



**Venta Acoustics**

**Report VA2840.190702.NIA**

**28 Goodge Street, London**

**Noise Impact Assessment**

**02 July 2019**

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## Attachments

VA2840/SP1	Indicative Site Plan
VA2840/TH1-TH3	Environmental Noise Time Histories
Appendix A	Acoustic Terminology
Appendix B	Acoustic Calculations

# 1. Introduction

It is proposed to install a new extract fan system at 28 Goodge Street, London.

Venta Acoustics has been commissioned by Bigbe Food Ltd to undertake an assessment of the potential noise impact of these proposals in support of an application for planning permission.

An environmental noise survey has been undertaken to determine the background noise levels at the most affected noise sensitive receptors. These levels are used to undertake an assessment of the likely impact with reference to the planning requirements of Camden Council.

# 2. Design Criterion and Assessment Methodology

## 2.1 Consultation with the Local Authority

Camden Council’s Local Plan (adopted June 2017), Appendix 3, provides the following guidance regarding noise from 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).*

Existing Noise sensitive receiver	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 <sub>L<sub>Amax</sub></sub>	‘Rating level’ between 9dB below and 5dB above background or noise events between 57dB and 88dB L <sub>Amax</sub>	‘Rating level’ greater than 5dB above background and/or events exceeding 88dB <sub>L<sub>Amax</sub></sub>

*\*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.*

*There are certain smaller pieces of equipment on commercial premises, such as extract ventilation, air conditioning units and condensers, where achievement of the rating levels (ordinarily determined by a BS:4142 assessment) may not afford the necessary protection. In these cases, the Council will generally also require a NR curve specification of NR35 or below, dependant on the room (based upon measured or predicted  $L_{eq,5mins}$  noise levels in octave bands) 1 metre from the façade of affected premises, where the noise sensitive premise is located in a quiet background area.*

## 2.2 Method of Assessment: BS4142 2014

British Standard BS4142:2014 Methods for rating and assessing industrial and commercial sound describes a method for rating and assessing sound of an industrial and/or commercial nature, which includes sound from fixed installations comprising mechanical and/or electrical plant and equipment;

The assessment methodology considers the Specific Sound Level, as measured or calculated at a potential noise sensitive receptor, due to the source under investigation. A correction factor is added to this level to account for the acoustic character of the sound as follows:

**Tonality** – A correction of up to 6dB depending on the prominence of tones;

**Impulsivity** - A correction of up to 9dB depending on the prominence of impulsivity;

**Other sound characteristics** - A 3dB correction may be applied where a distinctive acoustic character is present that is neither tonal nor impulsive;

**Intermittency** - A 3dB correction may be applied where the specific sound has identifiable on/off conditions.

An estimate of the impact of the source is obtained by subtracting the typical background noise level from the corrected Specific Sound Level.

Typically, the greater this difference, the greater 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.
- A difference of around +5 dB could 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 there will be an adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound having a low impact, depending on the context.

### 2.3 BS8233:2014

BS8233 *Guidance on sound insulation and noise reduction for buildings* provides guidance as to suitable internal noise levels for different areas within residential buildings.

The relevant section of the standard is shown below in Table 2.1.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB LAeq, 16 hour	-
Dining	Dining Room	40 dB LAeq, 16 hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq, 16 hour	30 dB LAeq, 8 hour

Table 2.1 - Excerpt from BS8233: 2014

[dB ref. 20µPa]

## 3. Site Description

As illustrated on attached site plan VA2840/SP1, the site building is located within a terrace of shops along Goodge Street with residential accommodation on the upper levels. To the rear of the property is a former music studio recently converted to office space.

Existing building services plant was noted serving several of the neighbouring premises.

It is expected that the extraction fan will only be used until 23:00 hours each evening.

The most affected noise sensitive receivers are expected to be dwellings directly above the site.

## 4. Environmental Noise Survey

### 4.1 Survey Procedure & Equipment

In order to establish the existing background noise levels at the site, a noise survey was carried out between Monday 24<sup>th</sup> and Thursday 27<sup>th</sup> June 2019 at the location shown in site plan VA2840/SP1. This location was chosen to be representative of the background noise level at the most affected noise sensitive receivers.

