43 Great Russell Street
Holborn
London

Environmental Noise Survey
and Plant Noise Assessment Report

27563/PNA1

13 February 2020

For:
ANA Properties Limited
20-23 Greville Street
London
EC1N 8SS

Hann Tucker Associates
Consultants in Acoustics Noise & Vibration

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Hann Tucker Associates

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Document Control

Rev	Date	Comment	Prepared by	Authorised by
0	13/02/2020	-	[redacted]	[redacted]
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1	13/02/2020	Nearest Noise Sensitive Receptors added to the drawing.	Alexander Wilson Assistant Consultant BSc(Hons), AMIOA	Andrew Fermer Director BSc(Hons), MIOA

Hann Tucker Associates

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Contents

Attachments

1.0 Introduction

The building at 43 Great Russell Street on the corner of Coptic Street is undergoing a refurbishment. The intention is to replace the services throughout the building and install new AC equipment, which will be located at the existing roof level.

Hann Tucker Associates have therefore been commissioned to undertake an environmental noise survey, set noise emission limits with reference to the requirements of the Local Authority and assess the proposed items of plant.

This report presents the methodology and findings of our noise survey and assessment.

2.0 Objectives

To inspect the site to familiarise ourselves with its layout and surroundings in order to identify suitable accessible locations for environmental noise measurements.

To establish by means of an unmanned 24 hour survey the existing L_{Amax}, L_{Aeq} and L_{A90} environmental road, rail and air traffic noise levels at a single secure and accessible on-site position, using fully computerised noise monitoring equipment.

Measurement procedures shall be in general accordance with those described in BS 4142: 2014, Method for rating industrial noise affecting mixed residential areas, published by the British Standards Institution.

The survey will enable noise emission limits from the development to be identified with reference to the requirements of the Local Authority and the application of BS 4142: 2014 and to minimise the possibility of noise nuisance by neighbours.

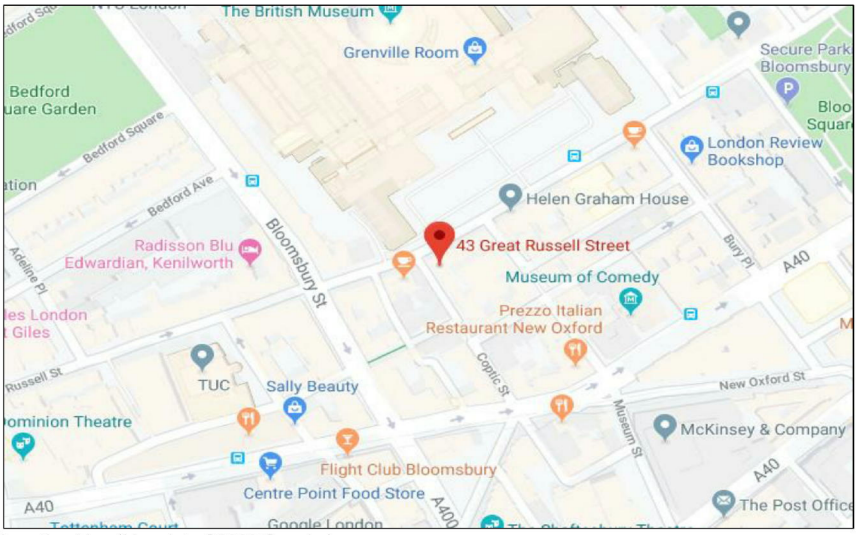
To undertake an assessment of proposed plant items (as per email received dated 12 December 2019), relative to the requirements of the Local Authority.

To advise on noise control measures, if required, with reference to the requirements of the Local Authority.

3.0 Site Description

3.1 Location

The site is located in Holborn, London at 43 Great Russell Street. The location is shown in the Location Map below.



Location Map (Map data ©2020 Google.)

The site falls within the jurisdiction of the London Borough of Camden.

