

Acoustic Assessment at



4 Broadmark Parade Rustington

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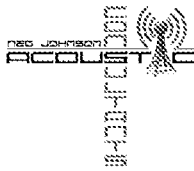
Executive Summary

Ned Johnson Acoustic Consultants Limited has been appointed by K&Z Newhaven Ltd to undertake an acoustic assessment of the proposed items of plant at 4 Broadmark Parade, Rustington.

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.

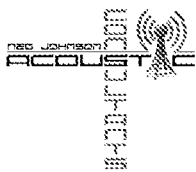
Noise control recommendations are required to meet the likely planning requirements of the Arun District Council. The plant items will require a specialist acoustic enclosures and the minimum performance criteria for the enclosure has been stated. In line silencers are also required.

The predictions in this report are based upon the information provided by K&Z Newhaven Ltd regarding the type of units to be installed at 4 Broadmark Parade.



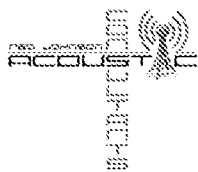
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1. Introduction

- 1.1 Ned Johnson Acoustic Consultants Limited has been appointed by K&Z Newhaven Ltd to undertake an acoustic assessment of the proposed items of plant at 4 Broadmark Parade, Rustington.
- 1.2 The proposed development is for the installation of a kitchen extraction and inlet system, as well as air conditioning condenser units and refrigeration chiller units at the rear of 4 Broadmark Parade. The nearest noise sensitive premises is the first floor flat at 4 Broadmark Parade. The premises proposed opening hours are Monday – Saturday 10:30 – 23:00 and on Sundays 10:30 – 22:00.
- 1.3 The extraction and inlet system fans will be located on the flat roof of the new rear extension, the various condenser units will also be on the flat roof. The fans to be installed are an Eltra SQU23/4HT, Eltra SPP450/4 and the condenser units will be a Mitsubishi PUHZ –ZRP125YKA3, a Mitsubishi PUHZ –ZRP71VHA2 and 2 Foster Duets. All plant will run during the opening hours. During the night only the chiller condensers will operate.
- 1.4 The noise levels from the system on the nearest noise-affected properties has been calculated and compared to the requirements of the Arun District Council using the methodology set-out in BS4142:2014. The requirement is that noise from the external equipment shall be at least 5dB below the background noise level.

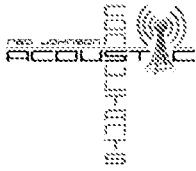


2. Site Description

- 2.1 The site is currently an empty premises in Broadmark Parade. The proposed plant is to be located at the rear of the premises with the extraction plant fan and inlet fan on the flat roof along with the air conditioning and chiller units. The nearest residential premises are located above the proposed restaurant at first floor level.
- 2.2 Figure 1 below shows the location of the development, which is shaded in blue. The measurement location is shown below.