Continuous 5-minute samples of the LAeq, LAmx, LA10 and LA90 sound pressure levels were undertaken at the measurement location.

The weather during the survey period was generally dry with light winds. The background noise data is not considered to have been compromised by these conditions.

Measurements were made generally in accordance with ISO 1996 2:2017 *Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels*.

The following equipment was used in the course of the survey:

Manufacturer	Model Type	Serial No	Calibration	
			Certificate No.	Date
NTi Class 1 Integrating SLM	XL2	A2A-15892-E0	FL-19-121	14/3/19
Larson Davis calibrator	CAL200	13049	UCRT19/1501	18/4/19

**Table 4.1 – Equipment used for the tests**

The calibration of the sound level meter was verified before and after use with no significant calibration drift observed.

## 4.2 Results

The measured sound levels are shown as time-history plots on the attached charts VA2840/TH1-3.

The background noise level is determined by road traffic and existing plant servicing neighbouring properties.

The typical background noise levels measured were:

Monitoring Period	Typical LA90,5min
07:00 – 23:00 hours	48 dB
23:00 – 07:00 hours	42 dB
Background noise immediately after neighbour plant turns off (23:00 hours)	43 dB

**Table 4.2 – Typical background noise levels**

[dB ref. 20 µPa]

## 4.3 Plant Noise Emission Limits

A rating level of 10dB below the existing background noise level will be sought. On the basis of the measured noise levels and considering that it is not expected that the mitigated sound levels generated by the proposed plant units will have audible acoustic character features, the following plant specific sound levels should not be exceeded at the most affected noise sensitive receivers.

Monitoring Period	Design Criterion (LAeq)
07:00 – 23:00 hours	38 dB
23:00 – 07:00 hours	32 dB
Operational Hours	33 dB

**Table 4.3 – Specific sound pressure levels not to be exceeded at most affected noise sensitive receivers**

## 5. Predicted Noise Impact

### 5.1 Proposed plant

The following plant is proposed for installation on the rear roof and ducted up the rear of the building at the location indicated on site plan VA2840/SP1.

Plant Item	Quantity	Proposed Model	Notes
Kitchen Extract Fan	1	Flakt Woods 40 JM Aerofoil Extraction Axial Fan	Motor assumed to be externally mounted

**Table 5.1 – Indicative plant selections assumed for this assessment**

Consulting the manufacturer’s datasheets, the following noise emissions levels are attributed to the proposed plant items:

Plant Item	Octave Band Centre Frequency (Hz)								dB(A)
	Power Level, L <sub>w</sub> (dB)								
	63	125	250	500	1k	2k	4k	8k	
Kitchen Extract Fan	73	76	71	70	67	64	61	55	73

**Table 5.2 – Advised plant noise data used for the assessment**

### 5.2 Recommended Mitigation Measures

The calculations have determined that an attenuator located after the extract fan will be required and should have the following acoustic performance:

Attenuation Component	Octave Band Centre Frequency (Hz), Attenuator Insertion Loss (dB)							
	63	125	250	500	1k	2k	4k	8k
3x diameter length attenuator	7	7	10	14	22	18	13	9

**Table 5.3 – Recommended attenuation performance of induct attenuator**

This performance is expected to be provided by an appropriate 1200mm long attenuator, having a diameter of 400mm. This is on the basis of information provided in the Helios RSD attenuator catalogue, although other suitable suppliers may be available.

It is recommended that a Melanex lined silencer is used to prevent grease impregnation into the acoustic media which may degrade the performance realised over time.

Additionally, to control breakout noise from the fan, the fan module should be enclosed in a double skinned casing around the fan. This should provide the minimum sound reduction performance shown in Table 5.4. Alternatively, the fan should be repositioned within the building which would effectively control noise breakout from the unit.

Attenuation Component	Octave Band Centre Frequency (Hz), Sound Reduction Index (dB)							
	63	125	250	500	1k	2k	4k	8k
Fan Enclosure	10	15	18	23	30	32	35	33

Table 5.4 – Recommended acoustic performance of the fan enclosure.

