Hawkins environmental

Acoustic Impact Assessment:

144 Fortess Road, Tufnell Park

Fortess Fitness Limited

16th May 2025

Report Details:

Report Title	Acoustic Impact Assessment
Site	144 Fortess Road, Tufnell Park
Client	Fortess Fitness Limited
Report No.	H4435 – NV – v1

Version History:

Version	Date	Notes	Author	Checked
V1	16th May 2025	Original Issue	Mathew Vaughan MSc MIOA	Nick Hawkins MSc MIOA MIAQM

Table of Contents

1. INTRODUCTION 5
1.1. Overview 5
1.2. The Nature, Measurement and Effect of Noise 5
1.3. Site Description 6
2. NATIONAL & LOCAL PLANNING POLICY 8
2.1. National Planning Policy Framework (2024) 8
2.2. Noise Policy Statement for England (2010) 9
2.3. Planning Practice Guidance 9
2.4. The London Plan (2021) 13
2.5. The London Borough of Camden Local Plan (2017) 15
3. ASSESSMENT METHODOLOGY & GUIDANCE 17
3.1. BS 8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' 17
3.2. World Health Organisation Guidelines for Community Noise (1999) 18
3.3. WHO Night Noise Guidelines for Europe (2009) 19
3.4. ProPG: Gym Acoustics Guidance (2023) 19
4. SOUND MEASUREMENT STUDY 22
4.1. Overview 22
4.2. Noise Survey Results 23
5. ANALYSIS 26
5.1. Consultation with the London Borough of Camden 26
5.2. Gym Activities 26
5.3. External Noise Measurements 27
5.4. Internal Noise Measurements at Gottfried Mews 28
6. MITIGATION 30
7. OVERALL CONCLUSIONS AND RECOMMENDATIONS 32

List of Appendices

Appendix 1 Glossary of Acoustic Terms 33
Appendix 2 Schedule of Equipment 35
Appendix 3 Summary of Sound Measurements 50

List of Tables

Table 1.1: Typical Noise Levels 6
Table 2.1: Noise Exposure Hierarchy 12
Table 2.2: Appendix C – Entertainment Noise Criteria – Observed Adverse Effect Levels 16
Table 2.3: Appendix C – Entertainment Noise Criteria – NR Criteria 16
Table 3.1: Summary of Noise Criteria: BS 8233: 2014 17
Table 3.2: Summary of Noise Criteria: WHO 19
Table 3.3: Internal Sound Target Criteria for Gym Activity – Residential & Other Areas 21
Table 4.1: Summary of Weather Conditions during the Sound Measurements 22
Table 4.2: Summary of the External Sound Level Measurements 23
Table 4.3: Summary of the Internal Sound Level Measurements – Gottfried Mews 25

List of Figures

Figure 3.1: Noise Measurement Location 20
Figure 4.1: Noise Measurement Location 23
Figure 4.2: 24hr Noise Measurements 24
Figure 5.1: Noise Measurements with Surrounding Dwellings (assuming an open window) 28

1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Fortess Fitness Limited to undertake an acoustic impact assessment for an existing gymnasium. The lawful use of the site is warehousing, although it had operated as a gym since 1984 under a personal permission. This has now expired with the beneficiary no longer involved with the operation of the gym. Therefore, planning permission is being sought for a change of use from warehousing (Class B8) to a gym with ancillary office accommodation (Class E). The gym is situated on Fortess Road in the Tufnell Park are of the London Borough of Camden.

1.1.1. Criteria

During the planning process, it has been identified that the site may require a noise assessment to determine whether noise emissions from the gym would be in line with permitted levels. Consequently, a noise survey was conducted to characterise the noise climate of the site and the impact of the gym has been assessed.

The assessment adheres to the principles of Government planning policy in relation to noise, specifically enacted by the *National Planning Policy Framework (NPPF), the National Planning Practice Guidance (NPPG) on Noise* and *the Noise Policy Statement for England (NPSE).*

All sound measurements were conducted in accordance with BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use'*. The assessment of plant sound has been assessed in accordance with the ProPG: Gym Acoustic and the entertainment noise criteria of the Camden Local Plan

1.2. The Nature, Measurement and Effect of Noise

Noise is often defined as sound that is undesired by the recipient. Whilst it is impossible to measure nuisance caused by noise directly, it is possible to measure the loudness of that noise. 'Loudness' is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitudes of the numbers involved, a logarithmic scale of decibels (dB) is normally used, based on a reference level of the lowest audible sound.

The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequencies to approximate the human response. The resulting 'A' weighted decibel, dB(A), has been shown to correlate closely to the subjective human response.

When related to changes in noise, a change of ten decibels from say 60 dB(A) to 70 dB(A) would represent a doubling in 'loudness'. Similarly, a decrease in noise from 70 dB(A) to 60 dB(A) would represent a halving in 'loudness'. A change of 3 dB(A) is generally considered to be just perceptible. **Table 1.1** details typical noise levels. A glossary of acoustic terms can be found in **Appendix 1**.

