Design and Access Statement

18 Whitfield Place, Fitzrovia, London W1T 5JX

Annex A - Acoustic report

This report is written

For

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of

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18 WHITFIELD PLACE, FITZROVIA, LONDON

PLANNING COMPLIANCE REVIEW

Report 18407.PCR.01

For:

Craig Pattinson

2 Acacia Gardens

London

NW8 6AH

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Disclaimer

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1.0 INTRODUCTION

KP Acoustics has been commissioned by Craig Pattinson, 2 Acacia Gardens, London, NW8 6AH, to undertake an environmental noise survey at 18 Whitfield Place, Fitzrovia, London, W1T 5JX. The background noise levels measured will be used to determine daytime and night-time noise emission criteria for condenser units installation, in agreement with the planning requirements of The London Borough of Camden.

This report presents the overall methodology and results from the environmental survey, followed by calculations to demonstrate the feasibility of the plant unit installations to satisfy the emissions criterion at the closest noise-sensitive receiver. Mitigation measures will be outlined as appropriate.

2.0 SITE SURVEYS

2.1 Site Description

The site is bounded by Whitfield Place to the South, residential properties and commercial premises to the North and residential properties to the remaining elevations. Initial inspection of the site revealed that the background noise profile at the monitoring location was typical of an urban cityscape environment, with the dominant source being road traffic noise from the surrounding roads and existing neighbouring plant units.

2.2 Environmental Noise Survey Procedure

A noise survey was undertaken on site as shown in Figure 2.1 and indicative site plan 18407.SP1. The choice of the position was based both on accessibility and on collecting representative noise data in relation to the nearest noise sensitive receiver relative to the proposed plant installation.

Continuous automated monitoring was undertaken for the duration of the survey between 11:53 on 20th December 2018 and 12:08 on 21st December 2018.

Weather conditions were generally dry with light winds and therefore suitable for the measurement of environmental noise. The measurement procedure complied with ISO 1996-2:2007 Acoustics '*Description, measurement and assessment of environmental noise - Part 2: Determination of environmental noise levels*'.

2.3 Measurement Positions

Measurement positions are as described within Table 2.1 and shown within Figure 2.1.

	Description
Noise Measurement Position 1 (MP.1)	The meter was installed at rear of the property on the First Floor, as shown in 18407.SP1. A correction of 3dB has been applied to account for non-free field conditions

