Acoustic Assessment at

11 Belsize Crescent

London

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Executive Summary

Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the proposed plant at 11 Belsize Crescent, London.

The assessment takes account of the existing noise environment, which has been quantified using direct measurement to take account of the effect of the plant referred to above.

Noise control recommendations are required to meet the likely planning requirements of Camden Council. The predictions show that the noise form the plant will be at least 10dB below the lowest measured background noise level at 1 metre from the nearest residential window.

Contents

1. Introduction

1.1 Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the proposed mechanical plant at 11 Belsize Crescent, London.

1.2 The development is for the installation of 2 air source heat pumps and one air conditioning condenser unit. The equipment will operate intermittently over a 24-hour basis but will not be audible above the residual ambient noise level. The plant to be installed are 2 Daikin EHBH16CB3V air source heat pumps and 1 Daikin RXYSCQ5TV1 air conditioning condenser unit.

1.3 The air source heat pumps and air conditioning condenser unit will be located on the roof of 11 Belsize Crescent and screened from the nearest window by the chimney breast and the lack of line of sight to the nearest window.

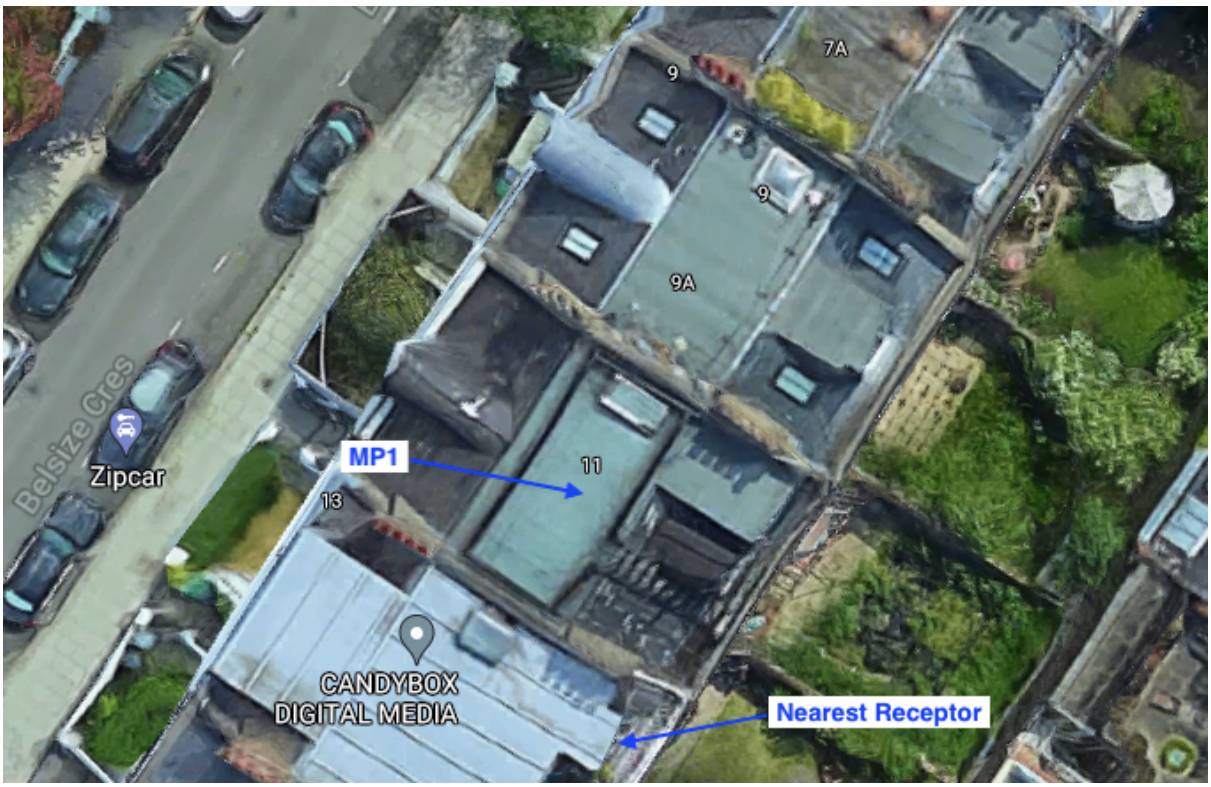
1.4 The noise levels from the plant at the nearest noise-affected properties has been predicted and compared to the requirements of Camden Council using the methodology set-out in BS4142:2014+A1 2019. The likely requirement is that noise from the mechanical plant shall be at least 10dB below the background noise level 1 metre from the nearest or most noise affected residential window.