Table 1.1: Typical Noise Levels

Approximate Noise Level (dB(A))	Example
0	Limit of hearing
30	Rural area at night
40	Library
50	Quiet office
60	Normal conversation at 1 m
70	In car noise without radio
80	Household vacuum cleaner at 1 m
100	Pneumatic drill at 1 m
120	Threshold of pain

1.3. Site Description

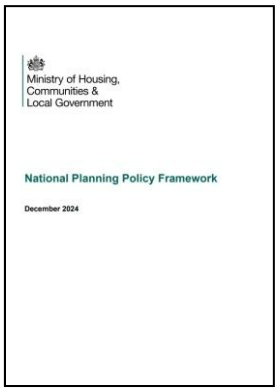
The development site is located towards the centre of Tufnell Park in the London Borough of Camden. The entrance to the site is situated along the eastern side of Fortess Road, with the majority of the gymnasium being situated to the rear of the commercial and residential uses lining Fortess Road. Apart from a small yard in the north-west corner of the site and a pedestrian access on the western side, the property is covered by buildings. A small two storey element fronts Fortess Road with the remainder of the buildings being single storey. All of the buildings are used in connection with the gym and a small retail frontage is maintained onto Fortess Road. The site is not overly visible in the street scene due to the narrow frontage and its position mostly behind other 2 to 3 storey buildings.

The lawful use of the site is warehousing although it has operated as a gym since 1984 under a personal permission. This has now expired with the person who benefitted from the permission no longer being involved with its operation. Therefore, planning permission is being sought for a change of use from warehousing (Class B8) to a gym with ancillary office accommodation (Class E) with no material changes to the existing onsite structures. A location plan of the proposed site can be seen in **Figure 1.1**.

Figure 1.1: Site Location Plan

2. NATIONAL & LOCAL PLANNING POLICY

2.1. National Planning Policy Framework (2024)



The National Planning Policy Framework (NPPF) was first published on the 27th March 2012 and revised July 2018, February 2019, July 2021, September 2023, December 2023 with the latest version published in December 2024.

The NPPF outlines the Government's planning policies for England and determines how they should be applied. It provides a framework within which Local Planning Authorities are required to prepare their own locally-prepared plans, where both the policies within the NPPF and the local plan are material planning considerations against which planning decisions are determined. These distinctive local and neighbourhood plans should be interpreted and applied in order to meet the needs and priorities of their communities.

The NPPF notes *"The purpose of the planning system is to contribute to the achievement of sustainable development, including the provision of homes, commercial development, and supporting infrastructure in a sustainable manner"* (Paragraph 7). The NPPF notes sustainable development should be delivered with three main dimensions: economic; social and environmental (Paragraph 8).

The NPPF supports a presumption in favour of development, unless the adverse impacts of that development outweighs the benefits it notes "*that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development*" (Paragraph 10).

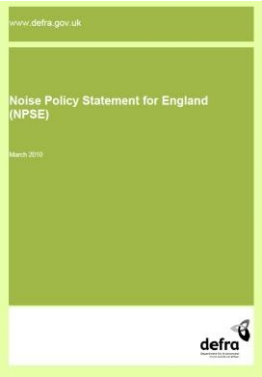
The NPPF states that in the planning system *"Planning policies and decisions should contribute to and enhance the natural and local environment by… e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels 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"* (Paragraph 187).

Paragraph 198 of the NPPF talks specifically about noise stating that *"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…"*

Specifically in relation to noise from existing commercial premises, Paragraph 200 of the NPPF notes: *"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".

2.2. Noise Policy Statement for England (2010)



The Noise Policy Statement for England (NPSE) provides further guidance on the interpretation of Section 123 of the NPPF and states that: *"Within the context of sustainable development:*

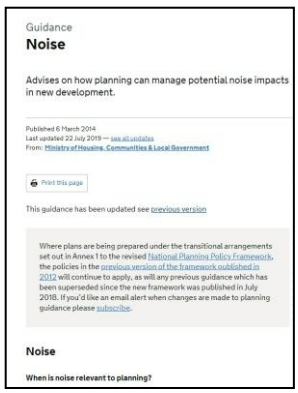
- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible contribute to the improvement of health and quality of life."

NPSE introduces established concepts originally from the field of toxicology that are now being applied to noise impacts. They are:

- **NOEL – No Observed Effect Level** - This is the level of noise 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 of noise above which adverse effects on health and quality of life can be detected.
- **SOAEL – Significant Observed Adverse Effect Level** - This is the level above which significant adverse effects on health and quality of life occur.

NPSE goes on to state that *"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."*

2.3. Planning Practice Guidance



The Planning Practice Guidance was launched on 6th March 2014 and provides additional guidance and interpretation to the Government's strategic policies, outlined within the NPPF, in a web-based resource. This is updated regularly.