Table 2.1 Measurement position and description

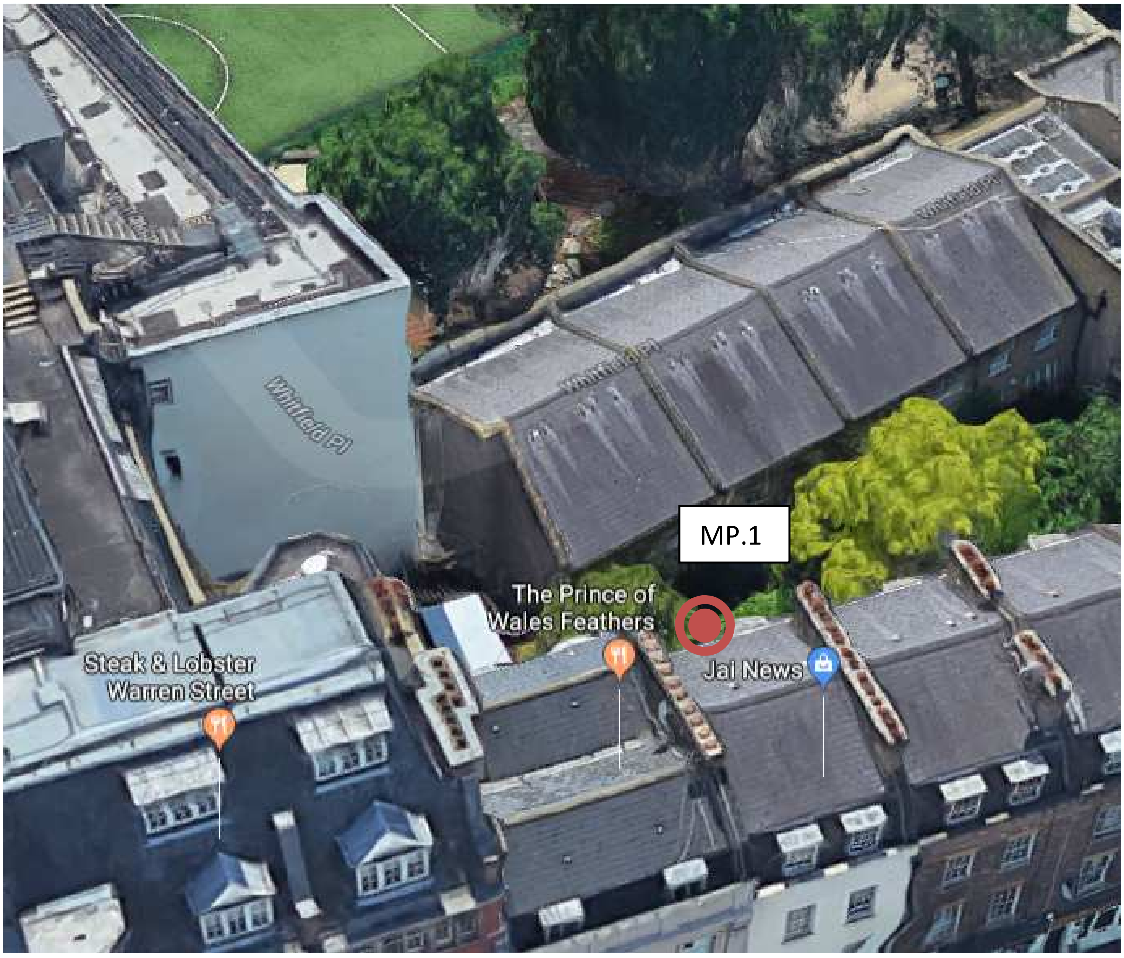


Figure 2.1 – Site Measurement position (Image Source: Google Maps)

2.4 Equipment

The equipment calibration was verified before and after use and no abnormalities were observed. The equipment used is described within Table 2.2.

Measurement instrumentation	Serial no.	Date	Cert no.
Svantek Type 977 Class 1 Sound Level Meter	34104	14/02/2018	1400 8638
Free-field microphone Aco Pacific 7052E	66830		
Preamp Svantek 2v12L	17293		
Rion NC-74 Class 1 Calibrator	34904938	07/12/2017	03673/1
Svantek External windshield	-	-	-

Table 2.2 Measurement instrumentation

3.0 RESULTS

3.1 Noise Survey

The $L_{Aeq: 5min}$, $L_{Amax: 5min}$, $L_{A10: 5min}$ and $L_{A90: 5min}$ acoustic parameters were measured throughout the duration of the survey. Measured levels are shown as a time history in Figure 18407.TH1.

Minimum background noise levels and logarithmically averaged L_{Aeq} levels are shown in Table 3.1 for daytime and night-time.

	Minimum background noise level L_{A90} dB(A)	Average ambient noise level L_{Aeq} dB(A)
Daytime (07:00-23:00)	45	58
Night-time (23:00-07:00)	40	52

Table 3.1 Minimum background noise levels and average ambient noise levels

4.0 NOISE ASSESSMENT GUIDANCE

4.1 BS4142: 2014 "*Methods for rating and assessing industrial and commercial sound*"

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 industrial and manufacturing processes
- Sound from fixed installations which comprise mechanical and electrical plant and equipment
- Sound from the loading and unloading of goods and materials at industrial and/or commercial premises, and
- Sound from mobile plant and vehicles that is an intrinsic part of the overall sound emanating from premises or processes.

This Standard compares the noise levels in terms of a L_{Aeq} for a one-hour period during the daytime (07:00 – 23:00 hours) and a fifteen-minute period during the night-time (23:00 – 07:00 hours) due to the noise source, the "Specific Noise Level", with the existing background noise level in terms of an L_{A90} when the noise source is not operating.

The resultant background sound level is subtracted from the Rating Level to obtain an initial estimate of the impact.

- 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.

The initial estimate of the impact may then be modified by taking consideration of the context in which the sound occurs.

4.2 Local Authority Guidance

The criterion of The London Borough of Camden for noise emissions of new plant in this instance is as follows:

"Noise generated by the new plant at a point 1 metre external to sensitive facades will be at least 5dB(A) less than the existing background measurement (LA90), 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 is given to reducing the noise levels from that piece of plant/equipment at any sensitive façade to at least 10dB(A) below the LA90, expressed in dB(A)."

4.3 Noise Emissions Criterion

As the proposed plant unit installation could be used at any time of the day or night, the criterion has been set as shown in Table 4.1 in order to comply with the above requirements.

Note that demonstrating compliance with the Local Authority's guidance would inherently result in a low magnitude of impact with regards to the plant installation negatively affecting the amenity of the closest receiver, as per the guidance contained in BS4142:2014.

	Night-time (23:00 to 07:00)
Noise criterion at nearest residential receiver (10dB below minimum L_{A90})	35 dB(A)

Table 4.1: Proposed Noise Emissions Criteria

5.0 NOISE IMPACT ASSESSMENT

5.1 Proposed Plant Installations

It is understood that the proposed plant installation is comprised of the following units:

- 2 No. Daikin MXM40N Condenser Units
- 1 No. Daikin 2MXM50M9 Condenser Unit

The Daikin MXM40N unit is proposed to be located within the attic (rear), as shown in indicative site plan 18433.SP2. The closest noise sensitive receivers to the proposed condenser units location will be a residential window at rear of 8 Warren Street, located approximately 6 meters away and a Hotel window at Whitfield Place elevation, located approximately 7 meters away from the proposed installation location.