3.2 Description

The existing site is the building at 43 Great Russell Street in Holborn, London. The site is bound by Great Russell Street to the north, Coptic Street to the west and commercial and residential buildings to the east and south. The Great British Museum is situated approximately 50m to the north. The dominant noise sources were noted to be road traffic from Great Russell Street and Coptic Street.

The site is shown in the Site Plan below.

Site Plan (Imagery 2020 © Bluesky, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The Geoinformation, Map Data © 2020 Google)

4.0 Acoustic Terminology

For an explanation of the acoustic terminology used in this report please refer to Appendix A enclosed.

5.0 Acoustic Standards and Guidelines

5.1 Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) was published in March 2010 (i.e. before the NPPF). The NPSE is the overarching statement of noise policy for England and applies to all forms of noise other than occupational noise, setting out the long term vision of Government noise policy which is to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The Explanatory Note to the NPSE has three concepts for the assessment of noise in this country:

NOEL – No Observed Effect Level
This is the level below which no effect can be detected and below which there is no detectable effect on health and quality of life due to noise.

LOAEL – Lowest Observable Adverse Effect Level
This is the level above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.

None of these three levels are defined numerically and for the SOAEL the NPSE makes it clear that the noise level is likely to vary depending upon the noise source, the receptor and the time of day/day of the week, etc. The need for more research to investigate what may represent an SOAEL for noise is acknowledged in the NPSE and the NPSE asserts that not stating specific SOAEL levels provides policy flexibility in the period until there is further evidence and guidance.

The NPSE concludes by explaining in a little more detail how the LOAEL and SOAEL relate to the three NPSE noise policy aims listed above. It starts with the aim of avoiding significant adverse effects on health and quality of life, then addresses the situation where the noise impact falls between the LOAEL and the SOAEL when *"all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development."* The final aim envisages pro-active management of noise to improve health and quality of life, again taking into account the guiding principles of sustainable development which include the need to minimise travel distance between housing and employment uses in an area.

5.2 National Planning Policy Framework (NPPF)

The following paragraphs are from the NPPF (revised February 2019):

"180. Planning policies and decisions should also ensure that new development is appropriate

for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed."

Paragraph 180 also references the Noise Policy Statement for England. This document does not refer to specific noise levels but instead sets out three aims:

"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development.

Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."

5.3 Planning Practice Guidance on Noise

Planning Practice Guidance (PPG) under the NPPF has been published by the Government as a web based resource at http://planningguidance.planningportal.gov.uk/blog/guidance/. This includes specific guidance on Noise although, like the NPPF and NPSE the PPG does not

provide any quantitative advice. It seeks to illustrate a range of effect levels in terms of examples of outcomes as set out in the following table:

Perception	Examples of Outcomes	Increasing effect level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable hard, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

5.4 Local Authority Requirements

The site lies within the jurisdiction of the London Borough of Camden. Their advice regarding criteria for atmospheric noise emissions from building service plant is as follows:

"Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (L_{A90}), expressed in dB(A) when all plant/equipment are in operation. Where it is anticipated that any plant/equipment will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps) special attention should be given to reducing the

noise levels from that piece of plant/equipment at any sensitive façade to at least 10dB(A) below the L_{A90}, expressed in dB(A)".

5.5 BS 4142:2014

When setting plant noise emission criteria reference is commonly made to BS 4142: 2014 "*Methods for rating and assessing industrial and commercial sound".*

The procedure contained in BS 4142:2014 provides an assessment of the likely effects of sound on people when comparing the specific noise levels from the source with representative background noise levels. Where the noise contains "a tone, impulse or other characteristic" then various corrections can be added to the specific (source) noise level to obtain the "rating level".

BS 4142 states that: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

- *"Typically, the greater this difference, the greater the magnitude of the impact."*

- *"A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context."*

- *"A difference of around +5dB 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."*

The determination of the "rating level" and the "background level" are both open to interpretation, depending on the context.