The NPPG provides more guidance on the assessment of noise for planning purposes and builds on the concepts of NOEL, LOAEL and SOAEL introduced in NPSE to establish whether noise is a factor that needs to be taken into account. It states*: "Local planning authorities' plan-making and decision taking should take account of the acoustic environment and in doing so consider:*

- *whether or not a significant adverse effect is occurring or likely to occur;*
- *whether or not an adverse effect is occurring or likely to occur; and*

- *whether or not a good standard of amenity can be achieved.*

In line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure (including the impact during the construction phase wherever applicable) is, or would be, above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation."

However, it goes into more detail about the subjective nature of noise and how the results of any assessment must be treated flexibly and pragmatically. The guidance states: *"The subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation. These factors include:*

- *the source and absolute level of the noise together with the time of day it occurs. Some types and level of noise will cause a greater adverse effect at night than if they occurred during the day – this is because people tend to be more sensitive to noise at night as they are trying to sleep. The adverse effect can also be greater simply because there is less background noise at night;*
- *for non-continuous sources of noise, the number of noise events, and the frequency and pattern of occurrence of the noise;*
- *the spectral content of the noise (ie whether or not the noise contains particular high or low-frequency content) and the general character of the noise (ie whether or not the noise contains particular tonal characteristics or other particular features). The local topology and topography should also be taken into account along with the existing and, where appropriate, the planned character of the area.*

More specific factors to consider when relevant include:

- *the cumulative impacts of more than one source of noise;*
- *whether any adverse internal effects can be completely removed by closing windows and, in the case of new residential development, if the proposed mitigation relies on windows being kept closed most of the time (and the effect this may have on living conditions). In both cases a suitable alternative means of ventilation is likely to be necessary. Further information on ventilation can be found in the Building Regulations.*
- *In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur.*
- *Noise Action Plans (where these exist), and, in particular the Important Areas identified through the process associated with the Environmental Noise Directive and corresponding regulations should be taken into account. Defra's website has information on Noise Action Plans and Important Areas. Local authority environmental health departments will also be able to provide information about Important Areas.*
- *the effect of noise on wildlife. Noise can adversely affect wildlife and ecosystems. Particular consideration needs to be given to the potential effects of noisy development on international, national and locally designated sites of importance for biodiversity;*

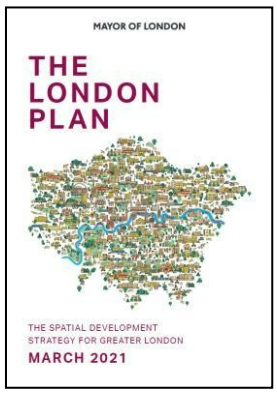
- *where external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.*
- *some commercial developments including restaurants, hot food takeaways, night clubs and public houses can have particular impacts, not least because activities are often at their peak in the evening and late at night. Local planning authorities will wish to bear in mind not only the noise that is generated within the premises but also the noise that may be made by customers in the vicinity".*

Table 2.1 shows examples of the noise hierarchy (adapted from the PPG) and shows that that the aim is to identify where the overall effect of the noise exposure falls in relation to SOAEL, LOAEL and NOEL. The implication of the advice is that only noise that is 'noticeable and very disruptive' would be considered unacceptable and therefore, should be prevented. The inference, therefore, is that all other outcomes can be acceptable, depending upon the specific circumstances and level of mitigation.

Table 2.1: Noise Exposure Hierarchy

Perception	Examples of outcomes	Increasing effect level	Action	
Not noticeable	No Effect	No Observed Effect	No specific measures required	Low Noise Level
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required	
Lowest Observed Adverse Effect Level				
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, eg turning up the volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. The potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum	Increasing Noise Levels ↓
Significant Observed Adverse Effect Level				
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, eg avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. The potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep.	Significant Observed Adverse Effect	Avoid	
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate the effect of noise leading to psychological stress or physiological effects, eg regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, eg auditory and non-auditory	Unacceptable Adverse Effect	Prevent	High Noise Level

2.4. The London Plan (2021)



The New London Plan was formally published on the 2nd of March 2021 and replaces the previous London Plan.

The London Plan notes that noise is an integral part of development planning. When designing developments, it notes that "measures to design out exposure to poor air quality and noise from both external and internal sources should be integral to development proposals and be considered early in the design process. Characteristics that increase pollutant or noise levels, such as poorly-located emission sources, street canyons and noise sources should also be designed out wherever possible. Optimising site layout and building design can also reduce the risk of overheating as well as minimising carbon emissions by reducing energy demand" (para 3.3.9).

Policy *D13 Agent of Change* formalises the Agent of Change principle in London's planning policy in relation to *noise. The policy notes:*

"For a long time, the responsibility for managing and mitigating the impact of noise and other nuisances on neighbouring residents and businesses has been placed on the business or activity making the noise or other nuisance, regardless of how long the business or activity has been operating in the area. In many cases, this has led to newly-arrived residents complaining about noise and other nuisances from existing businesses or activities, sometimes forcing the businesses or other activities to close" (para 3.13.1).

