Acoustic Assessment at

KFC

60 Station Road, Hayes

Document Ref: 702425

Date: 14/04/2025

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Executive Summary

Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the mechanical plant at KFC Hayes, 60 Station Road, Hayes, for extended opening hours.

The acoustic 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 Hillingdon Council. The predictions show that the combined plant will be at least 5dB below the typical background noise level at the nearest residential window.

Contents

1. Introduction

1.1 Ned Johnson Acoustic Consultants Limited has been appointed to undertake an acoustic assessment of the mechanical plant at KFC, 60 Station Road, Hayes, in relation to the application for extended hours

1.2 The development is an application for the extension of the existing takeaway's opening hours. Currently the premises are open 10:00 – 23:00. The application is to extend the hours to 02:00 every day.

1.3 All the plant has been installed and there are no proposed changes to the plant or the layout.

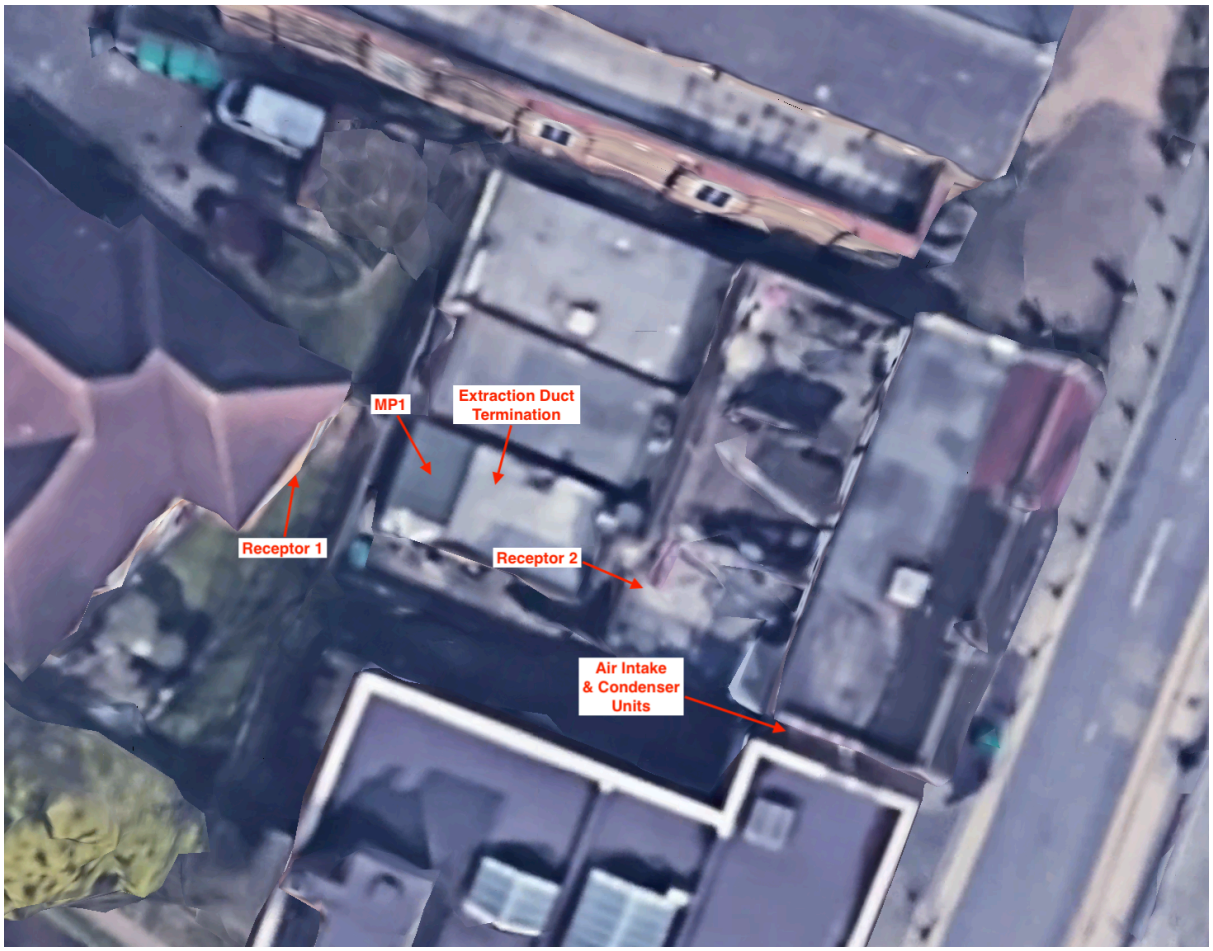
1.4 The sound levels from the system at the nearest noise-affected property has been predicted and compared to the requirements of Hillingdon Council using the methodology set-out in BS4142:2014+A1 2019. The requirement in Planning Noise Advice Document is that noise rating level from the external equipment should be no greater than 5dB below the existing background levels when measured in accordance with BS4142, at the nearest or most noise affected residential window.