2. Site Description

2.1 The main source of noise at this location is road traffic travelling the local road network. The area is relatively quiet with no other obvious sources of noise.

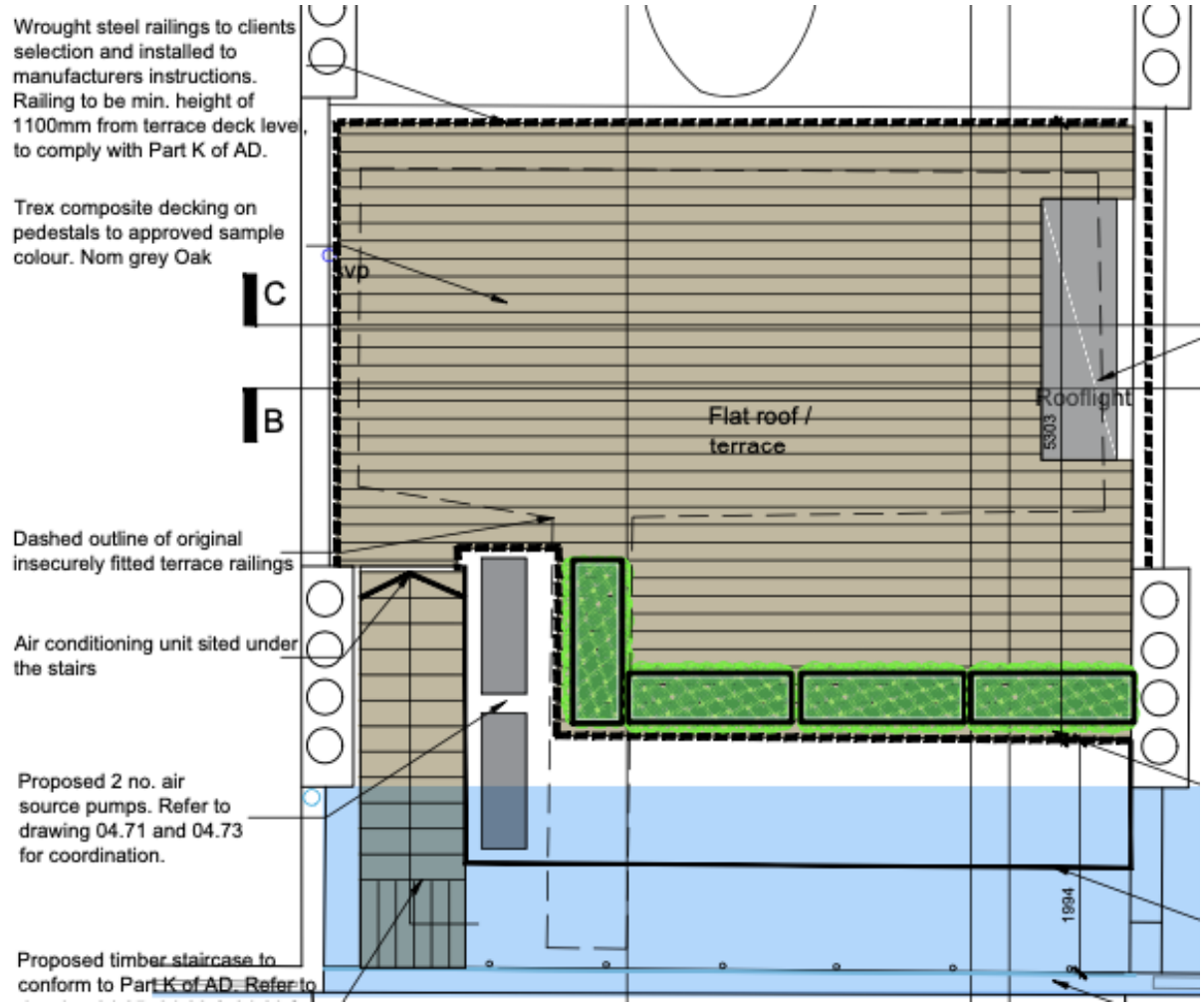
2.2 Figure 1 below shows the location of the development; the measurement location is shown below (MP1).