"The Agent of Change principle places the responsibility for mitigating the impact of noise and other nuisances firmly on the new development. This means that where new developments are proposed close to existing noise-generating uses, for example, applicants will need to design them in a more sensitive way to protect the new occupiers, such as residents, businesses, schools and religious institutions, from noise and other impacts. This could include paying for soundproofing for an existing use, such as a music venue. The Agent of Change principle works both ways. For example, if a new noise-generating use is proposed close to existing noise-sensitive uses, such as residential development or businesses, the onus is on the new use to ensure its building or activity is designed to protect existing users or residents from noise impacts" (para 3.13.2).

Policy D13 states:

A. *"The Agent of Change principle places the responsibility for mitigating impacts from existing noise and other nuisance-generating activities or uses on the proposed new noise-sensitive development. Boroughs should ensure that Development Plans and planning decisions reflect the Agent of Change principle and take account of existing noise and other nuisance-generating uses in a sensitive manner when new development is proposed nearby.*

B. *Development should be designed to ensure that established noise and other nuisance-generating uses remain viable and can continue or grow without unreasonable restrictions being placed on them.*

C. *New noise and other nuisance-generating development proposed close to residential and other noise-sensitive uses should put in place measures to mitigate and manage any noise impacts for neighbouring residents and businesses.*

D. *Development proposals should manage noise and other potential nuisances by:*

1) *ensuring good design mitigates and minimises existing and potential nuisances generated by existing uses and activities located in the area*

2) *exploring mitigation measures early in the design stage, with necessary and appropriate provisions including ongoing and future management of mitigation measures secured through planning obligations*

3) *separating new noise-sensitive development where possible from existing noise-generating businesses and uses through distance, screening, internal layout, sound-proofing, insulation and other acoustic design measures.*

E. *Boroughs should not normally permit development proposals that have not clearly demonstrated how noise and other nuisances will be mitigated and managed".*

Policy *D14 Noise* goes on to state:

A. *"In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:*

1) *avoiding significant adverse noise impacts on health and quality of life*

2) *reflecting the Agent of Change principle as set out in Policy D13 Agent of Change*

3) *mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses*

4) *improving and enhancing the acoustic environment and promoting appropriate soundscapes (including Quiet Areas and spaces of relative tranquillity)*

5) *separating new noise-sensitive development from major noise sources (such as road, rail, air transport and some types of industrial use) through the use of distance, screening, layout, orientation, uses and materials – in preference to sole reliance on sound insulation*

6) *where it is not possible to achieve separation of noise-sensitive development and noise sources without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through applying good acoustic design principles*

7) *promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

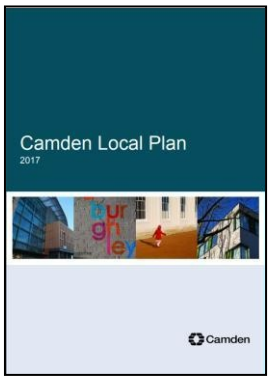
B. *Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations".*

Policy D14 notes that "*the management of noise should be an integral part of development proposals and considered as early as possible"* (para 3.14.1).

It notes that "*The management of noise also includes promoting good acoustic design of the inside of buildings. Section 5 of BS 8223:2014 provides guidance on how best to achieve this. The Institute of Acoustics has*

produced advice, Pro:PG Planning and Noise (May 2017), that may assist with the implementation of residential developments. BS4214 provides guidance on monitoring noise issues in mixed residential/industrial areas" (para 3.14.3).

2.5. The London Borough of Camden Local Plan (2017)



The London Borough of Camden's Local Plan (2017) states in Policy A4 Noise and vibration:

"The Council will seek to ensure that noise and vibration is controlled and managed. Development should have regard to Camden's Noise and Vibration Thresholds (Appendix 3). We will not grant planning permission for:

a. development likely to generate unacceptable noise and vibration impacts; or

b. development sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

We will only grant permission for noise generating development, including any plant and machinery, if it can be operated without causing harm to amenity. We will also seek to minimise the impact on local amenity from deliveries and from the demolition and construction phases of development".

Appendix 3 goes on to determine the noise thresholds to applied in Camden. The Guidance states that if noise from a particular source is below the LOAEL (the Lowest Observed Adverse Effect Level) at an appropriate receptor, the source would be *"considered to be at an acceptable level"*.

In relation to industrial and commercial noise sources, the guidance states that:

"A relevant standard or guidance document should be referenced when determining values for LOAEL and SOAEL for non-anonymous noise. Where appropriate and within the scope of the document it is expected that British Standard 4142:2014 'Methods for rating and assessing industrial and commercial sound' (BS 4142) will be used. For such cases a 'Rating Level' of 10 dB below background (15dB if tonal components are present) should be considered as the design criterion)".

The Guidance goes on to clarify that outside living room, dining room or bedroom windows during the day, the Rating level should be at least 10 dB lower than the background noise level. At night, outside bedroom windows, the Rating level should be at least 10 dB lower than the background noise level. The 10 dB should be increased to 15 dB if the noise contains audible tonal elements.