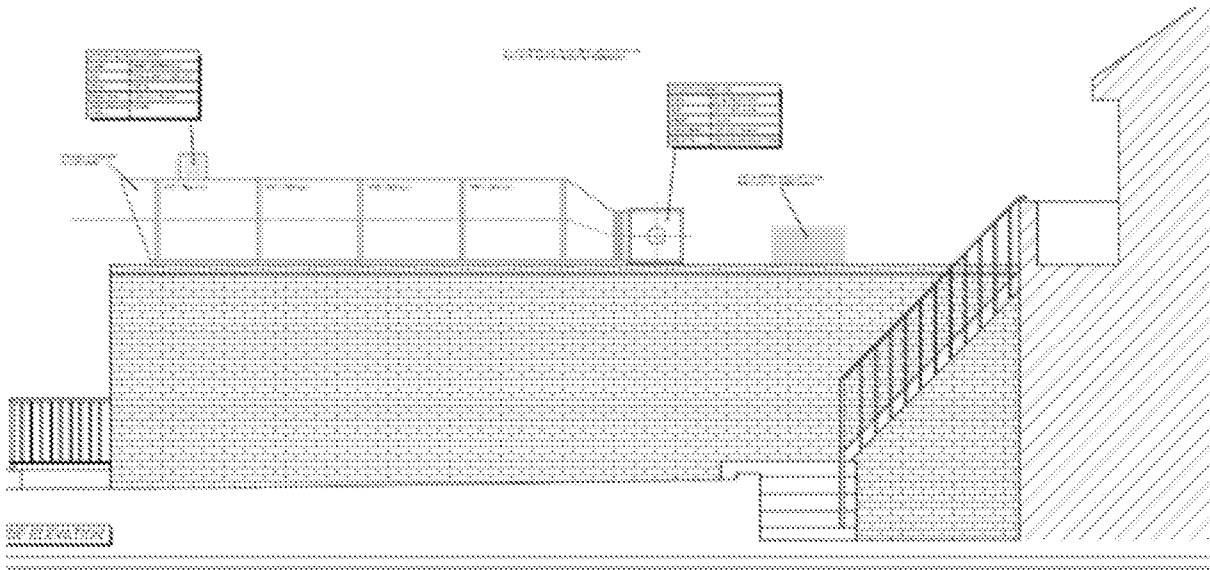
Figure 1.

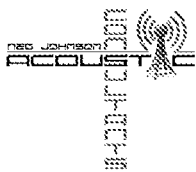




2.3 Figure 2 below shows the plant layout.

Figure 2.





3. Reference Documents

National Planning Policy Framework

3.1 The Department of Housing, Communities and Local Government published the National Planning Policy Framework (NPPF) on 24th July 2018.

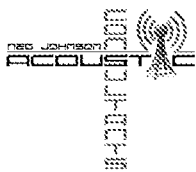
3.2 Paragraphs 170 e and 180a refer to noise in terms of policy approach:

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.



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.

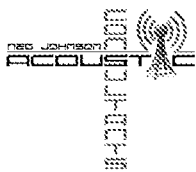
LOAEL – Lowest Observed Adverse Effect Level. This is the level above which adverse effects on health and quality of life can be detected.

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.”

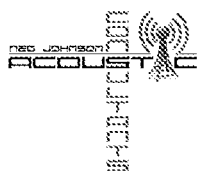
- 3.4 The NPSE does not define the SOAEL numerically, stating at paragraph 2.22:

“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.



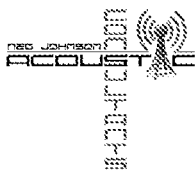
British Standard 8233

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

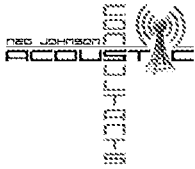
- 3.12 In terms of this development the internal noise levels have been compared to the internal noise levels in Table 1. It is suggested in this report that by meeting these noise levels the development would be classed as NOAEL.



British Standard 4142:2014

- 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.

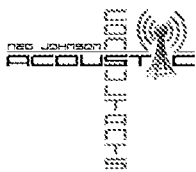
b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

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 4 hour period on October 22nd 2018 between 22:00 – 02:00. This time period was chosen as it will be representative of the quietest time 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 93.9dB_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 was set-up on a tripod 1.5 metres above the ground. There were no reflecting surfaces within 3.5 metres.
- 4.6 During the background survey the temperature was 3^oC with a wind speed of 0.1 metres per second, no precipitation and no cloud cover.
- 4.7 As none of the plant has yet been installed the predictive method in BS4142:2014 has been used.



5. Noise Survey Results

- 5.1 The results of the survey show that the typical measured background prior to 23:00 was 37dB L_{A90} and 34dB L_{A90} after 23:00.
- 5.2 No penalties in the BS4142 assessment have been added as the extraction system and inlet system run continuously during restaurant opening hours. Although the condensers will run intermittently this will not be readily distinctive against the residual acoustic environment and no penalty has been added. Using the subjective method in BS4142, the data for the fans does not show tonality and no penalty has been added.
- 5.3 The following tables present the BS4142 assessment for the combined plant and the chiller condensers after closure of the premises. All calculations can be found in Appendix 6. All calculations are based on attenuation measures, which are discussed in the next section.

