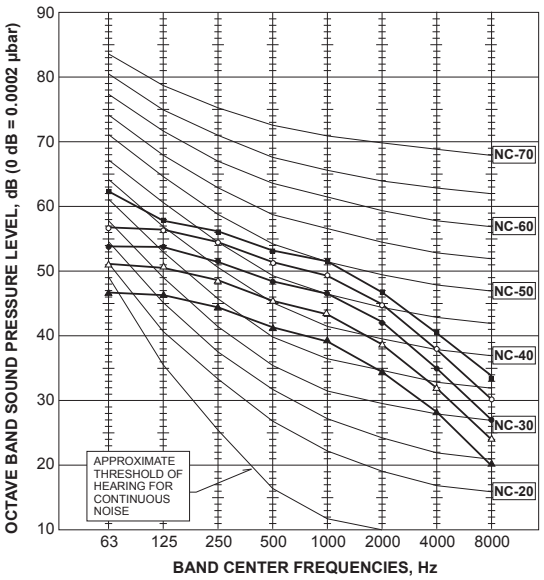
PUMY-SP125VKM.TH(-BS)
PUMY-SP125VKMR1.TH(-BS)
PUMY-SP125YKM.TH(-BS)
PUMY-SP125YKMR1.TH(-BS)

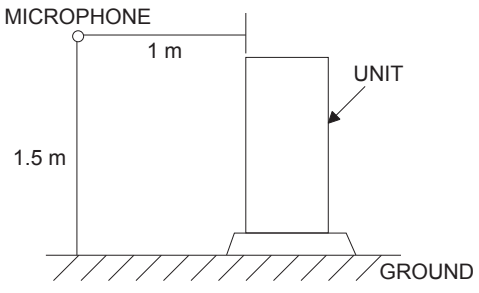
MODE	SPL(dB)	LINE
HEATING	56	■—■
COOLING	53	○—○
SILENT(Cooling)	50	●—●
SUPER SILENT 1(Cooling)	47	△—△
SUPER SILENT 2(Cooling)	43	▲—▲



PUMY-SP140VKM.TH(-BS)
PUMY-SP140VKMR1.TH(-BS)
PUMY-SP140YKM.TH(-BS)
PUMY-SP140YKMR1.TH(-BS)

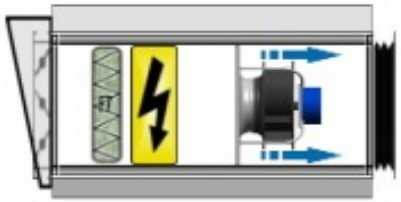
MODE	SPL(dB)	LINE
HEATING	56	■—■
COOLING	54	○—○
SILENT(Cooling)	51	●—●
SUPER SILENT 1(Cooling)	48	△—△
SUPER SILENT 2(Cooling)	44	▲—▲





Offer Number	D1/0000011/19-001 / 1 - 10/10/aa
Offer Ref.	-
Reference	KSF

Range	**UTBS8 PRO-REG**	
Baseframe	Included	
Rain Protection Canopy	Included	
Dimensions		
Height	580	mm
Width	1900	mm
L1	1205	mm
Weight	305.38	Kg



1) Supply module

Ref. UTBS-8 P F7 E45 2 KW PRO-REG L B OnRequest

Options

Rain Protection Canopy	5137267800
	TPP UTBS-8 L-1205

Inlet

Damper	5137057400
	ID KIT COMPUERTA UTBS-8
Width x Height	1600X310 mm
Servomotor	5416763000••••••••••
	LF-24 S
Weather cowl	5137266200
	VF-UTBS8

Outlet

High Eff. Filtration - F7

Front speed	1.2	m/s
Initial Pressure drop	27	Pa
P.D. medium life	114	Pa
P.D. replacement	200	Pa

electrical heater

Thermal Power	45	kW
Steps	3	
Voltage	3~ 400 V	
Air In Temperature / R.H.	-5 / 80.0%	ºC
Air Out Temperature / R.H.	37.66 / 4.9%	ºC

Supply Fan - 2xBPF315

Air volume	799.998	L/s
Available pressure	100	Pa
Total static pressure	261	Pa
rpm/0-10V	1473 / 4.7	
Absorbed power	2x0.219	kW
Installed motor power	2x0	kW
Voltage		
SFP	395	W/l/s

Control

Fans Working Mode

CAV - Constant Air Volume (Mode by default). Airflow sensor included in the unit.

Supply Fan

Radiated noise Lw — Lp(A)*

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	dB(A)	3.0 m
58	52	49	44	51	46	41	34	54	33

Inlet noise Lw — Lp(A)*

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	dB(A)	3.0 m
61	63	62	62	59	58	53	48	65	44

Outlet noise Lw — Lp(A)*

63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz	dB(A)	3.0 m
62	64	61	65	68	64	59	53	71	50

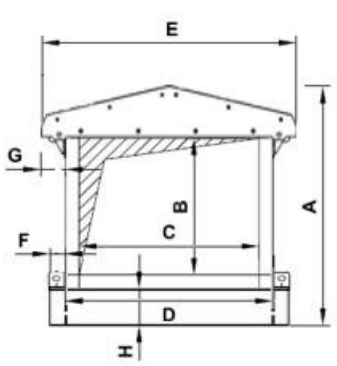
* (*) Sound pressure level, free field measured. Depending on the installation type and materials, real values could be quite different.