Since noise from the gym will typically involve noise from music playback and raised or amplified voice from instructors. The local plan does not provide an explicit criteria for noise from gymnasiums. However, due to the nature of the sources of noise, it is considered appropriate to use the Appendix C Entertainment Noise criteria.

The criteria is presented below in **Table 2.2** and **Table 2.3**.

Table 2.2: Appendix C – Entertainment Noise Criteria – Observed Adverse Effect Levels

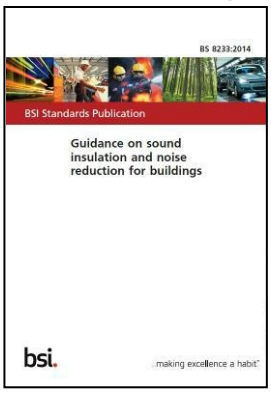
Noise Sensitive Receptors	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOEAL (Amber)	SOAEL (Red)
Dwellings	Garden used for amenity (free field)	Day	The higher of 55 dB $L_{Aeq,5min}$ Or 10 dB below existing $L_{Aeq,5min}$ Without entertainment noise	56 dB to 60 dB $L_{Aeq,5min}$ Or 9 dB to 3 dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 61 dB $L_{Aeq,5min}$ Or 2 dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field	Evening	The higher of 50 dB $L_{Aeq,5min}$ Or 10 dB below existing $L_{Aeq,5min}$ Without entertainment noise	51 dB to 55 dB $L_{Aeq,5min}$ Or 9 dB to 3 dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 56 dB $L_{Aeq,5min}$ Or 2 dB below existing $L_{Aeq,5min}$ Without entertainment noise
Dwellings	Garden used for amenity (free field	Night	The higher of 45 dB $L_{Aeq,5min}$ Or 10 dB below existing $L_{Aeq,5min}$ Without entertainment noise	46 dB to 50 dB $L_{Aeq,5min}$ Or 9 dB to 3 dB below existing $L_{Aeq,5min}$ Without entertainment noise	The higher of 51 dB $L_{Aeq,5min}$ Or 2 dB below existing $L_{Aeq,5min}$ Without entertainment noise

Table 2.3: Appendix C – Entertainment Noise Criteria – NR Criteria

Room	Noise rating curve	Design Period
Bedrooms	NR25	23:00-07:00hrs
All habitable rooms	NR35	07:00-23:00hrs

3. ASSESSMENT METHODOLOGY & GUIDANCE

3.1. BS 8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'



Originally published in 1999, the 2014 edition of BS 8233, significantly updates the guidance in light of the policy changes as a result of the advent of the NPPF and the withdrawal of PPG 24. The 2014 edition of BS 8233 sees a change in the title of the Standard, moving from a *'Code of Practice'* to *'Guidance'*, as the text *'largely comprises guidance that does not support claims of compliance'*.

BS 8233:2014 indicates that to control external noise ingress into a proposed development, a number of planning stages should occur as follows:

a) *"Assess the site, identify significant existing and potential noise sources, measure or estimate noise levels, and evaluate layout options.*

b) *Determine design noise levels for spaces in and around the building(s).*

c) *Determine sound insulation of the building envelope, including the ventilation strategy".*

BS 8233:2014 suggests design noise levels for various types of building. The recommended noise levels for dwelling houses, flats and rooms in residential use (when unoccupied) can be seen in **Table 3.1** below. This is replicated from Table 4 of Section 7.7.2 of BS 8233:2014. The guidance suggests that *"In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values"*. The noise levels in **Table 3.1** are marginally different to those published in BS 8233:1999 *'Sound insulation and noise reduction for buildings – Code of practice'*, but are based on the existing guidance from the current World Health Organisation (WHO) "Guidelines on Community Noise".

Table 3.1: Summary of Noise Criteria: BS 8233: 2014

Activity	Location	07:00 To 23:00	23:00 To 07:00
Resting	Living room	35 dB $L_{Aeq.16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq.16hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq.16hour}$	30 dB $L_{Aeq.8hour}$

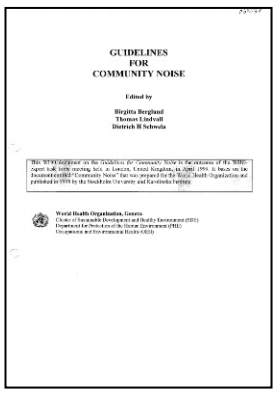
When considering the noise level criteria considered in **Table 3.1**, the following points should be noted:

- BS 8233: 2014 suggests that the above criteria should be adopted flexibly and that *"where development is considered necessary or desirable... the internal target level may be relaxed by up to 5 dB and reasonable internal conditions still achieved".*
- The noise levels quoted above are annual averages and *"do not need to be achieved in all circumstances*" e.g. New Year's Eve or fireworks night.