Table 2. BS4142 assessment for the residential unit nearest the combined plant up to 23:00.

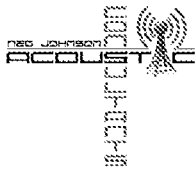
Results	Measurement	Clause	Commentary
Typical ambient sound level	$L_{Aeq\ 1-hour} = 42dB$	7.3.1	
Typical background sound level	$L_{A90} = 37dB$	8.3	
Specific sound level of the condenser units at nearest residential window	32dB _A		
Acoustic feature	0dB	9.2	No intermittency penalty and no tonality
Rating level	32dB _A	11	Sound source



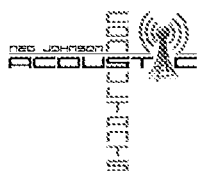
Typical background sound level	$L_{A90} = 37\text{dB}$	8.3	
Rating level at receptor point	-5dB	11	
The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level is -5 dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment. The measurement conditions were repeatable so overall uncertainty is low.

Table 3. BS4142 assessment for the chiller condensers

Results	Measurement	Clause	Commentary
Typical ambient sound level	$L_{Aeq \text{ 1-hour}} = 42$	7.3.1	
Typical background sound level	$L_{A90} = 35$	8.3	
Specific sound level at nearest residential window due to plant noise	25dB_A		
Acoustic feature	0dB	9.2	
Rating level	25dB_A	11	Sound source
Typical background sound level	$L_{A90} = 35\text{dB}$	8.3	
Rating level at receptor point	-10dB	11	



The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level over the background sound level is -10dB 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 from the plant at 4 Broadmark Parade has been determined by comparing the predicted noise levels with the criteria set out in Section 3 of this report.
- 6.2 The BS4142 assessment shows that the noise from the combined plant will be 5dB below background noise level, provided attenuation measures are installed. This noise consists of casing breakout from the fans and noise from the stacks and various condenser units as well. All components will require noise attenuation measures and for this reason acoustic enclosures are required for the fans and in line silencers for the ducting in order to meet the planning requirement of 5dB below the agreed background noise level. The condenser units also require enclosures to attenuate sound to meet the likely planning requirement. The fans should also be attached to ducting using flexible connectors and mounted on anti-vibration mounts.
- 6.3 The manufacturer's data was used in order to calculate the level of performance required by the acoustic enclosures for the two fans. Based on calculations (Appendix 6) the acoustic enclosures for the inlet and extraction fans must achieve the reductions shown in the tables below as a minimum:

Table 4. Performance of extraction fan acoustic enclosure

	Octave band centre frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Minimum Insertion Loss (dB)	-5	-10	-20	-20	-25	-25	-15	-15

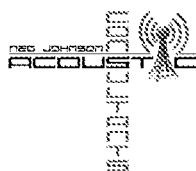


Table 5. Performance of inlet fan acoustic enclosure

	Octave band centre frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Minimum Insertion Loss (dB)	-5	-10	-18	-18	-18	-20	-15	-15

6.4 The calculation for the noise from the duct terminations using the manufacturer's data shows that silencers will be required for both the inlet and extraction systems. Consequently inline duct silencers are required and should have the following minimum performance:

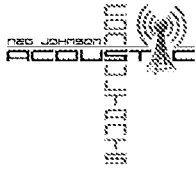
Table 6. Silencer Performance for the extraction system

	Octave band centre frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Minimum Insertion Loss (dB)	-10	-15	-20	-25	-29	-26	-24	-22

Table 7. Silencer Performance for the inlet system

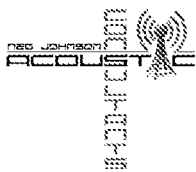
	Octave band centre frequency, Hz							
	63	125	250	500	1000	2000	4000	8000
Minimum Insertion Loss (dB)	-10	-10	-25	-26	-30	-30	-24	-22

6.5 The combined noise from the air conditioning and chiller condensers at the nearest noise sensitive receptor will be 25dB_A. This is dependent on the condensers being enclosed with acoustic enclosures that provide a



minimum of 15dB for the air conditioning condensers and 25dB for the chiller condensers.