Please note that the above recommendations relate to acoustic issues only. It is recommended that professional advice confirming the suitability of these measures be sought from others with regards to issues such as airflow, maintenance and visual impact.

### 5.3 Predicted noise levels

The cumulative noise level at the most affected noise sensitive receivers, the windows approximately 2m away, has been calculated on the basis of the above information and assuming the recommended mitigation measures, with reference to the guidelines set out in BS4142:2014 and ISO 9613-2:1996 *Attenuation of sound during propagation outdoors - Part 2: General method of calculation*.

A summary of the calculations are shown in Appendix B.

Description	dB(A)
Plant noise criterion	33 dB
L <sub>p</sub> 1m from receiver	31 dB

Table 5.5 – Predicted noise and level and design criteria at noise sensitive location

### 5.4 BS4142 Assessment

The context of the site is in a busy urban setting with several existing plant systems in the immediate surroundings and dominating the background noise level when operating. The introduction of a new extract system, with a specific noise level at least 10dB below the existing background, is not expected to change the local acoustic or draw attention to be perceived as characterful within this context.

As no acoustic character penalties are considered appropriate, the rating level is L<sub>Aeq</sub> 31dB, being 12dB below the representative background noise level. The BS4142 assessment would therefore indicate a low impact.

### 5.5 Comparison to NR35 Curve

As can be seen from the following comparison in Table 5.6, the predicted noise levels at 1m from the most affected receiver are comfortably below the NR35 curve as required by Camden Council.

Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
NR35	63	52	45	39	35	35	30	28
L <sub>p</sub> 1m from receiver	45	40	35	29	17	14	12	9

Table 5.6 – Comparison of predicted noise levels against the NR35 criterion



## 5.6 Comparison to BS8233:2014 Criteria

BS8233 assumes a loss of approximately 15dB for a partially open window. The external noise level shown in Table 5.5 would result in internal noise levels that achieve the guidelines shown in Table 2.1.

### 5.6.1 Structureborne Noise

All plant and ductwork should be fitted with anti-vibration mounts in accordance with the manufacturer guidelines.

The extract fan will have a dominant case frequency of 50-60Hz. To mitigate this, the fan motor should be mounted on rubber or neoprene mounts with a minimum deflection of 5mm, which would provide 95% isolation efficiency, considerably more than the recommended minimum of 90% isolation.

The fan should be attached to the ductwork on either side using flexible coupling to minimise vibration transfer to the ductwork. Ductwork should be attached to the building using isolated fixings, with either a rubber or neoprene isolator with a minimum deflection of 1mm, which would provide 90% isolation, considerably more than would be required considering the reduced energy transmitted to the ductwork.

The above measures are to control structureborne noise and re-radiated noise to other areas of the building to considerably below current internal noise levels and hence would be considered acceptable.

## 6. Conclusion

A baseline noise survey has been undertaken by Venta Acoustics to establish the background noise climate in the locality of 28 Goodge Street, London in support of a planning application for the proposed introduction of new building services plant.

This has enabled noise emission limits to be set at the most affected noise sensitive receiver such that the proposed installation meets the requirements of Camden Council.

The cumulative noise emission levels from the proposed plant have been assessed to be compliant with the plant noise emission limits, with necessary mitigation measures specified.

The proposed scheme is not expected to have a significant adverse noise impact and the relevant planning requirements have been shown to be met.