In summary it is not possible to set plant noise emission criteria purely on the basis of BS 4142:2014. It is reasonable to infer from the above, however, that a difference of around -5dB corresponds to "No Observed Effect Level" as defined in the Noise Policy Statement for

England. It is also reasonable to infer from the above that if the plant noise rating level does not exceed the existing background noise level outside any noise sensitive residential window then the plant noise is of "low impact".

5.6 World Health Organisation Guidelines on Community Noise

BS8233:2014 is based upon the current World Health Organisation (WHO) guidance "*Guidelines on Community Noise*". A summary of the noise guidelines relevant to the proposed scheme is presented in the table below.

Residential Environment	Critical Health Effect(s)	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

These WHO guidelines are based, in almost all cases, on the lower threshold below which the occurrence rates of any particular effect can be assumed to be negligible.

5.7 British Standard BS8233: 2014

British Standard 8233: 2014 "Guidance on sound insulation and noise reduction for buildings" provides guidance for the control of noise in and around buildings.

BS8233:2014 Section 7.7.2 titled "Internal ambient noise levels for dwellings" states:

"In general for steady external noise sources, it is desirable that internal ambient noise levels do not exceed the following guideline values:

Activity	*Location*	*Desirable Internal Ambient Criteria*	
		07:00 - 23:00	*23:00 - 07:00*
Resting	*Living Rooms*	*35 dB $L_{Aeq,16hour}$*	-

Activity	*Location*	*Desirable Internal Ambient Criteria*	
		07:00 - 23:00	*23:00 - 07:00*
Dining	*Dining Room/Area*	*40 dB $L_{Aeq,16hour}$*	-
Sleeping (Daytime Resting)	*Bedroom*	*35 dB $L_{Aeq,16hour}$*	*30 dB $L_{Aeq,8hour}$*

5.8 Statutory Noise Nuisance

There is no quantitative definition of statutory noise nuisance. It is generally accepted however, that if the plant noise level is at least 5dB (or 10dB if tonal) below the minimum background $L_{90(15minutes)}$ at 1m from the nearest noise sensitive residential window, then the risk of a statutory noise nuisance is avoided. By adopting this as a design criterion the guidance contained in BS 4142:2014 should also be complied with.

6.0 Survey Methodology

The survey was undertaken by Alexander Wilson BSc(Hons).

6.1 Procedure

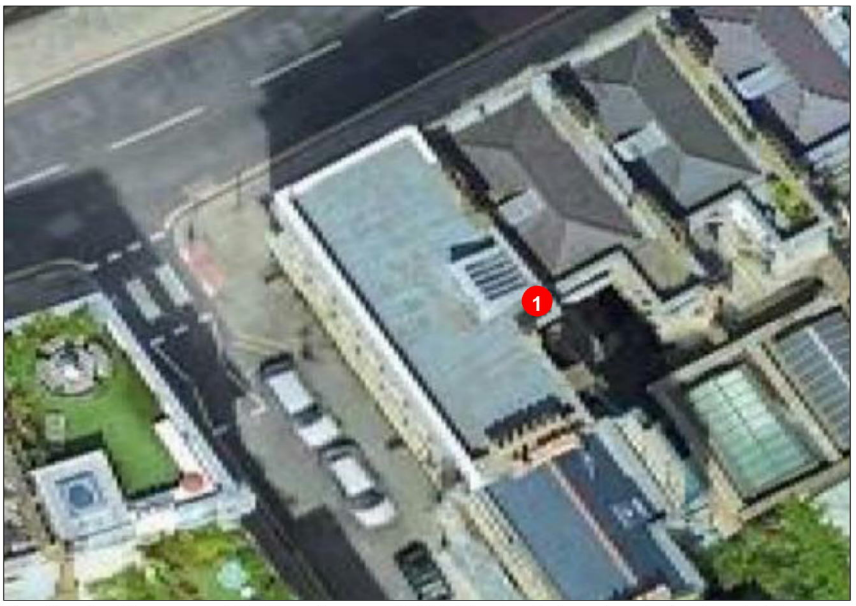
Fully automated environmental noise monitoring was undertaken from approximately 12:30 hours on Wednesday 8 January 2020 to 12:00 hours on Friday 10 January 2020.