2. Site Description

2.1 The development is for the extension of hours at the existing KFC, 60 Station Road, Hayes.

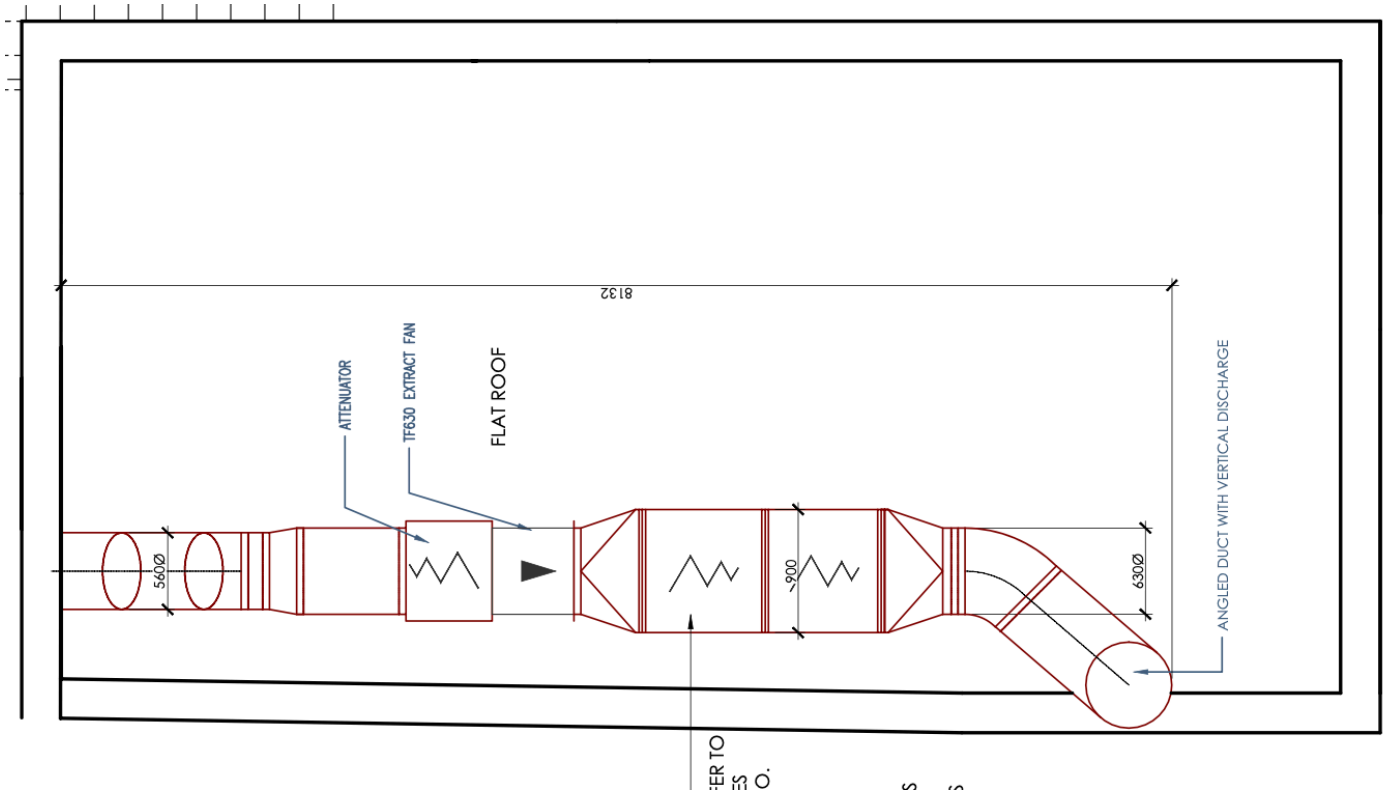
2.2 Figure 1 below shows the location of the development; MP1 is the measurement point. The measurement location is deemed to be representative of the receptors.