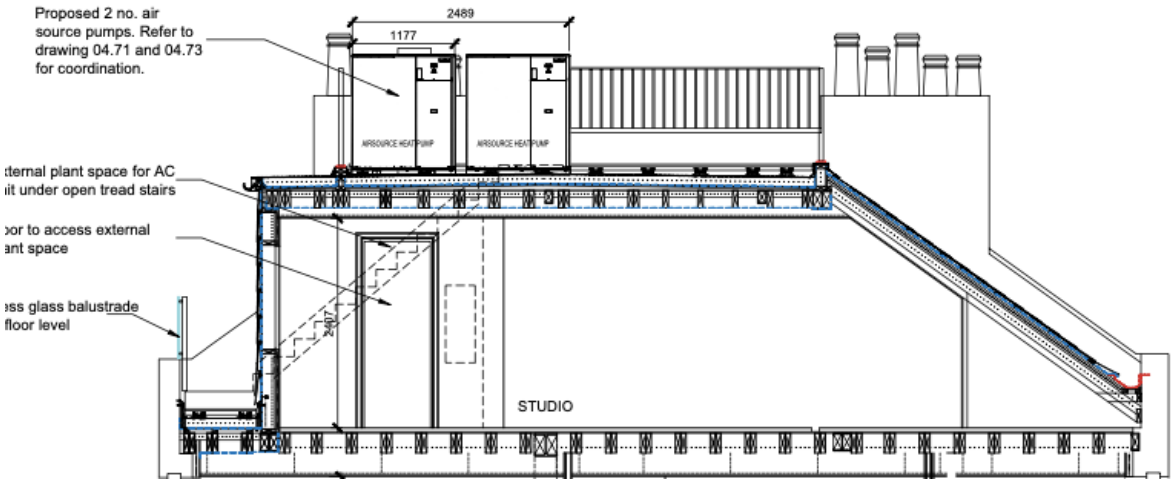
Figure 1.



2.3 Figure 2 below shows the plant locations.

Figure 2.


Wrought steel railings to clients selection and installed to manufacturers instructions. Railing to be min. height of 1100mm from terrace deck level, to comply with Part K of AD.
Trex composite decking on pedestals to approved sample colour. Nom grey Oak
vp
C
B
Flat roof / terrace
Rooflight
5303
Dashed outline of original insecurely fitted terrace railings
Air conditioning unit sited under the stairs
Proposed 2 no. air source pumps. Refer to drawing 04.71 and 04.73 for coordination.
1994
Proposed timber staircase to conform to Part K of AD. Refer to


Proposed 2 no. air source pumps. Refer to drawing 04.71 and 04.73 for coordination.
2489
1177
AIRSOURCE HEAT PUMP
AIRSOURCE HEAT PUMP
ternal plant space for AC it under open tread stairs
or to access external ant space
ss glass balustrade floor level
2400
STUDIO

3. Reference Documents

National Planning Policy Framework

3.1 The Department of Housing, Communities and Local Government published the National Planning Policy Framework (NPPF) in February 2019.

3.2 Paragraphs 170 (e) 180(a), (b) and 182 refer to noise in terms of policy approach:

170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

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.

Noise Policy Statement for England

3.3 The Department for Environment, Food and Rural Affairs published the *Noise Policy Statement for England* (NPSE) in March 2010. The explanatory note of NPSE defines the terms used in the NPPF:

"2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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

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

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

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

3.4 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

"2.22 It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available."

3.5 There is no local or national guidance on how the three terms should be defined numerically.

3.6 There are three aims in the NPSE, which match, and expand upon, the first two bullet points in paragraph 123 of the NPPF and add a third aim that relates to a wider improvement in health and quality of life (the bold text is in the NPSE):

3.7 The first aim of the NPSE states that significant adverse effects on health and quality of life should be avoided while also taking into account the guiding principles of sustainable development.

3.8 The second aim of the NPSE refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that 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. This does not mean that such adverse effects cannot occur.

3.9 This aim seeks, where possible, positively to improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society. The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

British Standard 8233

3.10 The scope of British Standard 8233: 2014 *Sound insulation and noise reduction for buildings – Code of practice* is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new or refurbished buildings undergoing a change of use.

3.11 The standard suggests suitable internal noise levels for residential dwellings, as shown in Table 1. Below.

Table 1.