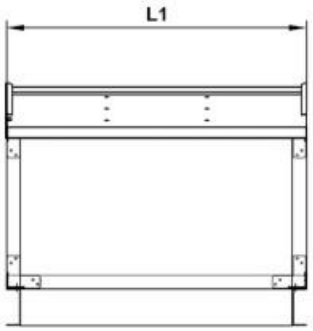
Characteristics

Sandwich panel thickness 25 mm
Mineral wool acoustic-thermal isolation and fire retardant A1.
External sheet metal with PVC cover for better protection.
Structure in aluminium profile.
Low pressure drop filters.
Coils with copper tubes and aluminium fins.
Condensation tray and droplet eliminator when cold coil is installed.
Three-phase electrical heaters with two thermal protections.
* First level with automatic resetting, second level with manual resetting (in case of high temperatures)

High efficiency plug fans, backward blades, three-phase motors.
For the right use it's needed frequency drivers.
NOTE: Accessories (Servomotors, VFD, Weather cowls, etc…) not cabled and not assembled.
NOTE: In the attached sketch, the modules are numbered from left to right and from bottom to top.

Dimensions



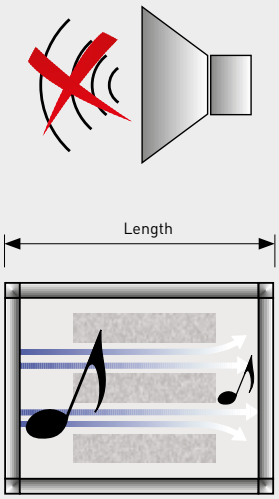


	A	B	C	D	E	F	G	Ø	H
mm	788	440	1840	1900	2060	36	80	10	80

	L1
mm	1205

OPTIONAL MODULES

SILENCER BOX (SIL)



Acoustic attenuation boxes. Two baffle lengths available: 600 mm and 900 mm.
Baffles with fireproof glass wool insulation, 200 mm wide, covered with highly resistant glass cloth for easy cleaning.

Model	Length 750 mm Baffles 600 mm		Length 1100 mm Baffles 900 mm	
	Baffles	Total weight (kg)	Baffles	Total weight (kg)
UTBS-2	2	34	2	39
UTBS-3	3	49	3	53
UTBS-5	4	65	4	86
UTBS-8	5	87	5	107

Silencer acoustic attenuation (in dB)

Length	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
750	1	2,3	6	11	15	16	9	1,5
1100	1,5	3,4	9	16,5	22,5	24	13,5	2,3

Appendix B

ACOUSTICS PLUS

CONTRACT TITLE: 40 Chalcot Road
SOUND SOURCE: Kitchen supply fan
MAKE & MODEL: Soler & Palau UTBS PRO-REG
From: Kitchen supply inlet

					OCTAVE BAND CENTRE FREQUENCY (Hz)								
OVERALL Lw					63	125	250	500	1k	2k	4k	8k	dBA
1			L_w of fan		61	63	62	62	59	58	53	48	65
2				1.000									
3			Lw at grille		61	63	62	62	59	58	53	48	65
4													
5	LENGTH (m)	C or R	x (mm)	x (mm)									
6	1.00	R	800-1500	400-800	1.48	0.99	0.49	0.26	0.23	0.23	0.23	0.23	
7													
8													
9													
10													
11													
12													
13													
14													
15													
16	Bends (Unlined)												
17	NUMBER	TYPE	SIZE (mm)										
18	0	90	0300-0400		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
19													
20													
21													
22													
23													
24													
25	BRANCHES												
26					0	0	0	0	0	0	0	0	
27													
28													
29	DUCT X-SECTIONAL AREAS												
30													
31													
32	OTHER ATTENUATION												
33	SIL-UBS				2	3	9	17	23	24	14	2	
34													
35													
36													
37	END REFLECTION SIZE (m)												
38	0.501 – 0.800				5	2	0	0	0	0	0	0	
39													
40				**Lw LEAVING SYSTEM**	53	57	53	45	36	34	39	45	50
41	Room Volume (m^3)			10000	-26	-26	-26	-26	-26	-26	-26	-26	
42	Mid-Frequency RT (s)			0.05	-13	-13	-13	-13	-13	-13	-13	-13	
43				**REVERBERANT SPL**	14	18	13	6	-3	-5	0	6	11
44	Distance to Listener			3	-21	-21	-21	-21	-21	-21	-21	-21	
45	Q=1 in free space			0.431 - 0.620	2	5	6	7	8	9	9	9	
46	Q=2 flush with surface			n/a	0	0	0	0	0	0	0	0	
47	Q=4 junction with 2 surfaces			n/a	0	0	0	0	0	0	0	0	
48				**DIRECT SPL**	34	41	38	32	24	22	28	34	37
49				**RESULTANT TOTAL SPL**	35	41	38	32	24	22	28	34	37