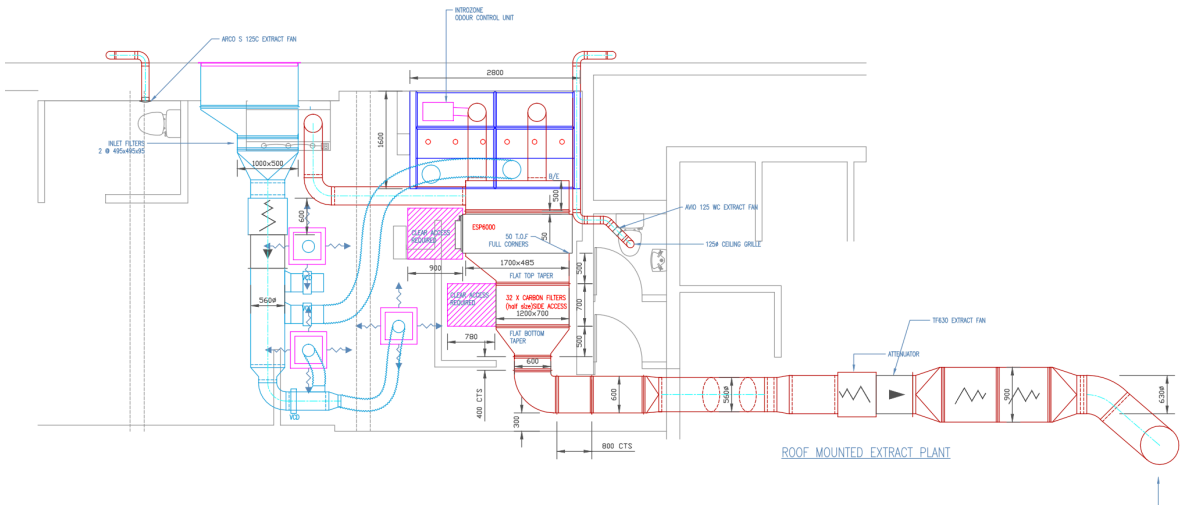
Figure 1.



2.3 Figure 2 below shows the plant layout.

Figure 2.





2.4 Receptor 1 is 7 metres from the extraction system duct termination and currently the noise from the system at this location is above the background sound pressure level and is the dominant noise source. Receptor 2 is 14 metres from the duct termination of the extraction system and 5 metres from the air intake location. At Receptor 2 the dominant noise source is the air intake system.

2.5 The context of the site is that it is a busy location due to the mechanical plant at commercial properties and traffic on the local road network as well as deliveries and goods movement at the commercial units and aircraft noise during the day.

2.6 All the plant will operate during the opening hours of 11:00 – 02:00.

2.7 The extraction system has two circular 630mm silencers connected to the intake and discharge sides of the fan.

2.8 In terms of the sensitivity of the receptor, the receptor is located in a busy town centre location, which does mean that the acoustic environment can be expected to be noisier than would a suburban location. The receptors in this location are not more sensitive due to the period of time when the mechanical plant operates.

2.9 The BS4142 rating will be no greater than the typical background sound levels. It is considered that a rating level at background is a low impact.

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 December 2024.

3.2 Paragraphs 187 (e) 198(a), (b) and 200 refer to noise in terms of policy approach:

187. 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

198. 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

200. 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 3-hour period, April 9th – April 10th, 2025, between the hours of 23:00 – 02:00. The measurement point can be seen in Figure 1.

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 microphone at MP1 was housed in a Bruel & Kjaer UA1404 outdoor microphone cover and attached to a tripod positioned on the rear flat roof. MP1 was representative of the nearest residential premises to the mechanical plant.

4.6 During the background survey the temperature was 6^{o}C with a wind speed of 0.1 metres per second and no precipitation. Cloud cover was approximately 30% with no precipitation.

4.7 Short-term measurements of the extraction and air intake systems were also made with the 2260. Both systems were measured in $^1/_3$ octave frequency bands

5. Acoustic Survey Results

5.1 The typical L_{A90} 23:00 – 02:00, was 35dB and the typical ambient was 41dB L_{Aeq}.

5.2 The measurements of the extraction fan duct termination were 69dB$_A$ at 1 metre and the inlet system was 72dB$_A$ at 1 metre. Both will need attenuation and this is discussed in the next section.