- The noise levels in **Table 3.1** are *"for steady external noise sources"* such as traffic noise or plant noise. This is a departure from the 1999 version of BS 8233, where the recommended internal noise levels were irrespective of the external noise source and therefore included the suggestion that in order to achieve *"reasonable"* noise levels within bedrooms at night, L_{AFmax} noise levels should not exceed 45 dB. Whilst this has been omitted from the 2014 version of BS 8233, it does state that *"Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values."* Therefore, at sites which may be affected by individual noise events, it is more appropriate to use the guidance contained within the WHO *"Guidelines on Community Noise"* which suggest that good sleep will not generally be affected if internal levels of L_{AFmax} 45 dB are not exceeded more than 10-15 times per night.
- BS 8233:2014 notes that if the design of the building is "relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or resulting noise level".
- BS 8233 provides guidance for noise in gardens and outdoor amenity space. It suggests that "it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments." The guidance does go on to say that these guideline values are not achievable in all circumstances and in some areas, "such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."

3.2. World Health Organisation Guidelines for Community Noise (1999)

The 1999 World Health Organisation (WHO) guidance *"Guidelines for Community Noise"*, provides recommendations on maximum internal and external noise levels in a range of situations. The WHO guidelines are a consequence of a comprehensive review of the scientific evidence in relation to community noise exposure and the health and social aspects of such exposure. Whilst not adopted policy, the recommendations within the WHO Guidelines are often quoted and form the basis of the recommendations within BS 8233 and other similar guidance. A summary of the noise criteria can be seen in **Table 3.2**.


GUIDELINES
FOR
COMMUNITY NOISE

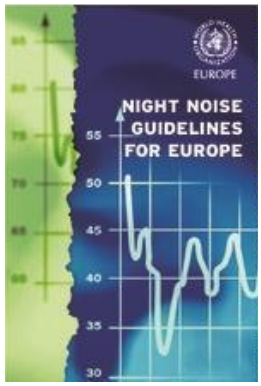
Edited by

Birgitta Berglund
Thomas Lindvall
Dietrich H Schwela

Table 3.2: Summary of Noise Criteria: WHO

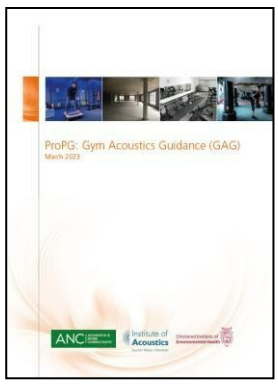
Residential Environment	Critical Heath Effect	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
Inside bedrooms	Sleep disturbance, night-time	30	45	23:00-07:00
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	60	23:00-07:00

3.3. WHO Night Noise Guidelines for Europe (2009)



In 2009, the World Health Organisation published the *"Night Noise Guidelines for Europe"* as a partial update and extension to the *"Guidelines for Community Noise*", specifically in relation to development on the scientific evidence of night noise exposure. The 2009 guidance suggests that a *"$L_{night,outside}$ of 40 dB should be the target of the night noise guideline (NNG) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly"*. However, since that target would be impossible to achieve in many situations, a *"$L_{night,outside}$ value of 55 dB is recommended as an interim target for the countries where the NNG cannot be achieved in the short term for various reasons, and where policy-makers choose to adopt a stepwise approach"*.