**Steven Liddell MIOA**



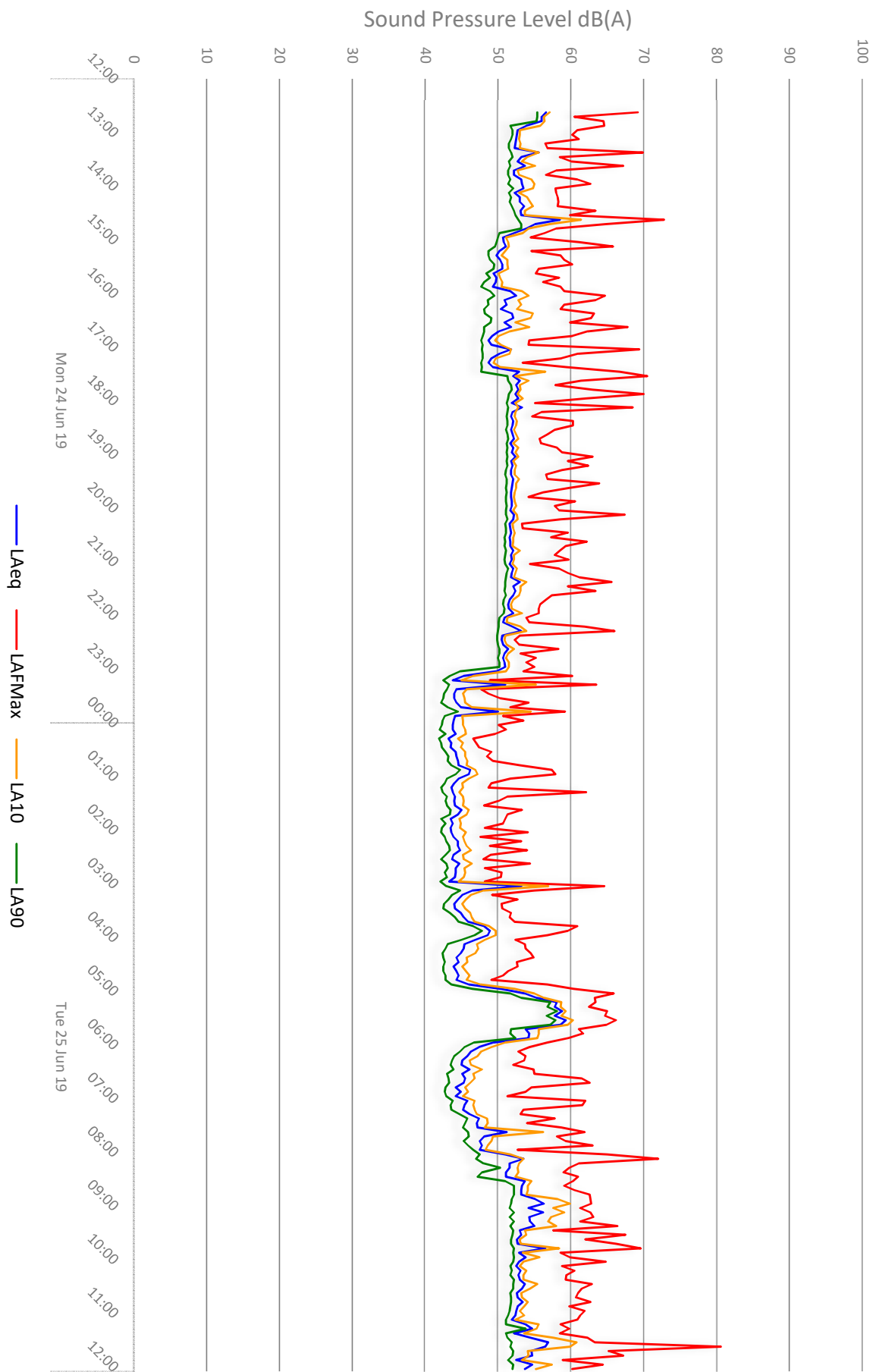
28 Goadge Street, London

Environmental Noise Time History: 1



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Figure VA2840/TH1



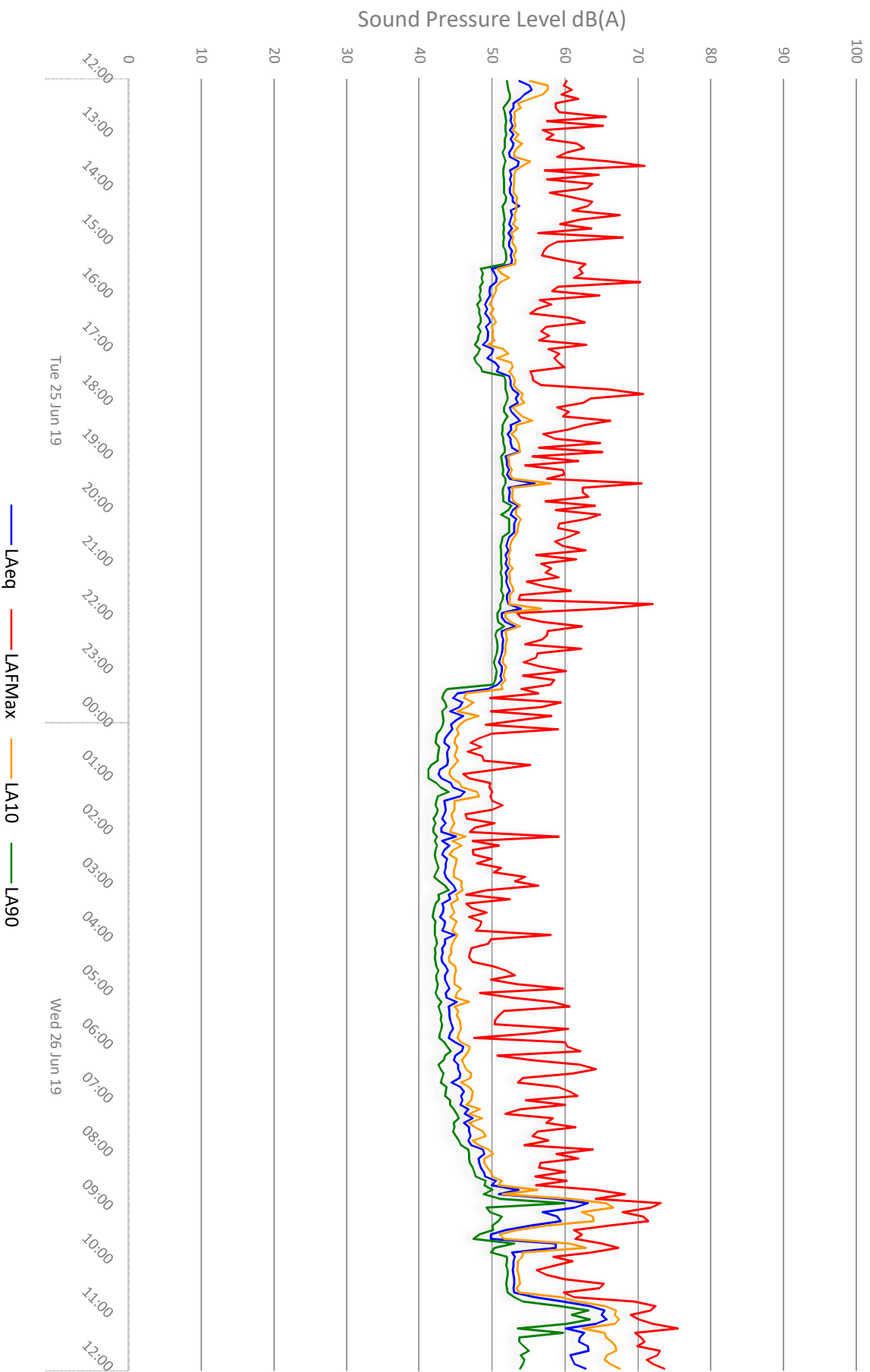
28 Goadge Street, London