Activity	Location	07:00 - 23:00 $L_{Aeq,\ 16\ hour}$	23:00 - 07:00 $L_{Aeq,\ 8\ hour}$
Resting	Living Rooms	35	-
Dining	Dining Area	40	-
Sleeping	Bedrooms	35	30

3.12 In terms of this development the internal noise levels have been compared to the internal noise levels in Table 1. It is suggested in this report that by meeting these noise levels the development would be classed as NOAEL.

British Standard 4142:2014+A1 2019

3.13 The scope of British Standard 4142: *Method for rating industrial noise affecting mixed residential and industrial areas* describes methods for determining, at the outside of a building:

a) noise levels from factories, or industrial premises, or fixed installations, or sources of an industrial nature in commercial premises; and

b) background noise level.

3.14 In particular BS4142 describes the *"use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident."* It sets out a methodology for assessing a noise Rating level which is a combination of absolute or 'specific' noise level (in terms of L_{Aeq} average noise level over different durations; 1 hour for daytime and

15 minute at night); and then including penalties to account for character of a noise (i.e. tonality, impulsivity, intermittency and 'other').

3.15 BS4142 applies to new noise sensitive developments that are proposed near existing industrial sources, the following paragraph relates to such developments:

"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation."

Further to this BS4142:2014 also notes that other standards may be relevant; in this development this would include BS8233:2014.

3.16 The rating levels in BS4142 are as follows:

"a) Typically, the greater this difference, the greater the magnitude of the impact.

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

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) 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."

3.17 BS4142:2014 also states *'where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration'.* In terms of those factors the document states the following: *'The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as, facade insulation ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and acoustic screening.'*

3.18 Where there is an adverse impact in terms of the BS4142 rating mitigation can be proposed to reduce the impact or achieve desirable internal noise levels.

4. Survey Methodology

4.1 The survey was conducted over a 24-hour period from February 20th – February 21st 2021. This time period was chosen as it will be representative of the ambient and background noise levels during operational hours.

4.2 The instrument used for the survey was a Bruel & Kjaer 2260 precision grade sound level meter.

4.3 The sound level meter was calibrated immediately before and after the survey with a Bruel & Kjaer 4231 Acoustic Calibrator producing 94dB$_A$ at 1KHz and no drift was noted in calibration readings. Both calibration results were 93.8dB$_A$.

4.4 During the survey there were no unusual noise events. The sound level meter was set to log every 15 minutes. The metrics measured were L_{Aeq} and L_{A90}.

4.5 The measurement procedure in BS4142:2014 was followed. The sound level meter at MP1 was set-up on a tripod 1.5 metres above the ground with no reflecting surfaces, other than the ground, within 3.5 metres. It was housed in a UA1404 weatherproof microphone assembly with a 3-metre extension cable.

4.6 During the background survey the temperature ranged between 7°C – 14°C with a wind speed of 1.5 metres per second and no precipitation. Cloud cover was approximately 10% - 30%.

5. Noise Survey Results

5.1 The following table sets out the results of the measurements at MP1. The lowest daytime and night time L_{A90} was 34dB and the lowest daytime ambient was 39dB L_{Aeq} while the lowest night time ambient sound pressure level was 35dB L_{Aeq}.

Table 2. Measurements at MP1

Date	Time Period	Lowest L_{Aeq} dB	Lowest L_{A90} dB
23/02/21	14:30 – 23:00	41	34
23/02/21	23:00 – 07:00	36	34
24/02/21	07:00 – 14:30	39	37

5.2 No penalties in the BS4142 assessment have been added for intermittent operation of tools because this noise will not be readily distinctive against the residual acoustic environment at the nearest noise sensitive receptor. This is as per paragraph 9.2 of BS4142:2014.

5.3 The following table presents the BS4142 assessments for the plant noise at night, as this will be the most sensitive time during operation. The calculations can be found in Appendix 5. The calculation includes a barrier to reduce the sound pressure from the air source heat pumps.

Table 3. BS4142 assessment for the combined plant

Results	Measurement	Clause	Commentary
Lowest ambient sound level	L_{Aeq} = 36dB	7.3.1	
Lowest background sound level	L_{A90} = 34dB	8.3	
Specific sound level of the extraction system at 1 m from residential window	22dB$_A$		See Appendix 5 for calculations.
Acoustic feature	0dB	9.2	No penalty as the intermittent use will not be audible against the residual acoustic environment.
Rating level	22dB$_A$	11	Sound source
Lowest measured background sound level	L_{A90} = 34dB	8.3	
Rating level at receptor point	-12dB	11	
The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level is -12 dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment. The measurement conditions were repeatable so overall uncertainty is low.