The Daikin 2MXM50M9 unit is proposed to be located within the attic (front), as shown in indicative site plan 18433.SP2. The closest noise sensitive receivers to the proposed condenser units location will be a residential window at rear of 8 Warren Street, located approximately 10 meters away and a Hotel window at Whitfield Place elevation, located approximately 3 meters away from the proposed installation location.

The sound pressure levels at 1 metre as provided by the manufacturer for the units are shown in Table 5.1.

	Sound Pressure Level (dB) in each Frequency Band at 1m							
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Daikin MXM40N	50	52	50	47	43	38	32	26
Daikin 2MXM50M9	55	52	50	48	46	41	36	30

Table 5.1 Manufacturers Sound Pressure Levels at 1m

5.2 Objective Overview

Taking all acoustic corrections into consideration, the noise level contribution expected at the closest noise sensitive window from the condenser installation would be as shown in Table 5.2. Detailed calculations are shown in Appendix B1-2.

Receiver	Criterion	Noise Level at 1m from the Noise Sensitive Window
Hotel window at Whitfield Place elevation, as shown in SP1	35dB(A)	32dB(A)
Residential window at rear of 8 Warren Street, as shown in SP1		24dB(A)

Table 5.2: Predicted noise level and criterion at nearest noise sensitive location

As shown in Appendices B1-2 and Table 5.2, transmission of noise to the nearest sensitive windows due to the effects of the condenser unit installation satisfies the emissions criterion of BS4142:2014 and the Local Authority, providing that the mitigation measure described in Section 5.4 is implemented.

5.3 BS8233 Assessment

The predicted levels of 32dB(A) and 17dB(A) are to be considered externally at 1m from the receiving windows. Windows may be closed or partially closed leading to further attenuation, as follows.

Further calculations have been undertaken to assess whether the noise emissions from the plant unit installation would be expected to meet the recognised British Standard recommendations, in order to further ensure the amenity of nearby noise sensitive receivers.

British Standard 8233:2014 '*Sound insulation and noise reduction for buildings – Code of Practice*' gives recommendations for acceptable internal noise levels in residential properties. Assuming worst case conditions, of the closest window being for a bedroom, BS8233:2014 recommends 30dB(A) for internal resting/sleeping conditions during night-time hours.

With the calculated external levels of 32dB(A) and 24dB(A), the window itself would need to provide no additional nominal attenuation in order for the recommended internal noise conditions to be achieved. According to BS8233:2014, even a partially open window offers 10-15dB attenuation, thus leading to a further reduced interior noise level.

Receiver	Design Range – *For resting/sleeping conditions in a bedroom during night-time, in BS8233:2014*	Noise Level at Receiver (due to plant installation)
Hotel window at Whitfield Place elevation, as shown in SP1	30dB(A)	17-22dB(A)
Residential window at rear of 8 Warren Street, as shown in SP1		Non- significant

Table 5.3 Noise levels and criteria inside nearest residential space

Predicted levels are shown in Table 5.3, with detailed calculations shown in Appendix B1-2. It can therefore be stated that, as well as complying with the requirements of The London Borough of Camden, the noise emissions from the plant unit installation would be expected to comfortably meet the most stringent recommendations of BS8233: 2014.

5.4 Noise Mitigation Proposals

In order to reduce noise emissions from the proposed plant unit to within the criteria specified in Section 4.3, we would recommend that acoustic louvres are installed between the plant room located to the front of the attic and the atmospheric side.

The acoustic louvres should provide the minimum attenuation characteristics shown in Table 5.4.

	Insertion Loss (dB) in each Frequency Band							
Unit	**63Hz**	**125Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
Acoustic louvres	4	4	6	8	11	11	11	10

Table 5.4 Required insertion loss of proposed acoustic louvres

It would be anticipated that the aforementioned insertion loss can be provided by an acoustic louvre such as SS150 from Caice, or similar.

Providing that the above mitigation measure is installed between the plant room located to the front of the attic and the outside atmosphere, noise emissions from the proposed plant units would be fully compliant with the requirement of the Local Authority.

The above mitigations measures could be provided by companies such as Noico. EEC, Allaway Acoustics, AVK or any other supplier of noise control products.

6.0 CONCLUSION

An environmental noise survey has been undertaken at 18 Whitfield Place, Fitzrovia, London, W1T 5JX, by KP Acoustics Ltd between 11:53 on 20th December 2018 and 12:08 on 21st December 2018.. The results of the survey have enabled criteria to be set for noise emissions.

Using manufacturer noise data, noise levels are predicted at the nearby noise sensitive receivers for compliance with current requirements.