Environmental Noise Time History: 2



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Figure VA2840/TH2



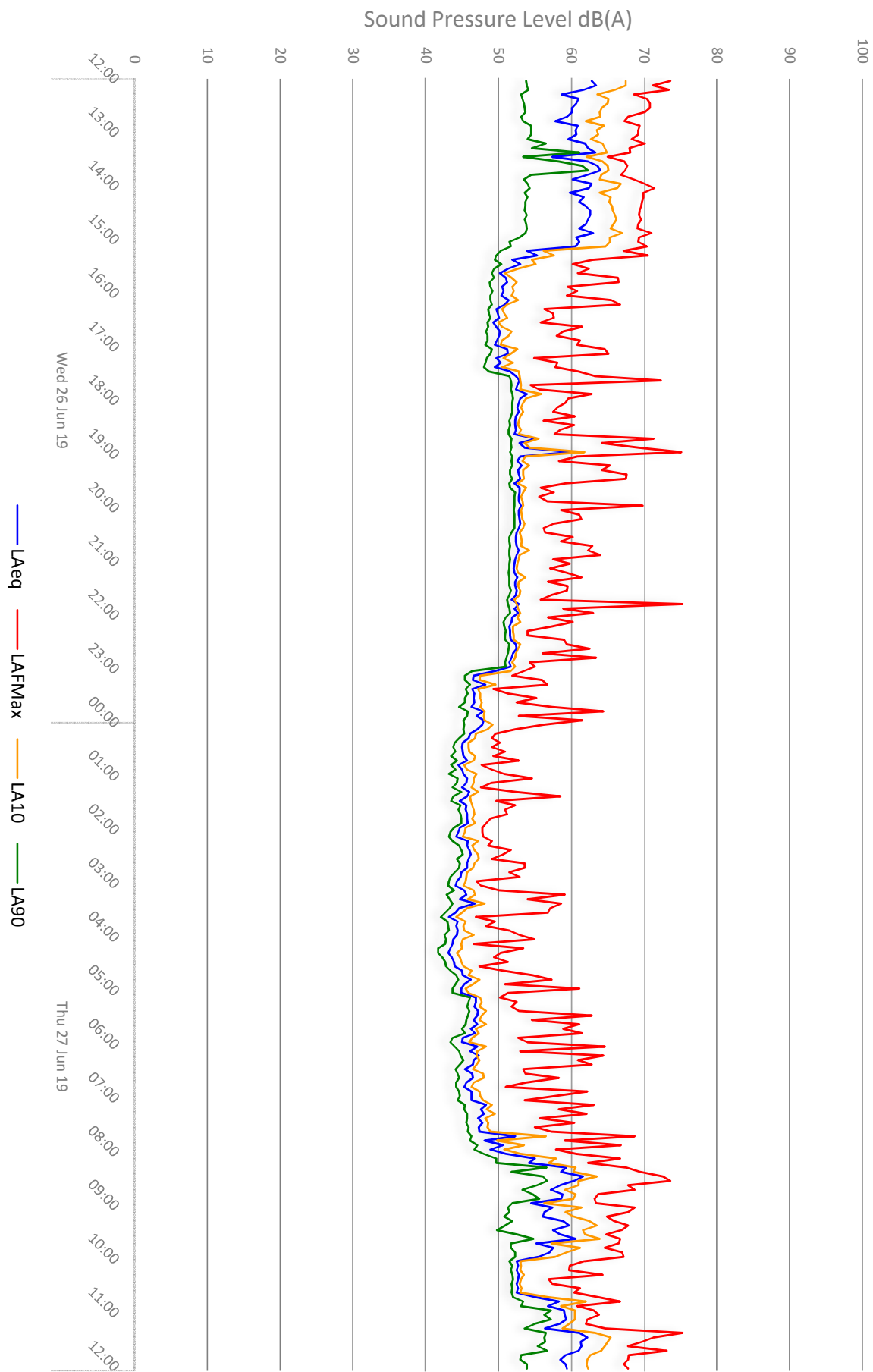
28 Goadge Street, London

Environmental Noise Time History: 3



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Figure VA2840/TH3



## Acoustic Terminology & Human Response to Broadband Sound

### 1.1 Acoustic Terminology

The human impact of sounds is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and variation in level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