- 6.6 The combined sound pressure level of all plant once the mitigation measures are implemented is predicted to be 32dB_A at the nearest noise sensitive receptor.
- 6.7 With mitigation measures the impact of the plant at the nearest receptor would be low. BS8233:2014 states that an open window provides 15dB of attenuation; on this basis, following mitigation, the noise from the plant inside the nearest noise sensitive receptor would be less than 30dB, complying with the internal noise levels due to external sources, as per Table 4 of BS8233:2014.



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.

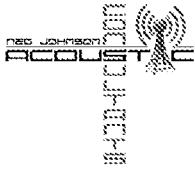
Decibel (dB): A unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure levels the reference quantity is 20 μ Pa. The threshold of normal hearing is in the region of 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
55 Chelmsford Road Industrial Estate
GREAT DUNMOV, Essex, CM8 1HD



CALIBRATION

Manufacturer: Brüel & Kjær
Type: 3280, 251
Serial no: 2034414

Customer: Ned Johnson Acoustic Consultants Ltd
Address: 378 Church Street,
London, NE 9H3.
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 7680 Part 1:1997

Microphone	Producer	Type	Serial No:	Certificate number
Calibrator	Brüel & Kjær	4188	2100817	26771
Pre-amplifier	Brüel & Kjær	4231	2036082	26770
		2C0000	Not marked	Included

Additional items that also have been submitted for verification

Wind shield: None
Attenuator: None
Extension cable: None

These items have been taken into account whenever appropriate.

Environmental conditions:	Pressure:	Temperature:	Relative humidity:
Reference conditions:	101.325 kPa	23.0 °C	50 %RH
Measurement conditions:	101.10 kPa	23.0 °C	45.6 %RH

Date received: 06/06/2018
Date of calibration: 13/06/2018
Date of issue: 13/06/2018