Calculations show that noise emissions from the condenser unit installations would meet the requirements of The London Borough of Camden. The proposed plant installation would result in a low magnitude of impact and an indication of low adverse impact on the closest residential receiver, in accordance with BS4142:2014, providing that the mitigation measure described in Section 5.4 is implemented.

Further calculations have been undertaken with regards to the relevant British Standard and it has been ensured that the amenity of nearby residential receivers will be protected.

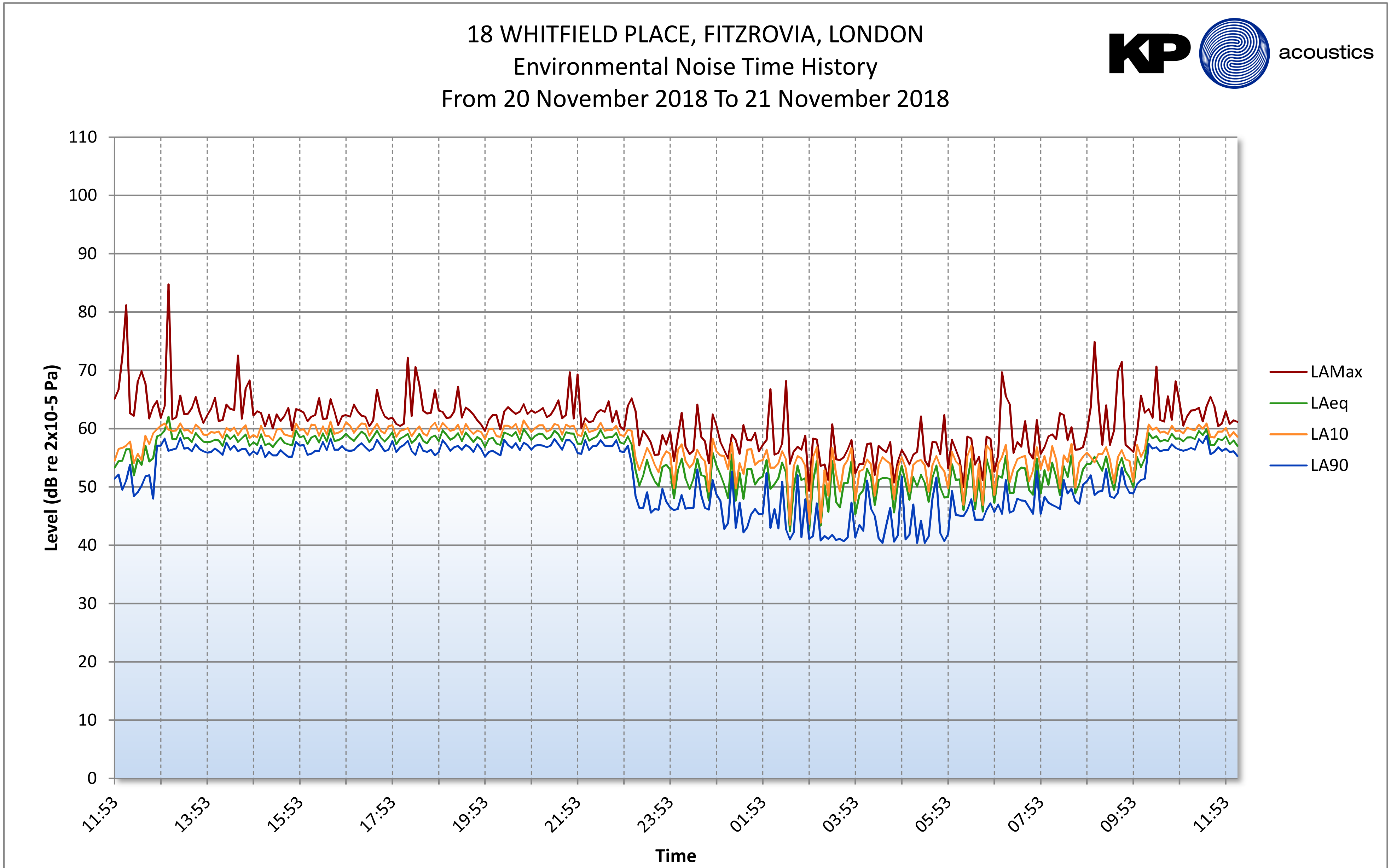
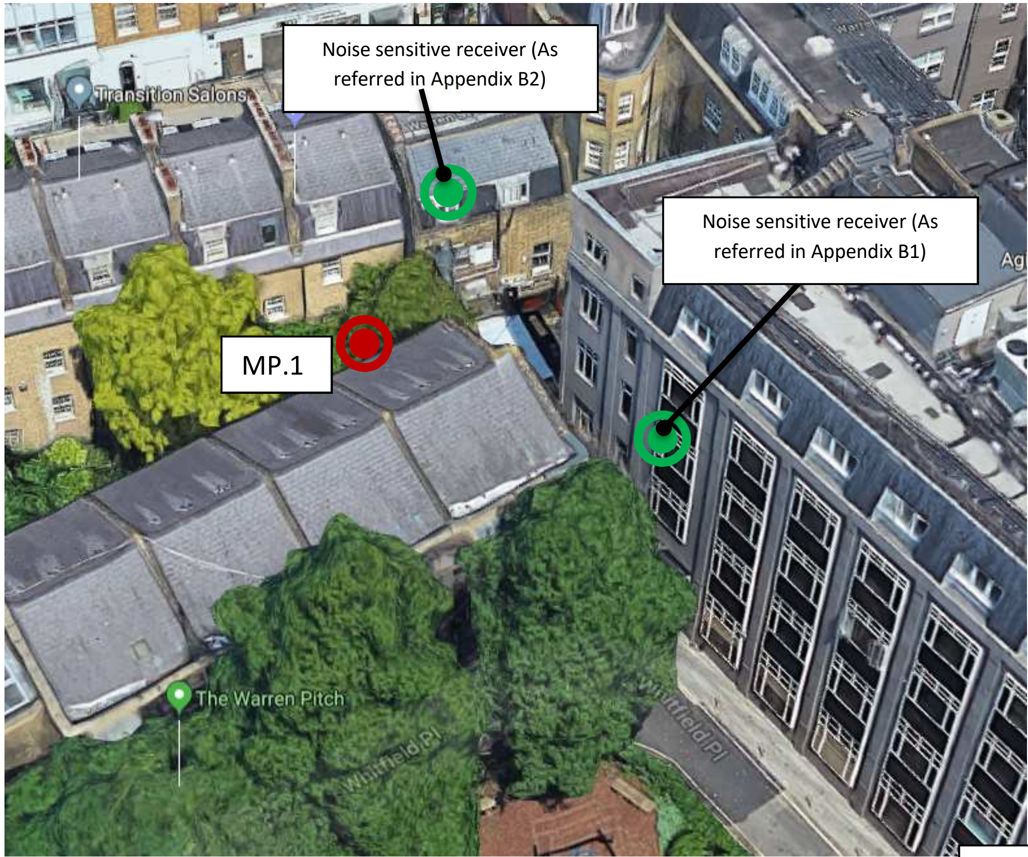