<b>Sound</b>	Vibrations propagating through a medium (air, water, etc.) that are detectable by the auditory system.
<b>Noise</b>	Sound that is unwanted by or disturbing to the perceiver.
<b>Frequency</b>	The rate per second of vibration constituting a wave, measured in Hertz (Hz), where 1Hz = 1 vibration cycle per second. The human hearing can generally detect sound having frequencies in the range 20Hz to 20kHz. Frequency corresponds to the perception of 'pitch', with low frequencies producing low 'notes' and higher frequencies producing high 'notes'.
<b>dB(A):</b>	Human hearing is more susceptible to mid-frequency sounds than those at high and low frequencies. To take account of this in measurements and predictions, the 'A' weighting scale is used so that the level of sound corresponds roughly to the level as it is typically discerned by humans. The measured or calculated 'A' weighted sound level is designated as dB(A) or $L_A$ .
<b><math>L_{eq}</math> :</b>	A notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the actual, fluctuating sound measured over that period (e.g. 8 hour, 1 hour, etc). The concept of $L_{eq}$ (equivalent continuous sound level) has primarily been used in assessing noise from industry, although its use is becoming more widespread in defining many other types of sounds, such as from amplified music and environmental sources such as aircraft and construction. Because $L_{eq}$ is effectively a summation of a number of events, it does not in itself limit the magnitude of any individual event, and this is frequently used in conjunction with an absolute sound limit.
<b><math>L_{10}</math> &amp; <math>L_{90}</math> :</b>	Statistical $L_n$ indices are used to describe the level and the degree of fluctuation of non-steady sound. The term refers to the level exceeded for n% of the time. Hence, $L_{10}$ is the level exceeded for 10% of the time and as such can be regarded as a typical maximum level. Similarly, $L_{90}$ is the typical minimum level and is often used to describe background noise. It is common practice to use the $L_{10}$ index to describe noise from traffic as, being a high average, it takes into account the increased annoyance that results from the non-steady nature of traffic flow.
<b><math>L_{max}</math> :</b>	The maximum sound pressure level recorded over a given period. $L_{max}$ is sometimes used in assessing environmental noise, where occasional loud events occur which might not be adequately represented by a time-averaged $L_{eq}$ value.

### 1.2 Octave Band Frequencies

In order to determine the way in which the energy of sound is distributed across the frequency range, the International Standards Organisation has agreed on "preferred" bands of frequency for sound measurement and analysis. The widest and most commonly used band for frequency measurement and analysis is the Octave Band. In these bands, the upper frequency limit is twice the lower frequency limit, with the band being described by its "centre frequency" which is the average (geometric mean) of the upper and lower limits, e.g. 250 Hz octave band extends from 176 Hz to 353 Hz. The most commonly used octave bands are:

Octave Band Centre Frequency Hz | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000

## 1.3 Human Perception of Broadband Noise

Because of the logarithmic nature of the decibel scale, it should be borne in mind that sound levels in dB(A) do not have a simple linear relationship. For example, 100dB(A) sound level is not twice as loud as 50dB(A). It has been found experimentally that changes in the average level of fluctuating sound, such as from traffic, need to be of the order of 3dB before becoming definitely perceptible to the human ear. Data from other experiments have indicated that a change in sound level of 10dB is perceived by the average listener as a doubling or halving of loudness. Using this information, a guide to the subjective interpretation of changes in environmental sound level can be given.

Change in Sound Level dB	Subjective Impression	Human Response
0 to 2	Imperceptible change in loudness	Marginal
3 to 5	Perceptible change in loudness	Noticeable
6 to 10	Up to a doubling or halving of loudness	Significant
11 to 15	More than a doubling or halving of loudness	Substantial
16 to 20	Up to a quadrupling or quartering of loudness	Substantial
21 or more	More than a quadrupling or quartering of loudness	Very Substantial

## 1.4 Earth Bunds and Barriers - Effective Screen Height

When considering the reduction in sound level of a source provided by a barrier, it is necessary to establish the "effective screen height". For example if a tall barrier exists between a sound source and a listener, with the barrier close to the listener, the listener will perceive the sound as being louder if he climbs up a ladder (and is closer to the top of the barrier) than if he were standing at ground level. Equally if he sat on the ground the sound would seem quieter than if he were standing. This is explained by the fact that the "effective screen height" is changing with the three cases above. In general, the greater the effective screen height, the greater the perceived reduction in sound level.

Similarly, the attenuation provided by a barrier will be greater where it is aligned close to either the source or the listener than where the barrier is midway between the two.