6 Evaluation of results

6.1 The impact of the proposed plant at 11 Belsize Crescent, has been determined by comparing the measured noise levels with the criteria set out in Section 3 of this report.

6.2 The BS4142 assessment shows that the noise from the plant, 1 metre from the nearest residential window, is predicted to be 12dB below the lowest measured background noise level.

6.3 The above results demonstrate that the noise from the proposed plant would have a low impact. The predicted sound pressure level at the nearest noise sensitive receptors would meet with the likely requirements of Camden Council for plant noise.

6.4 In terms of BS4142 penalties, the plant will operate intermittently, but the noise will not be readily distinctive against the residual acoustic environment at the nearest noise sensitive receptor and no penalty has been added.

6.5 The noise level due to the plant at the nearest receptor is a result of the attenuation with distance and the installation of a barrier (see Appendix 5 for calculations). The air conditioning condenser is located under a wooden staircase leading to the flat roof and has no line of sight to the nearest window and is completely screened by a wall. The air source heat pumps are on the flat roof and are screened from the nearest window by a chimney breast. As the chimney breast does not provide enough sound attenuation on its own to reduce the plant noise from the air source heat pumps to 10dB below the lowest measured background noise level, the barrier is required to provide the extra attenuation necessary.

6.6 The barrier must have a minimum sound attenuation of 15dB, which can be achieved with a solid-boarded wooden panels, with a minimum mass of 20Kg/m^2. An example of such performance can be found using Jackson's Jakoustic Reflective Barrier. The barrier must be higher and wider than the air source heat pumps by a minimum of 10% of their dimensions.

Appendix 1: Glossary of Terms

Daytime Defined in BS8233 and BS4142 as the period 07:00-23:00 hours.

Night-time Defined in BS8233 and BS4142 as the period 23:00-07:00 hours.

Decibel (dB): A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 uPa. The threshold of normal hearing is in the region of 0 dB and 140 dB is the threshold of pain. A change of 1 dB is only perceptible under controlled conditions.

dB_A: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB_A broadly agree with people's assessment of loudness. A change of 3 dB is the minimum perceptible under normal conditions, and a change of 10 dB corresponds roughly to halving or doubling the loudness of a sound. The background noise in a living room may be about 30 dB_A; normal conversation about 60 dB_A at 1 metre; heavy road traffic about 80 dB_A at 10 metres; the level near a pneumatic drill about 100 dB_A.

$L_{A10,T}$: The A weighted noise level exceeded for 10% of the measurement period, T. It gives an indication of the upper limit of fluctuating noise such as that from road traffic.

$L_{A90,T}$: The A weighted noise level exceeded for 90% of the measurement period, T. This is defined in BS 4142 as the background noise level.

L_{AE}: The sound exposure level – the level of a sound with a period of 1 second that has the same sound energy as the event considered.

$L_{Aeq,T}$: The equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T).

$L_{A\ Max}$: The highest A weighted noise level recorded during a noise event. The time weighting (slow or fast) should be stated.

Appendix 2: Calibration Certificates

Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
www.campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

CALIBRATION

Certificate of Calibration

Certificate number: 34700

Test object:	**Sound Level Meter, Type 1 (Precision)**
Producer :	**Brüel and Kjær**
Type :	**2260_G1**
Serial No.:	**2034414**
Customer:	**Ned Johnson Acoustic Consultants Ltd**
Address:	**378 Church Street, London. N9 9HS.**
Contact Person:	**Ned Johnson.**

Method :
Calibration has been performed as set out in CA Technical Procedures TP01 & 02 as appropriate. The following items have been calibrated as set out in BS 7580 Part 1:1997

Tested

	Producer:	Type:	Serial No:	Certificate number
Microphone	Brüel & Kjær	4189	2169417	34699
Calibrator*	Brüel and Kjær	4231	2039392	34698
Preamplifier	Brüel & Kjær	ZC0026	Not marked	Included

Additional items that also have been submitted for verification

Wind shield	-
Attenuator	-
Extension cable	-

These items have been taken into account wherever appropriate.