Figure 18407.TH1



Closest Noise sensitive receivers

Noise Survey Monitoring Positions

Title: Indicative site plan showing noise monitoring and closest noise sensitive receivers
(Image Source: Google maps)

Date: 14 December 2018

FIGURE 18407.SP1

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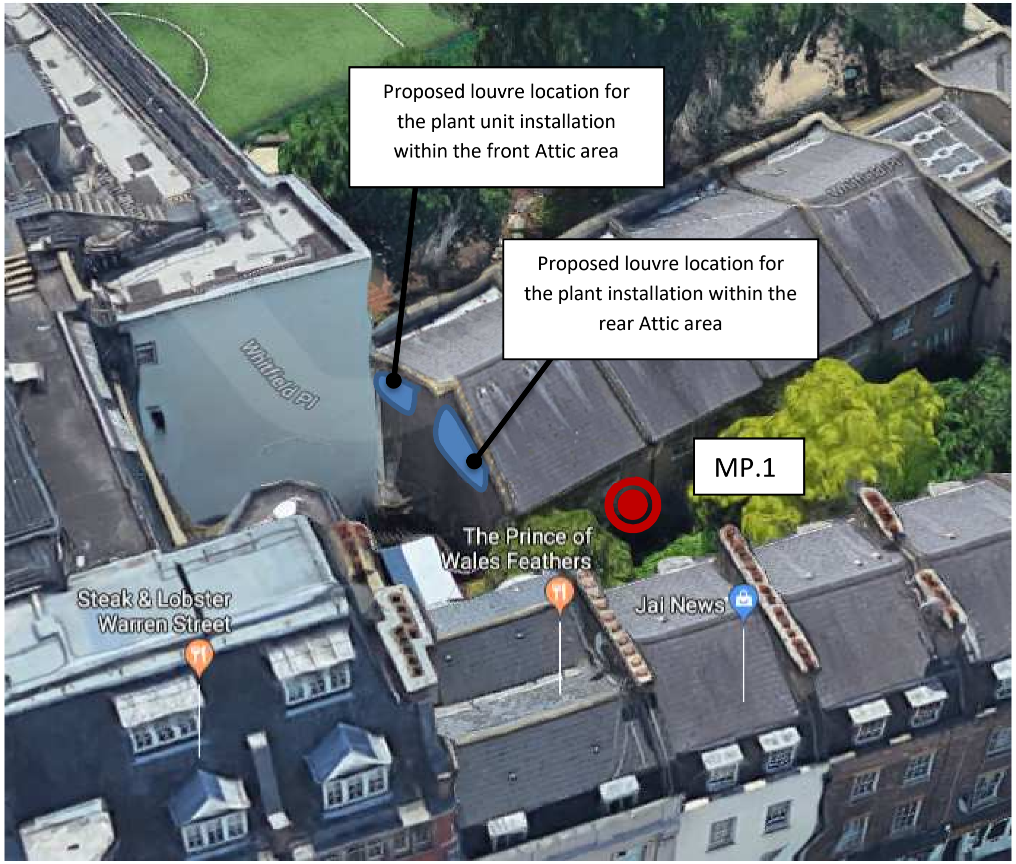