5.3 The fans run continuously and are not intermittent and for this reason no penalty has been added. Using the objective method in BS4142 none of the plant does not show tonality and no penalty has been added.

5.4 The following tables present the BS4142 assessments for the mechanical plant noise. The system calculations can be found in Appendix 4 and includes mitigation, which is discussed in the next section.

Table 2. BS4142 assessment for the combined plant at Receptor 1, 23:00 – 02:00

Results	Measurement	Clause	Commentary
Typical ambient sound level	L_{Aeq} = 41dB	7.3.1	
Typical background sound level	L_{A90} = 35dB	8.3	
Specific sound level of the plant at residential window	28dB$_A$		
Acoustic feature	0dB	9.2	No penalties as the plant will not be audible above the residual acoustic environment
Rating level	28dB$_A$	11	Sound source

Typical background sound level	L_{A90} = 35dB	8.3	
Rating level at receptor point	-7dB	11	
The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level is - 7dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment.

Table 3. BS4142 assessment for the combined plant at Receptor 2, 23:00 – 02:00

Results	Measurement	Clause	Commentary
Typical ambient sound level	L_{Aeq} = 41dB	7.3.1	
Typical background sound level	L_{A90} = 35dB	8.3	
Specific sound level of the plant at residential window	26dB$_A$		
Acoustic feature	0dB	9.2	No penalties as the plant will not be audible above the residual acoustic environment
Rating level	26dB$_A$	11	Sound source
Typical background sound level	L_{A90} = 35dB	8.3	

Rating level at receptor point	-9dB	11	
The assessment shows that there is likely to be no adverse impact at receptor point			
Uncertainty of the assessment			The rating level is - 9dB and in this instance the uncertainty of the measurement does not have any significance to the outcome of the assessment.

6 Evaluation of results

6.1 The impact of the plant at KFC Hayes, 60 Station Road for the extended hours, 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 combined plant, with further mitigation, is predicted to be 7dB below the typical background noise level during proposed extended operational hours at night at Receptor 1 and 9dB below typical background during the proposed extended hours at Receptor 2.

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

6.4 In terms of penalties the extraction and inlet systems will run continuously during operating hours and will not be intermittent therefore, no penalty for intermittency is required. The $^{1}/_{3}$ octave band data for the extraction and inlet fans can be seen in Appendix 6, the data shows that the units are not tonal. Experience of this type of plant at other sites allows a subjective assessment, which shows that this type of plant is not tonal and no penalty is required. The plant does not have impulsivity characteristics and no penalty is required.

6.5 The noise level due to the extraction and inlet system at the nearest receptors is a result of the attenuation with distance and the screening. The fans already have silencers installed after the fans in the ducting which do not provide sufficient sound attenuation and further works on these items of plant is necessary.

6.6 The table below shows the performance required of the new silencer for both the extraction fan and the air intake fan.

Table 4 Performance of the silencer for the extraction and air intake fans

	Octave band centre frequency, Hz							
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
Minimum Insertion Loss (dB)	-11	-20	-20	-50	-50	-50	-50	-48

6.7 The above silencer is based upon an Acoustica rectangular 1200mm attenuator fitted after the discharge side of the fans. This could fitted to the ducting with a rectangular/round transformation section.

6.8 The extraction fan and transformation sections should be externally lagged with one layer of Transmatic Acoustic Damping sheet and one layer of Transhield Acoustic Insulation. The duct should be fitted with acoustic lagging which has a minimum mass of 5Kg/m^2 and has a minimum performance of 27dB sound reduction index.

6.9 For the new extract attenuators, it is recommended that Melinex lined silencers are used to prevent grease impregnation into the acoustic media which may degrade the performance realised over time

6.10 As the above insertion loss by achieved using multiple silencers, these should be separated from each other by a distance of minimum 3-4 x D, where D is the largest internal dimension of the ductwork (e.g. D is 0.5m, so a minimum of 1.5-2m apart).