Conditions	Pressure	Temperature	Humidity
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.57 ±0.06 kPa	23.6 ±0.4 °C	33.9 ±0.7 %RH

Date received for calibration:	30/04/2020
Date of calibration:	05/05/2020
Date of issue:	05/05/2020

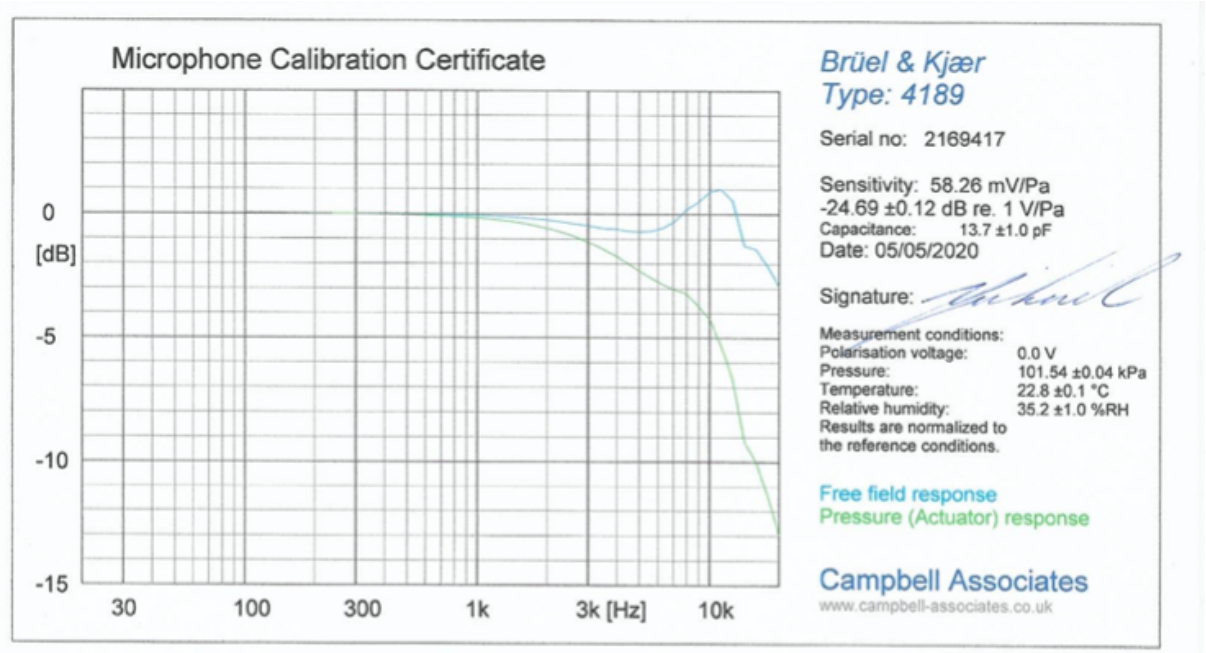
Engineer

Michael Tickner

Supervisor

Darren Batten TechIOA

This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.
* The calibrator was complete with any required coupler for the microphone specified