Noise Survey Monitoring Positions

Title: Indicative site plan showing noise monitoring and plant installation
(Image Source: Google maps)

Date: 14 December 2018

FIGURE 18407.SP2

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APPENDIX A

GENERAL ACOUSTIC TERMINOLOGY

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

L_{eq}

The sound from noise sources often fluctuates widely during a given period of time. An average value can be measured, the equivalent sound pressure level L_{eq}. The L_{eq} is the equivalent sound level which would deliver the same sound energy as the actual fluctuating sound measured in the same time period.

L_{10}

This is the level exceeded for no more than 10% of the time. This parameter is often used as a "not to exceed" criterion for noise.

L_{90}

This is the level exceeded for no more than 90% of the time. This parameter is often used as a descriptor of "background noise" for environmental impact studies.

L_{max}

This is the maximum sound pressure level that has been measured over a period.

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Environmental noise terms are defined in BS7445, *Description and Measurement of Environmental Noise*.

APPENDIX A

APPLIED ACOUSTIC TERMINOLOGY

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

APPENDIX B1

18 Whitfield Place, Fitzrovia, London

PROPOSED PLANT UNIT EMISSIONS CALCULATION

Source: Proposed plant units installation within the attic Receiver: Nearest Noise Sensitive Window, as shown in SP1	*Frequency, Hz* 63	125	250	500	1k	2k	4k	8k	dB(A)
Manufacturers Sound Pressure Level									
Daikin MXM40N (Sound Presure Level at 1 m) - Rear installation within the attic	50	52	50	47	43	38	32	26	
Conversion to Sound Power Level, dB	11	11	11	11	11	11	11	11	
Reverberation field contribution (dB increment)									
Plasterboard absorption coefficient (α)	0.20	0.20	0.15	0.10	0.05	0.05	0.05	0.05	
Total plasterboard walls surface area (52m^2)	52	52	52	52	52	52	52	52	
Room Constant	13	13	9	6	3	3	3	3	
Correction due to reverberation field	-5	-5	-4	-2	2	2	2	2	
Sound pressure level inside the room due to reverberation field	56	58	57	56	56	51	45	39	
Aperture discharge (Sound Power Level)									
Correction for surface area of 2m^2 (10log A -6)	-3	-3	-3	-3	-3	-3	-3	-3	
Aperture SPL due to reverberation field	53	55	54	53	53	48	42	36	
Correction due to distance from source to aperture (min. 1.6m)	-4	-4	-4	-4	-4	-4	-4	-4	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
SPL at Aperture due to direct field	46	48	46	43	39	34	28	22	
Correction for surface area of 2m^2 (10log A)	3	3	3	3	3	3	3	3	
Sound Power Level at the aperture due to direct field (SPLrev+10logA)	49	51	49	46	42	37	31	25	
Total discharge Aperture (Sound Power Level)	54	56	56	54	53	48	42	36	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
Attenuation provided by distance (min. 7m)	-17	-17	-17	-17	-17	-17	-17	-17	
Correction due to number of units (2), dB	3	3	3	3	3	3	3	3	
Correction due to directivity, dB	-1	-1	-3	-5	-5	-8	-8	-8	
Total Sound Pressure Levels from 2 No. Daikin MXM40N at closest noise sensitive receiver	28	30	28	24	23	15	0	0	27
Daikin 2MXM50M9 (Sound Presure Level at 1 m) - Front installation within the attic	55	52	50	48	46	41	36	30	
Conversion to Sound Power Level, dB	11	11	11	11	11	11	11	11	
Reverberation field contribution (dB increment)									
Plasterboard absorption coefficient (α)	0.20	0.20	0.15	0.10	0.05	0.05	0.05	0.05	
Total plasterboard walls surface area (52m^2)	52	52	52	52	52	52	52	52	
Room Constant	13	13	9	6	3	3	3	3	
Correction due to reverberation field	-5	-5	-4	-2	2	2	2	2	
Sound pressure level inside the room due to reverberation field	61	58	57	57	59	54	49	43	
Aperture discharge (Sound Power Level)									
Correction for surface area of 2m^2 (10log A -6)	-3	-3	-3	-3	-3	-3	-3	-3	
Aperture SPL due to reverberation field	58	55	54	54	56	51	46	40	
Correction due to distance from source to aperture (min. 1.6m)	-4	-4	-4	-4	-4	-4	-4	-4	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
SPL at Aperture due to direct field	51	48	46	44	42	37	32	26	
Correction for surface area of 2m^2 (10log A)	3	3	3	3	3	3	3	3	
Sound Power Level at the aperture due to direct field (SPLrev+10logA)	54	51	49	47	45	40	35	29	
Total discharge Aperture (Sound Power Level)	59	56	56	55	56	51	46	40	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
Attenuation provided by distance (min. 3m)	-10	-10	-10	-10	-10	-10	-10	-10	
Correction due to reflections, dB	3	3	3	3	3	3	3	3	
Correction due to directivity, dB	-1	-1	-2	-2	-2	-3	-5	-5	
Attenuation provided by proposed louvres (150mm)	-4	-4	-6	-8	-11	-11	-11	-10	
Total Sound Pressure Levels from 1 No. Daikin 2MXM50M9 at closest noise sensitive receiver	37	34	30	28	25	19	12	7	30
Sound pressure level 1m from closest noise sensitive receiver									**32**