# APPENDIX B

## VA2840 - 28 Goodge Street, London

### Noise Impact Assessment

#### To Third Floor Window

<b>Extract Fan - Duct Borne</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	73	76	71	70	67	64	61	55	<b>73</b>
Indicative Attenuator (1200mm)		-7	-7	-10	-14	-22	-18	-13	-9	
End Reflection @400mm Ø		-10	-6	-2	-1	0	0	0	0	
Directivity (Hor:0,Vert:140)		-2	-3	-7	-9	-8	-8	-8	-8	
Free Field Propagation		-11	-11	-11	-11	-11	-11	-11	-11	
Distance Loss	To 3m	-10	-10	-10	-10	-10	-10	-10	-10	
<b>Level at receiver</b>		<b>33</b>	<b>40</b>	<b>31</b>	<b>26</b>	<b>16</b>	<b>17</b>	<b>19</b>	<b>17</b>	<b>29</b>

<b>Extract Fan - Duct Breakout</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	73	76	71	70	67	64	61	55	<b>73</b>
Indicative Attenuator (1200mm)		-7	-7	-10	-14	-22	-18	-13	-9	
Circular duct breakout		-30	-25	-26	-26	-25	-22	-36	-43	
Distance Loss	To 2m	-6	-6	-6	-6	-6	-6	-6	-6	
Hemispherical propagation		-8	-8	-8	-8	-8	-8	-8	-8	
<b>Level at receiver</b>		<b>22</b>	<b>30</b>	<b>21</b>	<b>16</b>	<b>6</b>	<b>10</b>	<b>-2</b>	<b>-11</b>	<b>19</b>

<b>Extract Fan breakout</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Extract Fan breakout	Lp @ 3m	55	54	53	52	46	42	37	32	<b>52</b>
Double skinned casing		-10	-15	-18	-23	-30	-32	-35	-33	
Distance Loss	To 7m	-7	-7	-7	-7	-7	-7	-7	-7	
<b>Level at receiver</b>		<b>37</b>	<b>31</b>	<b>27</b>	<b>21</b>	<b>8</b>	<b>2</b>	<b>-6</b>	<b>-9</b>	<b>23</b>

<b>Cumulative Level at receiver</b>		<b>39</b>	<b>41</b>	<b>33</b>	<b>28</b>	<b>17</b>	<b>18</b>	<b>20</b>	<b>18</b>	<b>31</b>
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#### To First Floor Window

<b>Extract Fan - Duct Borne</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	73	76	71	70	67	64	61	55	<b>73</b>
Indicative Attenuator (1200mm)		-7	-7	-10	-14	-22	-18	-13	-9	
End Reflection @400mm Ø		-10	-6	-2	-1	0	0	0	0	
Directivity (Hor:;Vert:)		-2	-3	-7	-9	-8	-8	-8	-8	
Free Field Propagation		-11	-11	-11	-11	-11	-11	-11	-11	
Distance Loss	To 8m	-18	-18	-18	-18	-18	-18	-18	-18	
<b>Level at receiver</b>		<b>25</b>	<b>31</b>	<b>22</b>	<b>18</b>	<b>8</b>	<b>9</b>	<b>11</b>	<b>9</b>	<b>21</b>

<b>Extract Fan - Duct Breakout</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Specified Outlet Sound Power	Lw	73	76	71	70	67	64	61	55	<b>73</b>
Indicative Attenuator (1200mm)		-7	-7	-10	-14	-22	-18	-13	-9	
Circular duct breakout		-30	-25	-26	-26	-25	-22	-36	-43	
Distance Loss	To 2m	-6	-6	-6	-6	-6	-6	-6	-6	
Hemispherical propagation		-8	-8	-8	-8	-8	-8	-8	-8	
<b>Level at receiver</b>		<b>22</b>	<b>30</b>	<b>21</b>	<b>16</b>	<b>6</b>	<b>10</b>	<b>-2</b>	<b>-11</b>	<b>19</b>

<b>Extract Fan breakout</b>		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	dB(A)
Extract Fan breakout	Lp @ 3m	55	54	53	52	46	42	37	32	<b>52</b>
Double skinned casing		-10	-15	-18	-23	-30	-32	-35	-33	
Distance Loss	To 3m	0	0	0	0	0	0	0	0	
<b>Level at receiver</b>		<b>45</b>	<b>39</b>	<b>35</b>	<b>29</b>	<b>16</b>	<b>10</b>	<b>2</b>	<b>-2</b>	<b>30</b>

<b>Cumulative Level at receiver</b>		<b>45</b>	<b>40</b>	<b>35</b>	<b>29</b>	<b>17</b>	<b>14</b>	<b>12</b>	<b>9</b>	<b>31</b>
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