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

Laboratory Location

Campbell Associates Ltd

5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

CALIBRATION

Certificate of Calibration

Certificate number: **47900**

Test Object: **Sound Level Meter, BS EN 60651 and or BS EN 60804 Class 1**

Producer: **Brüel & Kjær**
Type: **2260**
Serial number: **2034414**
Customer: **Ned Johnson Acoustic Consultants Ltd**
Address: **378 Church Street,**
London. N9 9HS.
Contact Person: **Ned Johnson**
Order No: **TBC**

Introduction:
Calibration has been performed as set out in CA Technical Procedures which are based on the procedures for periodic verification of sound level meters as per the **Test Object** listed above. Results and conformance statement are overleaf and detailed results, where appropriate, are provided in the attached Measurement Report.

Tested:	*Producer*	*Type*	*Serial No*	*Certificate No*
Microphone	Bruel & Kjaer	4189	2169417	47899
Calibrator*	Bruel & Kjaer	4231_V7	2039392	47898
Preamplifier	Brüel & Kjær	ZC0026	NoCode	Included

* The calibrator was complete with any required coupler for the microphone specified.

Additional items that have also been submitted for verification:
Wind shield N/A
Attenuator N/A
Extension cable N/A
These items have been taken into account wherever appropriate.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.72 ±0.01	21.13 ±0.2	64.40 ±2.4

Calibration Dates:

Received date:	16/05/2024	Reviewed date:	23/05/2024
Calibration date:	23/05/2024	Issued date:	23/05/2024

Technicians: (Electronic certificate)

Calibrated by: *Palaniwel Marappan B.Eng (Hons), M.Sc*

Reviewed by: *Jenny Crawford*

Doc ref: Slm-Cert-Master-V3-07

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Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

CALIBRATION

Certificate of Calibration

Certificate number: **47899**

Test Object: **Measurement Microphone**

Producer: **Brüel & Kjær**
Type: **4189**
Serial number: **2169417**
Customer: **Ned Johnson Acoustic Consultants Ltd**
Address: **378 Church Street,**
London. N9 9HS.
Contact Person: **Ned Johnson**
Order No: **TBC**

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-24.95*	*56.54*	*13.75*
Measurement 2	*-24.95*	*56.55*	*13.76*
Measurement 3	*-24.95*	*56.54*	*13.76*
Result (Average):	***-24.95***	***56.54***	***13.76***
Expanded Uncertainty:	0.10		2.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S_{250}, and is valid at reference conditions. The following correction factors have been applied during the measurement:
Pressure:-0.01 dB/kPa Temperature:-0.006 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.69 ± 0.040	20.8 ± 0.1	64.2 ± 0.7

The calibration test report shown on the next page gives details of the response at other frequencies relative to this 250 Hz reference sensitivity. Results ≥100 Hz are obtained using an electrostatic actuator as described in BS EN 61094-6 and those below 100 Hz are obtained in a reference pressure chamber. Detailed results are available from the calibration laboratory upon request.

The reported expanded uncertainty of measurements is based on a standard uncertainty multiplied by the coverage factor of k=2, providing a coverage probability 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.

Calibration Dates:

Received date:	16/05/2024	Reviewed date:	23/05/2024
Calibration date:	23/05/2024	Issued date:	23/05/2024

Technicians: (Electronic certificate)
Calibrated by: *Palanivel Marappan B.Eng (Hons), M.Sc*
Reviewed by: *Jenny Crawford*

Doc ref: Mic-Cert-Master-V3-04

Laboratory Location
Campbell Associates Ltd
5b Chelmsford Road Industrial Estate
GREAT DUNMOW, Essex, GB-CM6 1HD
Phone 01371 871030

CALIBRATION

Certificate of Calibration

Certificate number: **47898**

Test Object: **Sound Calibrator**

Producer: **Brüel & Kjær**
Type: **4231**
Serial number: **2039392**
Customer: **Ned Johnson Acoustic Consultants Ltd**
Address: **378 Church Street,**
London. N9 9HS.
Contact Person: **Ned Johnson**
Order No: **TBC**

Measurement Results	Level dB	Level Stability dB	Frequency Hz	Distortion %
Measurement 1	94.11	0.02	999.85	0.53
Measurement 2	94.11	0.02	999.86	0.51
Measurement 3	94.11	0.02	999.86	0.52
Result (Average):	**94.11**	**0.02**	**999.86**	**0.52**
Expanded Uncertainty:	0.1	0.02	1	0.1
Degree of Freedom:	>100	>100	>100	>100
Coverage Factor:	2	2	2	2

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
Pres:0.0008 dB/kPa Temp:0.0015 dB/°C Humi:0.001 dB/%RH Load volume: 0.0002 dB/mm3

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	100.69 ±0.040	20.8 ±0.1	64.2 ±0.7

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\Current Year\BNK4231_V7_2039392_M1.nmf

Preconditioning
The equipment was preconditioned for more than 4 hours in the specified calibration environment.