Design Criterion	**35**

APPENDIX B2

18 Whitfield Place, Fitzrovia, London

PROPOSED PLANT UNIT EMISSIONS CALCULATION

Source: Proposed plant units installation within the attic	*Frequency, Hz*								
Receiver: Nearest Noise Sensitive Window, as shown in SP1	***63***	***125***	***250***	***500***	***1k***	***2k***	***4k***	***8k***	***dB(A)***
Manufacturers Sound Pressure Level									
Daikin MXM40N (Sound Presure Level at 1 m) - Rear installation within the attic	50	52	50	47	43	38	32	26	
Conversion to Sound Power Level, dB	11	11	11	11	11	11	11	11	
Reverberation field contribution (dB increment)									
Plasterboard absorption coefficient (α)	0.20	0.20	0.15	0.10	0.05	0.05	0.05	0.05	
Total plasterboard walls surface area ($52m^2$)	52	52	52	52	52	52	52	52	
Room Constant	13	13	9	6	3	3	3	3	
Correction due to reverberation field	-5	-5	-4	-2	2	2	2	2	
Sound pressure level inside the room due to reverberation field	56	58	57	56	56	51	45	39	
Aperture discharge (Sound Power Level)									
Correction for surface area of $2m^2$ (10log A -6)	-3	-3	-3	-3	-3	-3	-3	-3	
Aperture SPL due to reverberation field	53	55	54	53	53	48	42	36	
Correction due to distance from source to aperture (min. 1.6m)	-4	-4	-4	-4	-4	-4	-4	-4	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
SPL at Aperture due to direct field	46	48	46	43	39	34	28	22	
Correction for surface area of $2m^2$ (10log A)	3	3	3	3	3	3	3	3	
Sound Power Level at the aperture due to direct field (SPLrev+10logA)	49	51	49	46	42	37	31	25	
Total discharge Aperture (Sound Power Level)	54	56	56	54	53	48	42	36	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
Attenuation provided by distance (min. 6m)	-16	-16	-16	-16	-16	-16	-16	-16	
Correction due to number of units (2), dB	3	3	3	3	3	3	3	3	
Correction due to directivity, dB	-5	-5	-6	-6	-8	-10	-10	-10	
Total Sound Pressure Levels from 2 No. Daikin MXM40N at closest noise sensitive receiver	26	28	26	25	0	0	0	0	23
Daikin 2MXM50M9 (Sound Presure Level at 1 m) - Front installation within the attic	55	52	50	48	46	41	36	30	
Conversion to Sound Power Level, dB	11	11	11	11	11	11	11	11	
Reverberation field contribution (dB increment)									
Plasterboard absorption coefficient (α)	0.20	0.20	0.15	0.10	0.05	0.05	0.05	0.05	
Total plasterboard walls surface area ($52m^2$)	52	52	52	52	52	52	52	52	
Room Constant	13	13	9	6	3	3	3	3	
Correction due to reverberation field	-5	-5	-4	-2	2	2	2	2	
Sound pressure level inside the room due to reverberation field	61	58	57	57	59	54	49	43	
Aperture discharge (Sound Power Level)									
Correction for surface area of $2m^2$ (10log A -6)	-3	-3	-3	-3	-3	-3	-3	-3	
Aperture SPL due to reverberation field	58	55	54	54	56	51	46	40	
Correction due to distance from source to aperture (min. 1.6m)	-4	-4	-4	-4	-4	-4	-4	-4	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
SPL at Aperture due to direct field	51	48	46	44	42	37	32	26	
Correction for surface area of $2m^2$ (10log A)	3	3	3	3	3	3	3	3	
Sound Power Level at the aperture due to direct field (SPLrev+10logA)	54	51	49	47	45	40	35	29	
Total discharge Aperture (Sound Power Level)	59	56	56	55	56	51	46	40	
Correction to sound pressure level	-11	-11	-11	-11	-11	-11	-11	-11	
Attenuation provided by distance (min. 10m)	-20	-20	-20	-20	-20	-20	-20	-20	
Correction due to reflections, dB	3	3	3	3	3	3	3	3	
Correction due to directivity, dB	-5	-5	-6	-6	-8	-10	-10	-10	
Attenuation provided by proposed louvres (150mm)	-4	-4	-6	-8	-11	-11	-11	-10	
Total Sound Pressure Levels from 1 No. Daikin MXM40N at closest noise sensitive receiver	22	19	16	13	0	0	0	0	13
Sound pressure level 1m from closest noise sensitive receiver									**24**