During the periods we were on site the wind conditions were moderate and the sky was generally overcast. We understand that generally throughout the survey period the weather conditions were clear. These conditions are considered suitable for obtaining representative measurement results.

Measurements were taken continuously of the A-weighted (dBA) L_{90}, L_{eq} and L_{max} sound pressure levels over 15 minute periods.

6.2 Measurement Position

The sound level meter was positioned with a microphone attached to a pole approximately 1 metre above the roof level. The microphone was attached to a railing and positioned approximately 1 metre from the façade.



Plan Showing Measurement Positions (Imagery 2020 © Bluesky, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The Geoinformation, Map Data © 2020 Google)

6.3 Instrumentation

The instrumentation used during the survey is presented in the table below:

Description	Manufacturer	Type	Serial Number	Calibration
Type 1 ½" Condenser Microphone	ACO Pacific	7052E	71839	Calibration on 09/08/2019
Preamp	Svantek	SV18	75733	Calibration on 09/08/2019
Type 1 Data Logging Sound Level Meter	Svantek	971	74368	Calibration on 09/08/2019

The sound level meter, including the extension cable, was calibrated prior to and on completion of the survey. No significant changes were found to have occurred (no more than 0.1dB).

The sound level meter was located in an environmental case with the microphone connected to the sound level meter via an extension cable.

The microphone was fitted with a windshield.

7.0 Results

The results have been plotted on Time History Graph 27563/TH1 enclosed, presenting the 15 minute A-weighted (dBA) L_{90} and L_{eq} noise levels at the measurement position throughout the duration of the survey.

The lowest $L_{A90\ (15\ min)}$ measurements recorded during the survey are presented in the table below:

Lowest Measured $L_{A90(15min)}$ Background Noise Level (dB re 2 x 10^{-5} Pa)	
Daytime (07:00 – 23:00) Hours	**Night-Time (23:00 – 07:00) Hours**
46 dBA	42 dBA

8.0 Discussion Of Noise Climate

During the periods we were on site the dominant noise sources were noted to be road traffic from Great Russell Street and Coptic Street.

9.0 Plant Noise Emission Criteria

Building services plant external noise emission levels will need to comply with local planning/environmental authority requirements and statutory noise nuisance legislation.

Based on the above criterion we therefore propose the following future plant noise emission criteria should be achieved (with all relevant plant operating simultaneously) at 1 metre from the nearest noise sensitive facades.

On the basis of the Local Authority requirements discussed in Section 5.4 and the results of the environmental noise survey discussed in Section 7.0, we propose that the following plant noise emission criteria be achieved at 1 metre from the nearest noise sensitive residential window.

Plant Noise Emission Criteria (dBA)	
Daytime (07:00 – 23:00 hours)	**Night-time (23:00 – 07:00 hours)**
41 dBA	37 dBA

10.0 Plant Noise Assessment

10.1 Proposed Plant

We understand the new items of plant being proposed are as followed:

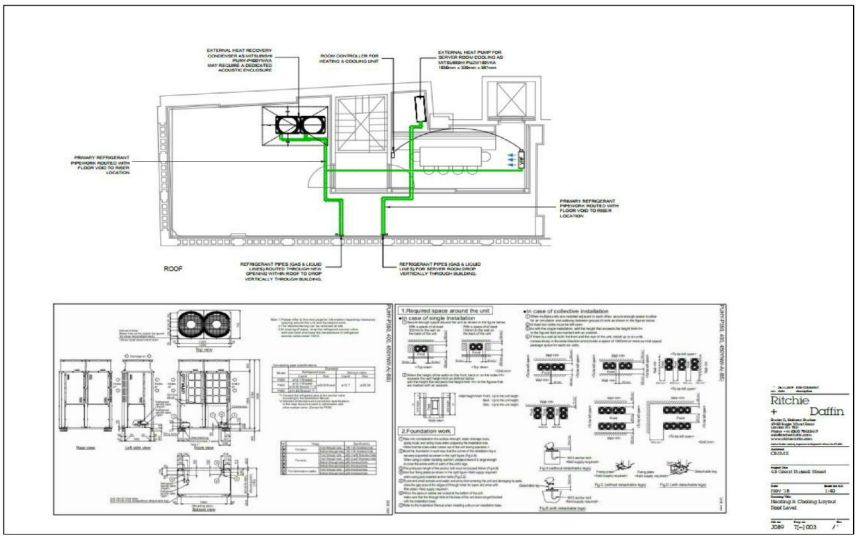
Sound Pressure Level at 1m Octave Band Centre Frequency									dBA
Plant Unit	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4KkHz	8kHz	
PURYP400YNWA	80	64	64	61	54	50	47	45	62
PUZM100VKA	54	54	53	49	46	41	35	29	51

10.2 Drawings

Our acoustic analyses is based on the following drawings provided by Ritchie & Daffin.

Reference	Title	Date
T[--] 003	Heating & Cooling Layout Roof Level	November 2018

A proposed site plan is shown below.



10.3 Mitigation Measures

In order to control plant noise emissions in line with the proposed criterion, we recommend an enclosure for both condensers. The enclosure for the PURYP400YNWA will need to be capable of a 18dB reduction. While the enclosure for the PUZM100VKA will need to be capable of a 13dB reduction.

Please see Appendix for list of suitable suppliers for acoustic enclosures.

10.4 Plant Noise Impact Assessment

The following tables summarise our predictions of plant noise emissions from the roof to the nearest noise sensitive window.

Description		Noise Level at Octave Band Centre Frequency								dBA
		63	125	250	500	1K	2K	4k	8K	
PURYP400YNWA	SPL @1m	80	64	64	61	54	50	47	45	**62**
Façade Correction		3	3	3	3	3	3	3	3	
Enclosure		-18	-18	-18	-18	-18	-18	-18	-18	
L_w to L_p Distance Correction (Approx. 6m)		-13	-13	-13	-13	-13	-13	-13	-13	
Sound Pressure Level at 1m from Nearest Window		52	36	36	33	26	22	19	17	**34**

Description		Noise Level at Octave Band Centre Frequency								dBA
		63	125	250	500	1K	2K	4k	8K	
PUZM100VKA	SPL @ 1m	54	54	53	49	46	41	35	29	**51**
Façade Correction		3	3	3	3	3	3	3	3	
Enclosure		-13	-13	-13	-13	-13	-13	-13	-13	

Description	Noise Level at Octave Band Centre Frequency								dBA
	63	125	250	500	1K	2K	4k	8K	
L_w to L_p Distance Correction (Approx. 3m)	-8	-8	-8	-8	-8	-8	-8	-8	
Sound Pressure Level at 1m from Nearest Window	36	36	35	31	28	23	17	11	**33**

Description		Noise Level at Octave Band Centre Frequency								dBA
		63	125	250	500	1K	2K	4k	8K	
PURYP400YNWA	Sound Pressure Level at 1m from Nearest Window	52	36	36	33	26	22	19	17	**34**
PUZM100VKA	Sound Pressure Level at 1m from Nearest Window	36	36	35	31	28	23	17	11	**33**
Combined Sound Pressure Level at 1m from Nearest Window of both Condensers		50	37	37	33	28	24	19	16	**37**

Our calculations indicate that with the proposed attenuation measures the plant noise emissions should achieve the proposed criteria of 37dBA outlined in Section 9 for 24 hour operation.

11.0 Conclusions

An environmental noise survey has been undertaken in order to establish the currently prevailing noise levels.

The environmental noise impact upon the surrounding buildings has been assessed in the context of national and local planning policies.

Noise emission limits from the development have been identified with reference to the requirements of the Local Authority and to minimise the possibility of noise nuisance to neighbours.