Method
Calibration has been performed as set out in the current version of CA Technical procedure TP01

Calibration Dates:

Received date:	16/05/2024	Reviewed date:	23/05/2024
Calibration date:	23/05/2024	Issued date:	23/05/2024

Technicians: (Electronic certificate)
Calibrated by: *Palanivel Marappan B.Eng(Hons), M.Sc*
Reviewed by: *Jenny Crawford*

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.

Doc ref: Calb-Cert-Master-V3-07

Appendix 3: 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

In terms of the complexity the data does not show a great variation between the octave band centre frequencies for any of the items of mechanical plant.

The complexity and level of variability of the residual acoustic environment

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

Both the air intake and the extraction systems are clearly audible at both receptors.

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 mechanical plant is 5-14 metres from the window of the most noise affected residential property.

The number of measurements taken

3 hours of data was collected in 15-minute periods to cover the proposed increased 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 6^{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.

Uncertainty in calculations:

Uncertainty in any measured sound levels used in calculations

Plant was measured on site and where possible this data has been used for calculations.

Uncertainty in the operation or sound emission characteristics of the specific sound source and any assumed sound power levels

The plant was measured in operation and uncertainty is low.

Uncertainty in the calculation method

Standard calculation for attenuation with distance was used in the calculations and all calculations followed normal acoustic methods.

Simplifying the real situation to 'fit' the model (user influence on modelling)

The performance of the plant and emissions was not modelled. All calculations were based on the site characteristics.

Error in the calculation process

All calculations were checked by a colleague in an independent consultancy and uncertainty is low.

Appendix 4: Calculations

Receptor 1:

Table 5. Calculation of impact to Receptor 1 due to extraction system.

Procedure	Overall								
	63	125	250	500	1000	2000	4000	8000	
Sound pressure level of fan (dB) at 1m	72.6	73.9	72.6	68.6	63.5	59	49.3	37.9	
Conversion to A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
Attenuation to 7m	-17	-17	-17	-17	-17	-17	-17	-17	
Silencer performance	-11	-20	-20	-50	-50	-50	-50	-48	
Total (dB_A)	18.4	20.8	27	-1.6	-3.5	-6.8	-16.7	-28.2	28

Table 6. Calculation of impact to Receptor 1 due to air intake system

Procedure	Overall								
	63	125	250	500	1000	2000	4000	8000	
Sound pressure level of fan (dB) at 1m	76.8	76.4	77.9	69.9	63.8	57.6	48.5	42.5	
Conversion to A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
Attenuation to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Silencer performance	-11	-20	-20	-50	-50	-50	-50	-48	
Screening 0.5m	-9	-10	-12	-15	-18	-20	-23	-23	
Total (dB_A)	2.6	2.3	9.3	-26.3	-32.2	-39.2	-51.5	-57.6	11

Table 7. Calculation of combined plant at Receptor 1.

Procedure	Sound Pressure dB_A
Extraction system	28
Inlet system	11
Total	28

Receptor 2:

Table 8. Calculation of impact to Receptor 2 due to extraction system.

Procedure	Overall								
	63	125	250	500	1000	2000	4000	8000	
Sound pressure level of fan (dB) at 1m	72.6	73.9	72.6	68.6	63.5	59	49.3	37.9	
Conversion to A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
Attenuation to 26m	-28	-28	-28	-28	-28	-28	-28	-28	
Silencer performance	-11	-20	-20	-50	-50	-50	-50	-48	
Total (dB_A)	7.4	9.8	16	-12.6	-14.5	-17.8	-27.7	-39.2	17