Microphone Calibration Certificate
0
[dB]
-5
-10
-15
30
100
300
1k
3k [Hz]
10k
Brüel & Kjær
Type: 4189
Serial no: 2169417
Sensitivity: 58.26 mV/Pa
-24.69 ±0.12 dB re. 1 V/Pa
Capacitance: 13.7 ±1.0 pF
Date: 05/05/2020
Signature:
Measurement conditions:
Polarisation voltage: 0.0 V
Pressure: 101.54 ±0.04 kPa
Temperature: 22.8 ±0.1 °C
Relative humidity: 35.2 ±1.0 %RH
Results are normalized to the reference conditions.
Free field response
Pressure (Actuator) response
Campbell Associates
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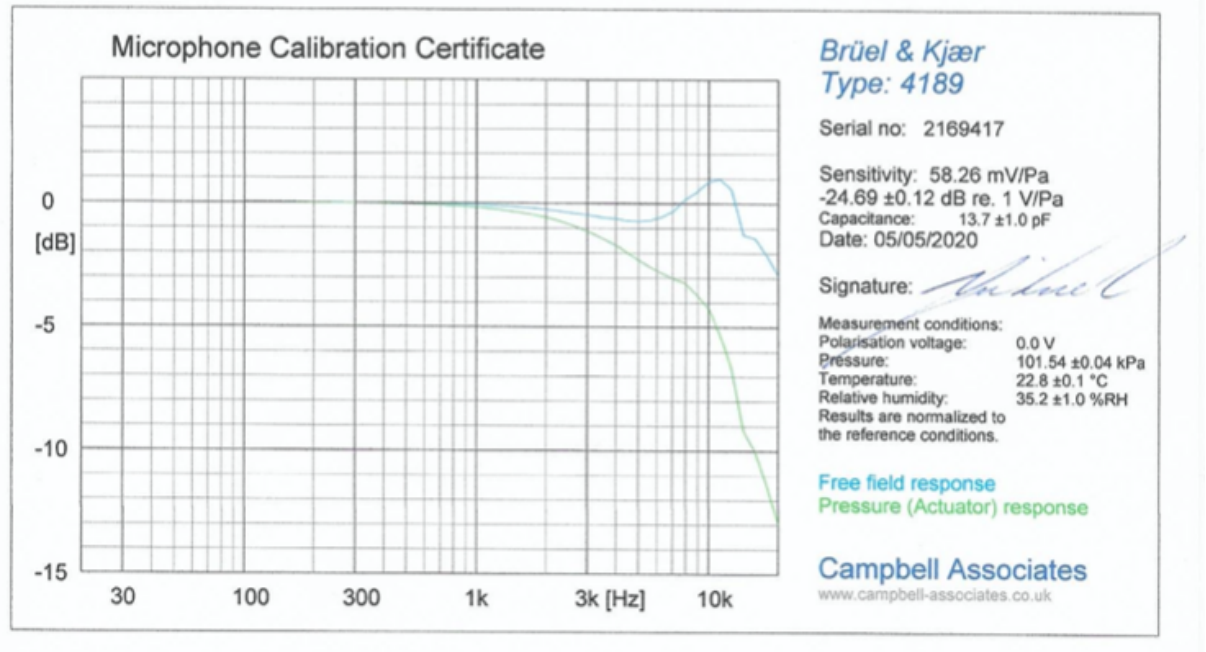
Microphone Calibration Certificate
0
[dB]
-5
-10
-15
30
100
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1k
3k [Hz]
10k
Brüel & Kjær
Type: 4189
Serial no: 2169417
Sensitivity: 58.26 mV/Pa
-24.69 ±0.12 dB re. 1 V/Pa
Capacitance: 13.7 ±1.0 pF
Date: 05/05/2020
Signature:
Measurement conditions:
Polarisation voltage: 0.0 V
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Free field response
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GREAT DUNMOW, CM6 1HD, England
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info@campbell-associates.co.uk
Phone 01371 871030 Facsimile 01371879106

CALIBRATION

Certificate number: 34698

Certificate of Calibration

Test object:	**Sound Calibrator**
Manufacturer:	**Brüel and Kjær**
Type:	**4231**
Serial no:	**2039392**
Customer:	Ned Johnson Acoustic Consultants Ltd
Address:	378 Church Street, London. N9 9HS.
Contact Person:	Ned Johnson.

Measurement Results:	Level	Level Stability	Frequency	Frequency Stability	Distortion
1:	94.06 dB	0.02 dB	999.85 Hz	0.00 %	0.46 %
2:	94.06 dB	0.02 dB	999.86 Hz	0.00 %	0.45 %
3:	94.06 dB	0.02 dB	999.86 Hz	0.00 %	0.45 %
Result (Average):	**94.06 dB**	**0.02 dB**	**999.85 Hz**	**0.00 %**	**0.45 %**
Expanded Uncertainty:	0.10 dB	0.02 dB	1.00 Hz	0.01 %	0.10 %
Degree of Freedom:	>100	>100	>100	>100	>100
Coverage Factor:	2.00	2.00	2.00	2.00	2.00

The stated level is relative to 20µPa. The level is traceable to National Standards.
The stated level is valid at reference conditions. The following correction factors have been applied during the measurement: Pressure: 0.0008 dB/kPa Temperature: 0.0015 dB/°C Relative humidity: 0.001 dB/%RH Load volume : 0.0003 dB/mm3
The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a level of confidence of approximately 95%. Where the degrees of freedom are insufficient to maintain this confidence level, the coverage factor is increased to maintain this confidence level. The uncertainty has been determined in accordance with UKAS requirements.
Records: K:\C A\Calibration\Nor-1504\Nor-1018 CalCal\2020\BNK4231_2039392_M1.nmf