3.4. ProPG: Gym Acoustics Guidance (2023)

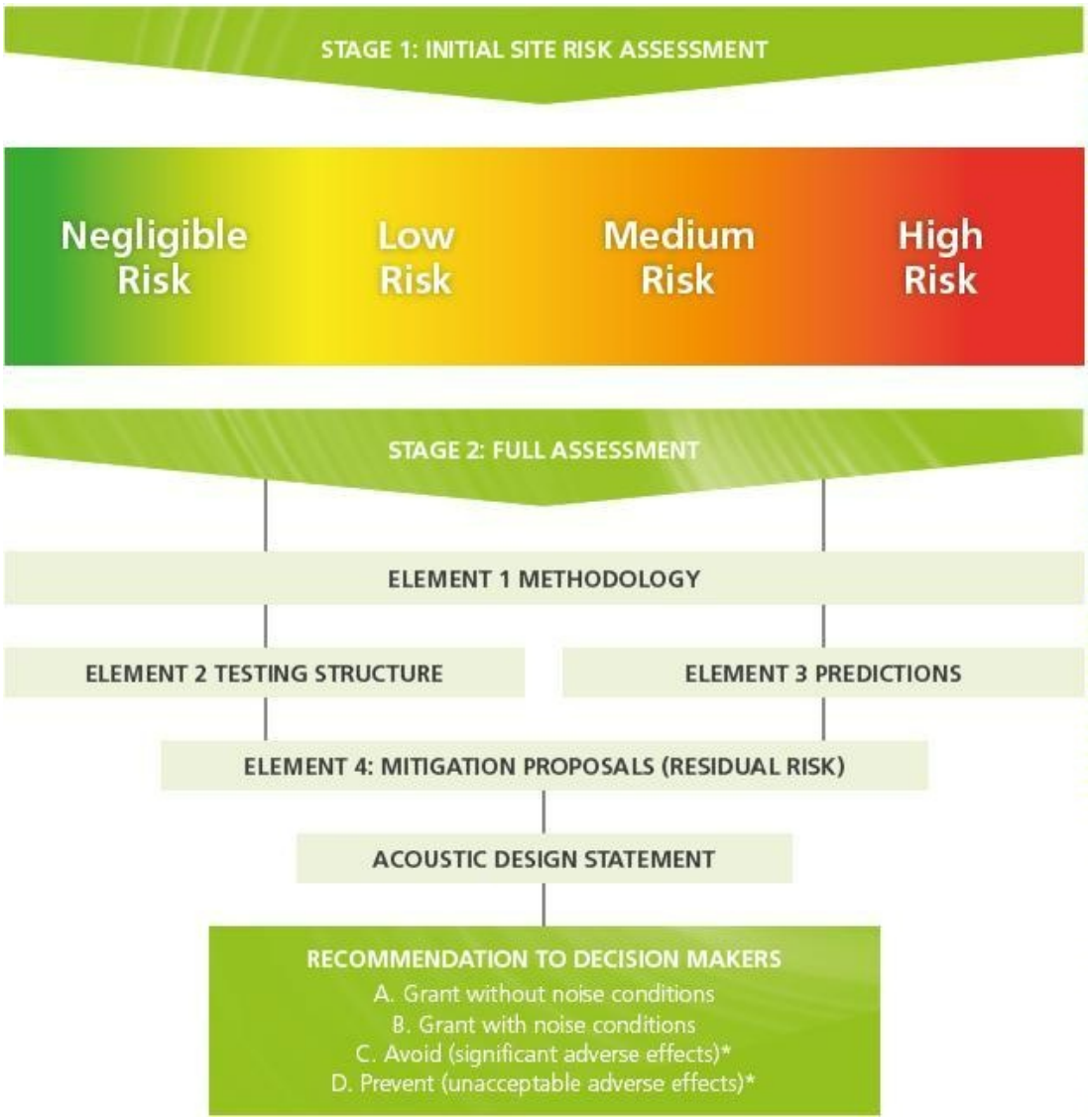


The ProPG: Gym Acoustics Guidance document (the "GAG"), published March 2023, provides a recommended approach for dealing with noise within the planning process, specifically in relation to assessing the impact of gymnasiums, fitness and exercise spaces. Specifically, the document considers:

- Airborne sound transfer;
- Structure-borne sound transfer;
- Vibration resulting from the activities;
- People using the equipment;
- Amplified music systems; and,
- Noise from mechanical plant.

The ProPG GAG follows a systematic, proportionate, risk-based, 2-stage approach. The two stages of the approach are presented below in **Figure 3.1** which was originally presented in Figure 1 of the ProPG GAG.

Figure 3.1: Noise Measurement Location



The ProPG GAG states *"The part of the methodology that is best suited to each stage in the approach, will be determined by the specific use scenario proposed, however it is expected that a heavy drop methodology (Method 1) will be most suited to the Stage 1 assessment and where there is an existing Gym operation that Method 2 can be used, over a suitably representative period of operation."*

The ProPG GAG introduces the G-Curves criteria as defined in Appendix G of the document. This provides a way to reference sound spectra data in a single figure, similar to Noise Rating (NR) curves. However, the G-Curves reference the 1/3 octave data to provide improved resolution. Specifically, the ProPG GAG notes that:

"using a 1/3 octave band curve as the upper limit for resulting gym noise, enables the practitioner to undertake a visual, graphical analysis of the resulting impact noise. Such analysis can be crucial in identifying compliance with the curve at lower frequencies, where resulting impact noise can often be most disturbing. Therefore, in cases where background noise is dominant at higher frequencies, it may be possible to exclude such frequencies and visually assess low-frequency compliance with the curve, even if analysis of the single-figure G-value alone (inclusive of all assessment frequencies and elevated due to background noise dominance) provides an 'artificially' pessimistic result. In such common examples, the graphical analysis can provide a truer assessment of the actual level of resulting noise and therefore of the potential to affect users of adjacent noise-sensitive spaces."

Table 2 of the ProPG GAG presents G-Curve criteria for a variety of receptor types and for internal airborne and heavy impact sound. This table is replicated in **Table 3.3** below. It should be noted that the ProPG GAG recognises that *"the values in Table 2 will not be suitable in all settings, particularly where the background noise is particularly low. Equally where background levels are higher, more relaxed criteria may be appropriate."*

Table 3.3: Internal Sound Target Criteria for Gym Activity – Residential & Other Areas

Receptor Type	Guide Criteria	
	Airborne Sound (e.g., music) $L_{eq,T}$ (31.5 Hz to 8 kHz)	Heavy Impact Sound $L_{max,F}$ (31.5 Hz to 8 kHz)
Commercial Offices	G25-G35	G35-G45
Retail Areas	G30-G45	G35-G50
Residential Areas	G15-G25 (day) G10-G20 (night)	G20-G25 (day) G15-G20 (night)

4. SOUND MEASUREMENT STUDY

4.1. Overview

In order to determine the extent to which the site is affected by sound, a detailed sound measurement study has been carried out on the proposed development site. Sound measurements have been carried out external to the building envelope to determine the airborne impact of noise from the gym activities as well as from within the adjacent Gottfried Mews building that abuts the southern façade. The sound measurements will determine if the existing operations of the gym are acceptable.