Table 9. Calculation of impact to Receptor 2 due to air intake system

Procedure	Overall								
	63	125	250	500	1000	2000	4000	8000	
Sound pressure level of fan (dB) at 1m	76.8	76.4	77.9	69.9	63.8	57.6	48.5	42.5	
Conversion to A-weighting	-26.2	-16.1	-8.6	-3.2	0	1.2	1	-1.1	
Attenuation to 5m	-14	-14	-14	-14	-14	-14	-14	-14	
Silencer performance	-11	-20	-20	-50	-50	-50	-50	-48	
Screening 0.5m	-9	-10	-12	-15	-18	-20	-23	-23	
Total (dB_A)	16.6	16.3	23.3	-12.3	-18.2	-25.2	-37.5	-43.6	25

Table 10. Calculation of combined plant at Receptor 2

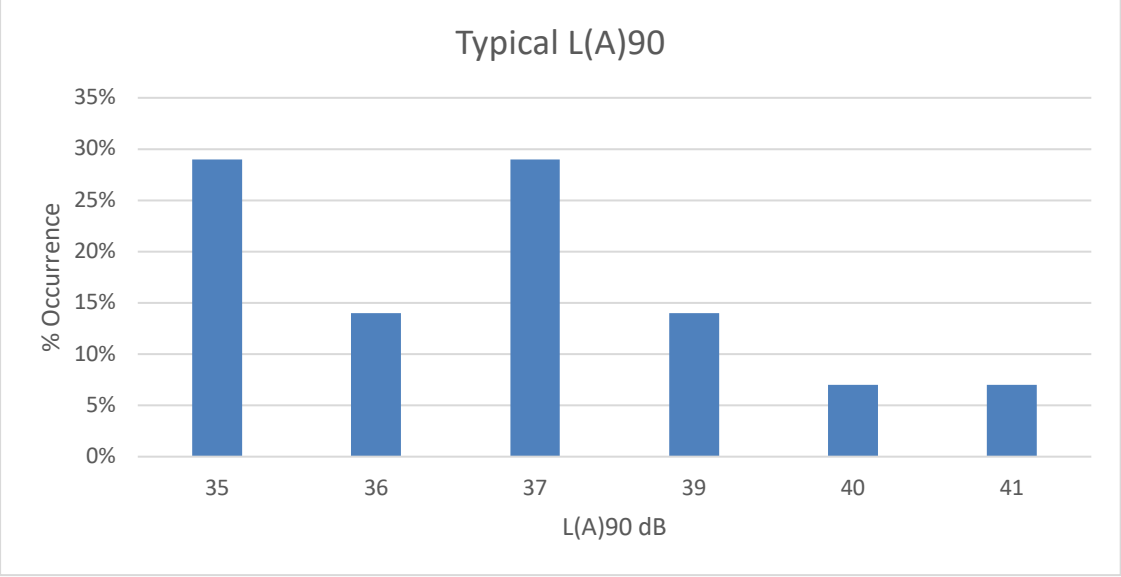
Procedure	Sound Pressure dB_A
Extraction system	17
Inlet system	25
Total	26

Appendix 5: Data

Table 11.