ANTI-VIBRATION MOUNTING SPECIFICATION REFERENCE DOCUMENT

1.0 General

1.1 All mountings shall provide the static deflection, under the equipment weight, shown in the schedules. Mounting selection should allow for any eccentric load distribution or torque reaction, so that the design deflection is achieved on all mountings under the equipment, under operating conditions.

1.2 It is the supplier's responsibility to ensure that all mountings offered are suitable for the loads, operating and environmental conditions which will prevail. Particular attention should be paid to mountings which will be exposed to atmospheric conditions to prevent corrosion.

1.3 All mountings shall be colour coded, or otherwise marked, to indicate their load capacity, to facilitate identification during installation.

Where use of resilient supports allows omission of pipe flexible connections for vibration/noise isolation, it shall be the Mechanical Service Consultant's or Contractor's responsibility to decide whether such devices are required to compensate for misalignment or thermal strain.

2.1 Type A Mounting (Caged Spring Type)

2.1.1 Each mounting shall consist of cast or fabricated telescopic top and bottom housings enclosing one or more helical steel springs as the principle isolation elements, and shall incorporate a built-in levelling device. The housing should be designed to permit visual inspection of the springs after installation, i.e. the spring must not be totally enclosed.

2.1.2 The springs shall have an outside diameter of not less than 75% of the operating height, and be selected to have at least 50% overload capacity before becoming coil-bound.

2.1.3 The bottom plate of each mounting shall have bonded to it a rubber/neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.1.4 Mountings incorporating snubbers or restraining devices shall be designed so that the snubbing, damping or restraining mechanism is capable of being adjusted to have no significant effect during the normal running of the isolated machine.

2.1.5 All nuts, bolts or other elements used for adjustment of a mounting shall incorporate locking mechanisms to prevent the isolator going out of adjustment as a result of vibration or accidental or unauthorised tampering.

2.2 Type B Mounting (Open Spring Type)

2.2.1 Each mounting shall consist of one or more helical steel springs as the principal isolation elements, and shall incorporate a built-in levelling device.

2.2.2 The springs shall be fixed or otherwise securely located to cast or fabricated top and bottom plates, shall have an outside diameter of not less than 75% of the operating height, and shall be selected to have at least 50% overload capacity before becoming coil-bound.

2.2.3 The bottom plate shall have bonded to it a rubber/ neoprene pad designed to attenuate any high frequency energy transmitted by the springs.

2.3 Type C Mounting (Rubber/Neoprene Type)

Each mounting shall consist of a steel top plate and base plate completely embedded in oil resistant rubber/neoprene. Each mounting shall be capable of being fitted with a levelling device, and should have bolt holes in the base plate and a threaded metal insert in the top plate so that they can be bolted to the floor and equipment where required.

3.0 Plant Bases

3.1 **Type A Bases (A.V. Rails)**

An A.V. Rail shall comprise a steel beam with two or more height-saving brackets. The steel sections must be sufficiently rigid to prevent undue strain in the equipment and if necessary should be checked by the Structural Engineer.

3.2 **Type B Bases (Steel Plant Bases)**

Steel plant bases shall comprise an all-welded steel framework of sufficient rigidity to provide adequate support for the equipment, and fitted with isolator height saving brackets. The frame depth shall be approximately 1/10 of the longest dimension of the equipment with a minimum of 150 mm. This form of base may be used as a composite A.V. rail system.

3.3 **Type C Bases (Concrete Inertia Base: for use with steel springs)**

These shall consist of an all-welded steel pouring frame-work with height saving brackets, and a frame depth of approximately 1/12 of the longest dimension of the equipment, with a minimum of 100 mm. The bottom of the pouring frame should be blanked off, and concrete (2300 kg/m^3) poured in over steel reinforcing rods positioned 35 mm above the bottom. The inertia base should be sufficiently large to provide support for all parts of the equipment, including any components which over-hang the equipment base, such as suction and discharge elbows on centrifugal pumps.