Measurements procedures have been in general accordance with British Standard BS 7445 "Description and measurement of environmental noise."

Plant noise emission criteria have been recommended based on the results of the noise survey and with reference to the Local Authority's requirements, together with the assessment of the proposed items and required attenuation to meet the requirements.

Appendix A

The acoustic terms used in this report are defined as follows:

dB — Decibel - Used as a measurement of sound level. Decibels are not an absolute unit of measurement but an expression of ratio between two quantities expressed in logarithmic form. The relationships between Decibel levels do not work in the same way that non-logarithmic (linear) numbers work (e.g. 30dB + 30dB = 33dB, not 60dB).

dBA — The human ear is more susceptible to mid-frequency noise than the high and low frequencies. The 'A'-weighting scale approximates this response and allows sound levels to be expressed as an overall single figure value in dBA. The $_A$ subscript is applied to an acoustical parameter to indicate the stated noise level is A-weighted

It should be noted that levels in dBA do not have a linear relationship to each other; for similar noises, a change in noise level of 10dBA represents a doubling or halving of subjective loudness. A change of 3dBA is just perceptible.

$L_{90,T}$ — L_{90} is the noise level exceeded for 90% of the period *T* (i.e. the quietest 10% of the measurement) and is often used to describe the background noise level.

$L_{eq,T}$ — $L_{eq,T}$ is the equivalent continuous sound pressure level. It is an average of the total sound energy measured over a specified time period, *T*.

L_{max} — L_{max} is the maximum sound pressure level recorded over the period stated. L_{max} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the L_{eq} noise level.

Sound Pressure Level (L_p) is the sound pressure relative to a standard reference pressure of 2×10^{-5} Pa. This level varies for a given source according to a number of factors (including but not limited to: distance from the source; positioning; screening and meteorological effects).

Sound Power Level (SWL or L_w) is the total amount of sound energy inherent in a particular sound source, independent of its environment. It is a logarithmic measure of the sound power in comparison to a specified reference level (usually 10^{-12} W).

43 Great Russell Street

SPECIFICATION FOR

SMALL ACOUSTIC ENCLOSURES

The condenser units shall be supplied complete with acoustic treatment which shall achieve adequate levels of attenuation to ensure that the following limiting sound pressure levels are not exceeded when measured at a distance of 1m free field over a reflecting plane are in any horizontal direction or in any horizontal or vertical direction under any load conditions.

Condenser unit: PURYP400YNWA

Duty/Time	A-weighted Limiting Sound Pressure Level @ 1m (dB re 2 x 10^{-5} Pa)
24 hours	42

Condenser unit: PUZM100VKA

Duty/Time	A-weighted Limiting Sound Pressure Level @ 1m (dB re 2 x 10^{-5} Pa)
24 hours	31

Furthermore they shall not exhibit any significant tonal content.

Exceedances in excess of the measurement tolerance for a Type 1 sound level meter shall constitute a failure.

The enclosed outer panels shall be constructed from galvanized sheet steel having a minimum thickness of 1.6mm and fixed at 300mm (max) centres. The enclosure inner panels shall be constructed from punch-perforated (round-hole) galvanised sheet steel facing, having a minimum thickness of 0.7mm fixed at 300mm (max) centres. Flattened-expanded ("Expamet") sheet shall not be used, unless all edges of the sheet are mechanically fixed to the panel casing and galvanised steel cover strips are used to prevent rivet heads pulling through the perforated sheet (trapping the Expamet between two solid steel layers).

The inert, rot and vermin proof, non-hygroscopic and non-combustible mineral wool or glass fibre acoustic medium shall be packed to a density of not less than 48kg/m^3 This shall be faced with a glass fibre cloth, or other approved infill protection membrane. Panels shall be constructed and assembled so that no egress of the acoustic medium will occur under the operating conditions.

Doors, access panels, windows and ventilation ducts or electrical cable penetrations hall be treated so as to maintain the specified acoustic insulation of the assembled enclosure.