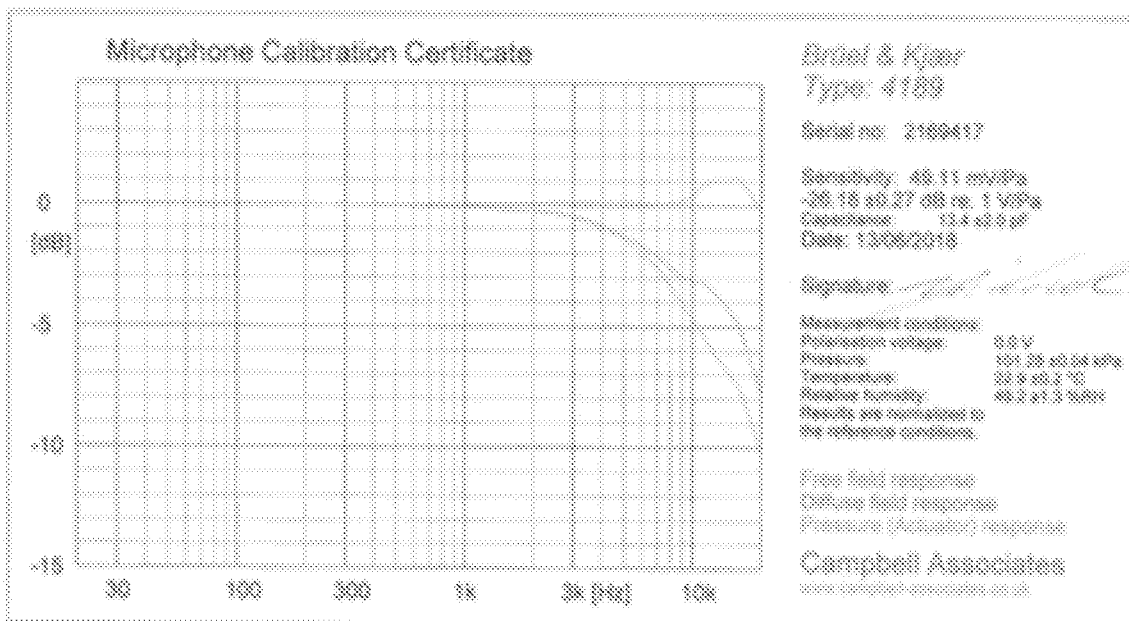
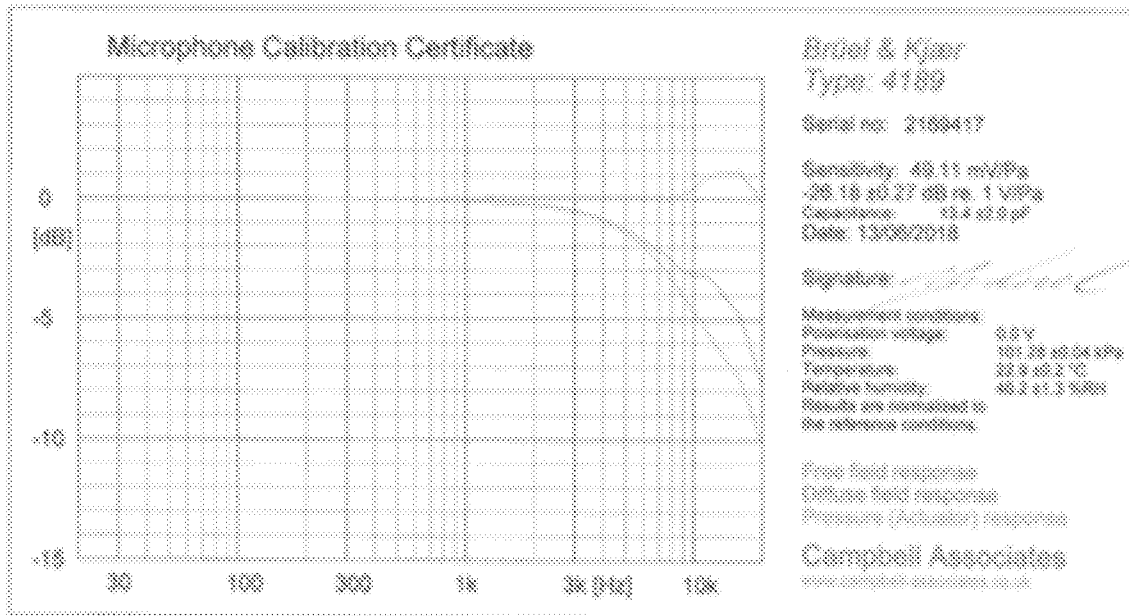
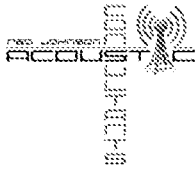
Engineer

Supervisor

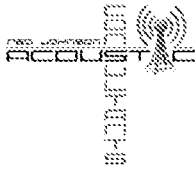
This certificate provides evidence of the
National Physical Laboratory or other
except with the prior written approval of

* The calibration was complete with any relevant documents and records.