	Pressure:	Temperature:	Relative humidity:
Environmental conditions:			
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.520 ± 0.042 kPa	22.1 ± 0.2 °C	35.0 ± 1.2 %RH

Date received for calibration:	30/04/2020
Date of calibration:	05/05/2020
Date of issue:	05/05/2020
Engineer	Michael Tickner
Supervisor	Darren Batten TechIOA

Appendix 3: Qualifications, Experience and Professional Memberships

Qualifications, training, accreditation

BSc. Honours Applied Biology, 1995; MSc. Modern Approaches to Plant Health, 1996; BSc. (Honours) Environmental Health, 2006; Institute of Acoustics Diploma in Acoustics & Noise Control, 2004; MIOA, 2012; EHRB Registration, 2009; MCIEH, 2012.

Experience in BS4142:2014

I have undertaken 88 BS4142 assessments following the issue of the revised standard in 2014.

Appendix 4: Uncertainty

The measurement method used was to measure the existing background noise levels.

As part of the BS4142 assessment the headings from the 2014 standard have been used to consider where uncertainty in the measurements may have occurred.

The complexity of the sound source and the level of variability in sound emission from the source

The plant has not yet been installed so no comment can be made.

The complexity and level of variability of the residual acoustic environment

The residual acoustic environment does not show great variability. The main source of noise is road traffic, providing steady sound pressure levels both day and night, with low levels of variability.

The ambient environment overall provided consistent, reproducible results and therefore uncertainty for this aspect is low.

The level of residual sound in the presence of the specific sound at the measurement location

The plant has not yet been opened and therefore no comment can be made.

The location(s) selected for taking the measurements

The location for measurements followed the guidance in BS4142:2014 and was representative of the noise sources in the area.

The distance between sources of sound and the measurement location and intervening ground conditions

The measurement location was for background only as the plant has not yet been installed and cannot be measured.

The number of measurements taken

24 hours of data was collected in 15-minute periods, which is representative of the local noise environment during operational hours. Overall there is a reliable dataset from which to derive the typical background noise levels and uncertainty is low.

The measurement time intervals

The time intervals for logged data were 15-minute periods, which is an appropriate period for this type of survey and uncertainty is low.

The range of times when the measurements have been taken

The measurement times were representative of the background and ambient sound levels at both measurement locations.

The range of suitable weather conditions during which measurements have been taken

During the surveys the wind conditions were suitable as they did not exceed 5m/s at any time; there was also no precipitation and the temperature was a 7^{o}C – 14^{o}C. All conditions were recorded, including cloud cover and all were in line with the requirements of BS4142 and therefore uncertainty due to weather is low.

The measurement method and variability between different practitioners in the way the method is applied

The method for taking measurements followed that required in BS4142. The measurement procedure is reproducible and therefore uncertainty is low.

The level of rounding of each measurement recorded

Where necessary results have been rounded to the nearest whole decibel; any results at 0.5 have been rounded up.

The instrumentation used

The instrument used is a class 1 sound level meter and calibrator and have all been calibrated to a traceable standard at a UKAS accredited laboratory in the last 24 months. Uncertainty due to instrumentation is low.

Appendix 5: Calculations

Calculation of impact to the plant at the nearest residential window.

Table 4. Air source heat pump 1

Procedure	Overall dB_A
1. Sound pressure of air source heat pump 1	56
2. Attenuation due to barrier	-15
3. Attenuation to nearest residential property (5m)	-14
4. Attenuation due to lack of line of sight	-12
5. Overall sound pressure level at nearest window	15

Table 5. Air source heat pump 2

Procedure	Overall dB_A
1. Sound pressure of air source heat pump 1	56
2. Attenuation due to barrier	-15
3. Attenuation to nearest residential property (5m)	-14
4. Attenuation due to lack of line of sight	-10
5. Overall sound pressure level at nearest window	17

Table 6. Air conditioning unit

Procedure	Overall dB_A
1. Sound pressure of air source heat pump 1	53
2. Attenuation due to wall	-20
3. Attenuation to nearest residential property (5m)	-14
4. Overall sound pressure level at nearest window	19

Table 7. Calculation of combined plant noise

Procedure	Overall dB_A
1. Sound pressure of air source heat pump 1	15
2. Sound pressure of air source heat pump 2	17
3. Sound pressure of air conditioning condenser unit	19
4. Overall sound pressure level at nearest window	22