Demountable sections shall be designed to allow easy disassembly and reassembly by unskilled personnel without affecting the acoustic performance.

The supplier shall ensure that the assembled enclosure is designed and constructed to withstand site operating conditions such as wind and snow loads, roof mounted plant, etc., as appropriate, and if outside, to be suitably weatherproofed.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

Any deviations from the above specification must be agreed by, and confirmed in writing to, Hann Tucker Associates.

SUITABLE SUPPLIERS

Of

ACOUSTIC ENCLOSURES

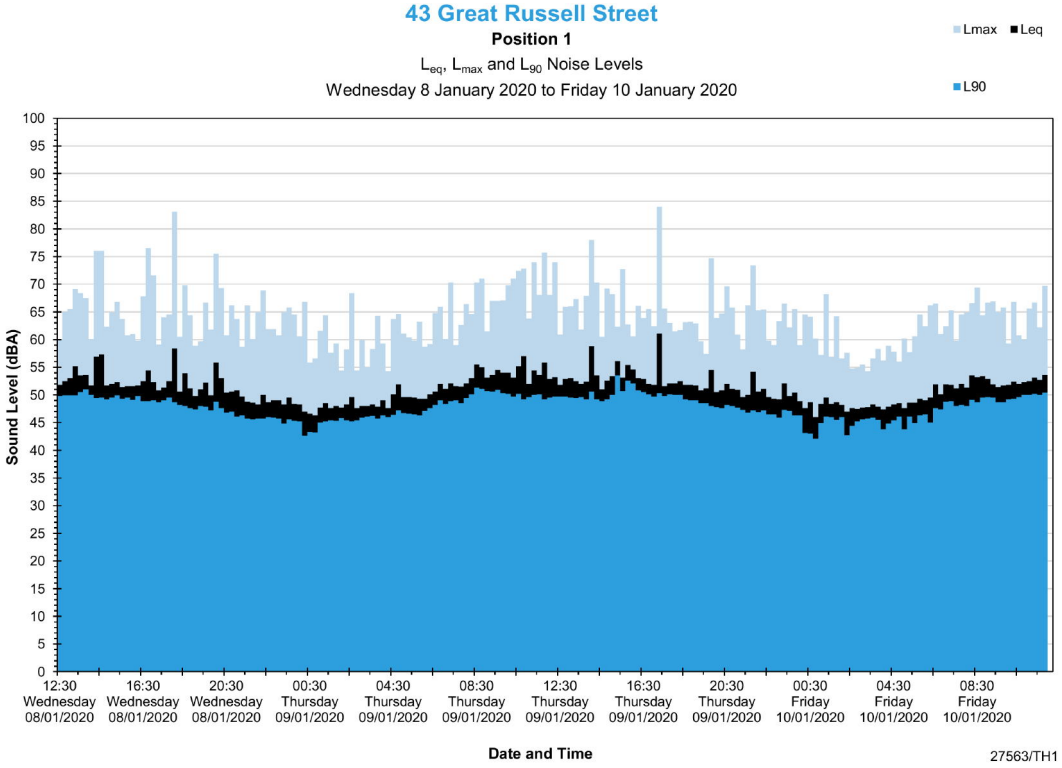
Name & Address	Telephone Number	Contact
IAC Acoustics IAC House Moorside Road Winchester SO23 7US	01962 873000	Paul Gilbert
Allaway Acoustics Ltd 1 Queens Road Hertford SG14 1EN	01992 550825	Jim Grieves Roger Wade
Acoustic Engineering Services (UK) Ltd The Redwood Suite Guardian House Borough Road Godalming Surrey GU7 2AE	01483 495963	Barry Austin Mark Stagg
QuietStar Limited 1 Glen Road Fleet Hampshire GU51 3QS	01252 674327	Luke Willis

43 Great Russell Street

Position 1

L_{eq}, L_{max} and L_{90} Noise Levels

Wednesday 8 January 2020 to Friday 10 January 2020



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