Page 1 of 2



Comment:



Campbell Associates Ltd
 5b Chelmsford Road Industrial Estate
 GREAT DUNMOW, CM8 1HD, England
 www.campbell-associates.co.uk
 info@campbell-associates.co.uk
 Phone 01371 871030 Facsimile 01371 879108



Certificate number: 28770

Certificate of Calibration and Conformance

Test object: Sound Calibrator
Manufacturer: Brüel and Kjær
Type: 4231
Serial no: 2038382

Customer: Ned Johnson Acoustic Consultants Ltd
Address: 378 Church Street,
 London, N9 9HG
Contact Person: Ned Johnson

Measurement Results	Level	Level Stability	Frequency	Frequency Stability	Distortion
1	94.04 dB	0.01 dB	999.85 Hz	0.00 %	0.32 %
2	94.04 dB	0.01 dB	999.85 Hz	0.00 %	0.32 %
3	94.04 dB	0.01 dB	999.85 Hz	0.00 %	0.32 %
Result (Average):	94.04 dB	0.01 dB	999.85 Hz	0.00 %	0.32 %
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/m³.

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: KIC AC Calibration 15044 Rev 1018 CalC-02018-0004231_2038382_M1.pdf

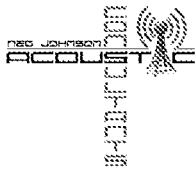
Environmental conditions:	Pressure	Temperature	Relative humidity
Reference conditions:	101.325 kPa	20.0 °C	50 %RH
Measurement conditions:	101.306 ± 0.043 kPa	22.5 ± 0.1 °C	46.5 ± 1.1 %RH

Date received for calibration: 06/06/2018
Date of calibration: 13/06/2018
Date of issue: 13/06/2018
Engineer:

Supervisor:

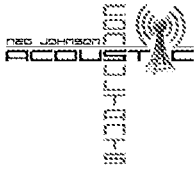
This certificate is issued in accordance with the UK code of practice for the calibration of sound level meters, to the units of measurement contained in the National Measurement System, except with the grey units.

Document: Cert_Calibration_M1.pdf



Appendix 3: Data

Start Time	L _{A90} , 15 min	L _{Aeq} , 15 min
22:00:00	37.23454352	41.98
22:15:00	36.48529625	44.34
22:30:00	36.94163038	42.17
22:45:00	37.65767878	42.85
23:00:00	36.78636813	41.73
23:15:00	36.34556025	41.5
23:30:00	35.41012421	40.75
23:45:00	34.53155168	49.6
00:00:00	34.91292081	41.4
00:15:00	35.02549677	45.92
00:30:00	34.13438022	42.09
00:45:00	35.46925396	43.62
01:00:00	34.56257828	42.98
01:15:00	35.12463677	45.77
01:30:00	36.53472442	42.14
01:45:00	35.15754679	43.69



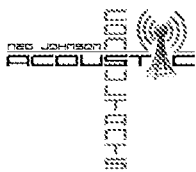
Appendix 4: Qualifications, Experience and Professional Memberships

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 64 BS4142 assessments following the issue of the revised standard in 2014.



Appendix 5: Uncertainty

The measurement method used was to measure the existing background noise levels. No measurement of the sources could be undertaken as they are not in place.

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

It is not possible to comment on the variability, as the plant has not been installed. In terms of the complexity the manufacturer's data does not show a great variation between the octave band centre frequencies.

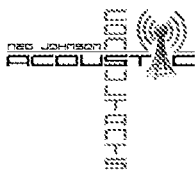
The complexity and level of variability of the residual acoustic environment

No residual measurements could be taken, as the sound sources are not in place. In relation to the existing ambient noise level the noise over each 15-minute period varied very little due to no particular sound sources impacting upon the measurement location.

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

This could not be done due to the absence of the specific sound sources.



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 results were unaffected by reflections or unusual events and reproducible.

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

Again as the sound sources are not yet in place this is not a source of uncertainty in this survey.

The number of measurements taken

A full 4-hours of data was collected in 15-minute periods providing a data set which is representative of the quietest conditions 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.