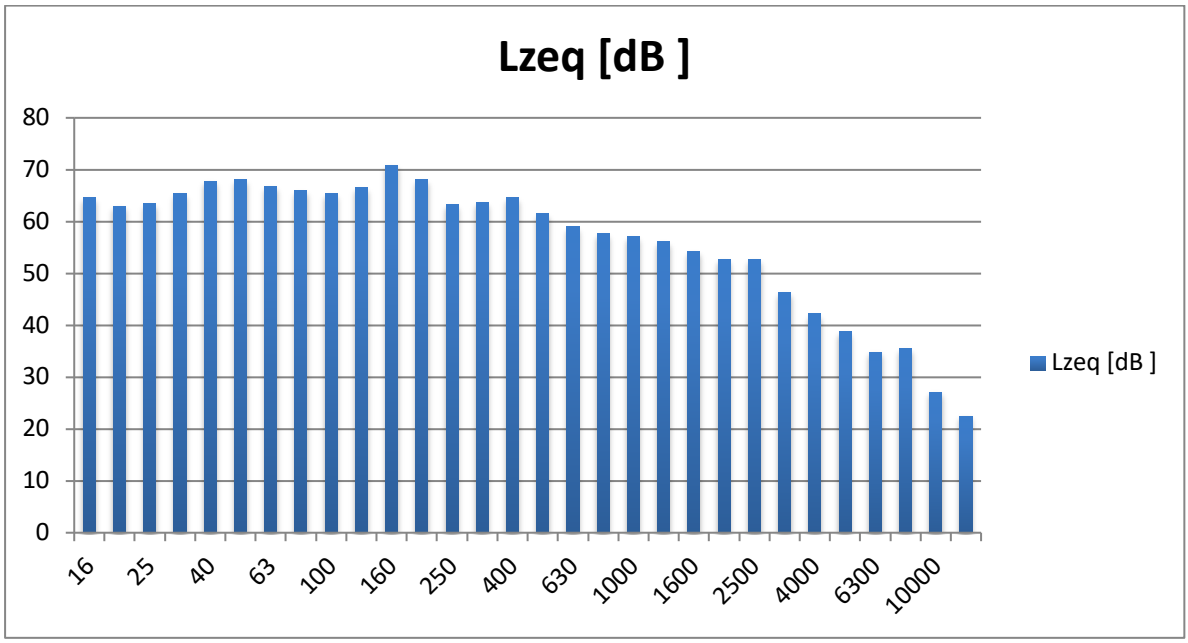
Start Time	$L_{Aeq\ 15\ min}$	$L_{A90\ 15\ min}$
23:00:00	66.37	65.99
23:15:00	65.87	53.18
23:30:00	49.03	41.28
23:45:00	44.86	40.44
00:00:00	44.37	39.87
00:15:00	43.2	39.06
00:30:00	42.86	37.48
00:45:00	41.68	36.65
01:00:00	42.47	37.47
01:15:00	41.9	36.56
01:30:00	41.87	37.38
01:45:00	41.68	35.72
02:00:00	41.26	35.46
02:15:00	40.91	37.72
02:30:00	44.96	35.42
02:45:00	41.93	35.99

Typical L_{A90}

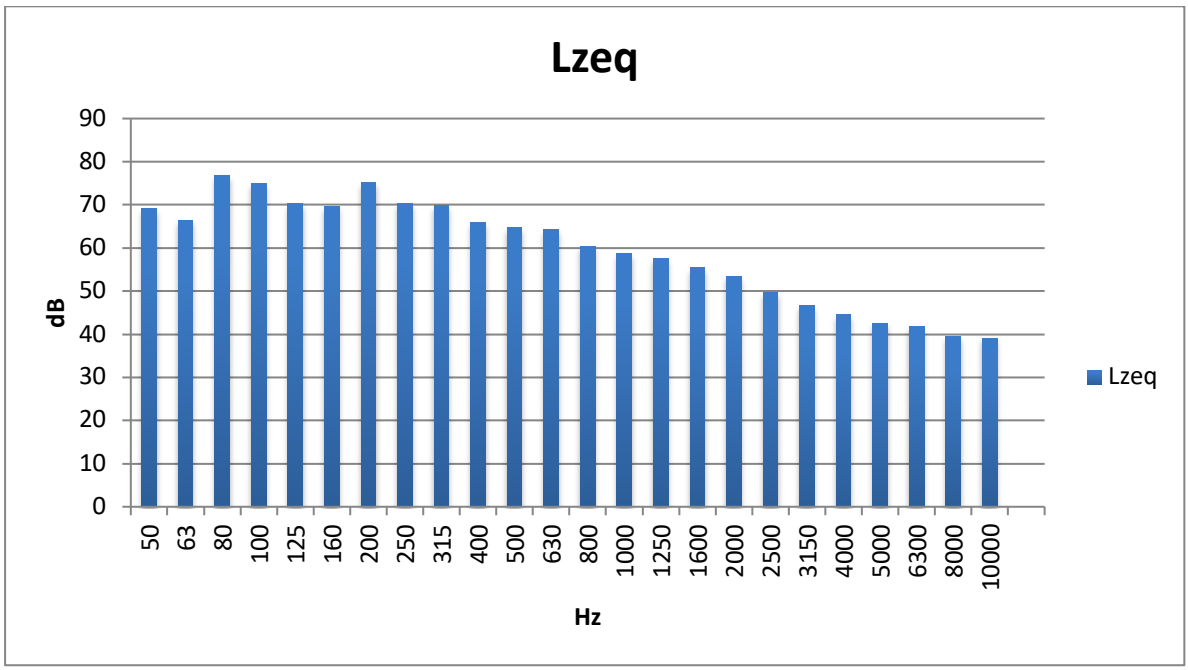


Appendix 6: Tonality Objective Method

Graph of extraction system:



Graph of air intake system:



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