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 temperature was 3°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

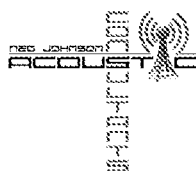
The method for taking measurements followed that required in BS4142. The measurement procedure is reproducible and therefore uncertainty is low.

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 instruments used are class 1 sound level meters and calibrators and have all been calibrated to a traceable standard at a UKAS accredited laboratory in the last 12 months. Uncertainty due to instrumentation is low.



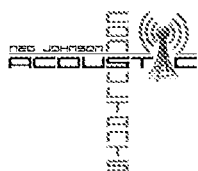
Appendix 6: Calculations

Calculation of impact to the residential property nearest to fan for casing breakout for extraction fan.

Procedure	Octave band centre frequency, Hz								Overall
	63	125	250	500	1000	2000	4000	8000	
1. Sound power level of fan (dB)	69	63	66	59	56	57	52	53	
2. A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
3. Conversion to SPL at 1m	-8	-8	-8	-8	-8	-8	-8	-8	
4. Measured attenuation to 4 metres	-12	-12	-12	-12	-12	-12	-12	-12	
5. Enclosure performance required	-5	-10	-20	-20	-25	-25	-15	-15	
6. Sound pressure level 1 metre from nearest window due to fan casing breakout	17.8	16.9	17.4	15.8	11	13.2	18	16.9	25

Calculation of impact to the residential property nearest to fan for casing breakout for inlet fan.

Procedure	Octave band centre frequency, Hz								Overall
	63	125	250	500	1000	2000	4000	8000	
1. Sound power level of fan (dB)	67	62	65	59	53	48	50	48	
2. A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
3. Conversion to SPL at 1m	-8	-8	-8	-8	-8	-8	-8	-8	
4. Measured attenuation to 4 metres	-12	-12	-12	-12	-12	-12	-12	-12	
5. Enclosure performance required	-5	-10	-18	-18	-18	-20	-15	-15	
6. Sound pressure level at nearest window due to fan casing breakout	15.8	15.9	18.4	17.8	15	9.2	16	11.9	25

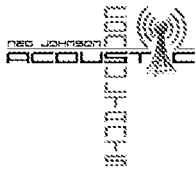


Calculation of impact to the residential property nearest due to extraction system stack vent

Procedure	Octave band centre frequency, Hz								Overall
	63	125	250	500	1000	2000	4000	8000	
1. Sound Power level of fan (dB)	83	81	85	85	84	83	80	73	
2. A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
End Reflection	-6	-2	0	0	0	0	0	0	
Duct Attenuation	-2.6	-1.32	-3.3	0	0	0	0	0	
5. Silencer 1 performance	-5	-15	-20	-25	-29	-26	-24	-22	
7. Directivity loss	-6	-9	-12	-14	-16	-18	-20	-22	
8. Conversion to L_{pA} at 5 metres	-22	-22	-22	-22	-22	-22	-22	-22	
9. Total	15.2	15.58	19.1	20.8	17	18.2	15	5.9	26

Calculation of impact to the residential property nearest due to inlet system stack vent

Procedure	Octave band centre frequency, Hz								Overall
	63	125	250	500	1000	2000	4000	8000	
1. Sound Power level of fan (dB)	71	72	81	78	74	70	64	58	
2. A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
3. End Reflection	-9	-5	-2	0	0	0	0	0	
4. Silencer 1 performance	-10	-10	-25	-26	-30	-30	-24	-22	
5. Directivity loss	0	-4	-6	-8	-10	-12	-13	-14	
6. Conversion to L_{pA} at 4 metres	-20	-20	-20	-20	-20	-20	-20	-20	
7. Total	5.8	16.9	19.4	20.8	14	9.2	8	0.9	25



Calculation of condenser noise.

Procedure	Overall dB _A
1. Combined sound pressure of condensers at 1m	64
2. Attenuation with distance to 5 m	-14
3. Performance required of enclosure	-25
4. Overall sound pressure level 1 metre from the nearest window	25