All noise monitoring was conducted using a Norsonic 140 sound level meter, which conforms to BS EN IEC 61672-1: 2003 as a Class 1 precision measurement system. A Norsonic 1251 field calibrator was used before and after the measurement periods in order to ensure that the equipment had remained within reasonable calibration limits (+/- 0.5 dB).

All of the equipment used has been calibrated in accordance with the procedures set out in BS EN IEC 61672-2: 2003 and for the electrical testing of frequency filters as set out in BS EN IEC 61260. The equipment was calibrated at Campbell Associates Limited, in Great Dunmow, Essex. Campbell Associates Limited meets the laboratory accreditation requirements of the United Kingdom Accreditation Service (UKAS Lab No. 0789). Sound level meters are laboratory calibrated every two years, with field calibrators laboratory calibrated every twelve months. **Appendix 2** summarises the equipment used including serial numbers and calibration certificates.

All noise monitoring has been conducted in accordance with the guidance set out in BS 7445-2: 1991 *'Description and measurement of environmental noise Part 2: Guide to the acquisition of data pertinent to land use*'. This standard details information that should be recorded in addition to the actual measured levels such as meteorological data, and a description of the noise source itself.

The survey was conducted on Wednesday 30th April and Thursday 1st May 2025. The noise monitoring was conducted by Mathew Vaughan of Hawkins Environmental Limited. Mathew is a Member of the Institute of Acoustics and holds a Masters of Science in Applied Acoustics from Solent University.

Weather conditions were conducive to successful monitoring. **Table 4.1** summarises the weather conditions during the measurement period.

Table 4.1: Summary of Weather Conditions during the Sound Measurements

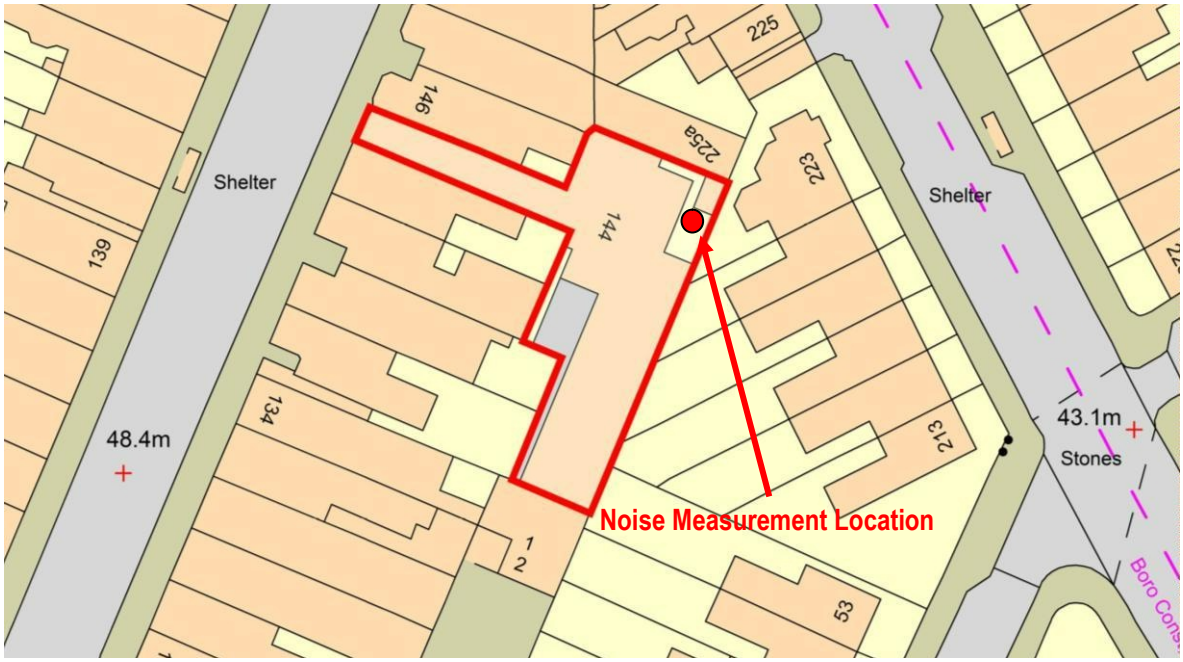
General Description	The measurement periods were warm, with some sunshine during the day with light winds.
Windspeed	Over the measurement period, the average windspeed was typically less than 1 m/s.
Temperature	Highs of 28˚C, lows of 8˚C.
Precipitation	No precipitation was observed during the measurement period.

4.2. Noise Survey Results

4.2.1. External 24 Hour Unattended Noise Measurements

Unattended 24 hour noise measurements were conducted external to the building envelope within the external amenity area to the north-east of the site as shown in **Figure 4.1**.

Figure 4.1: Noise Measurement Location

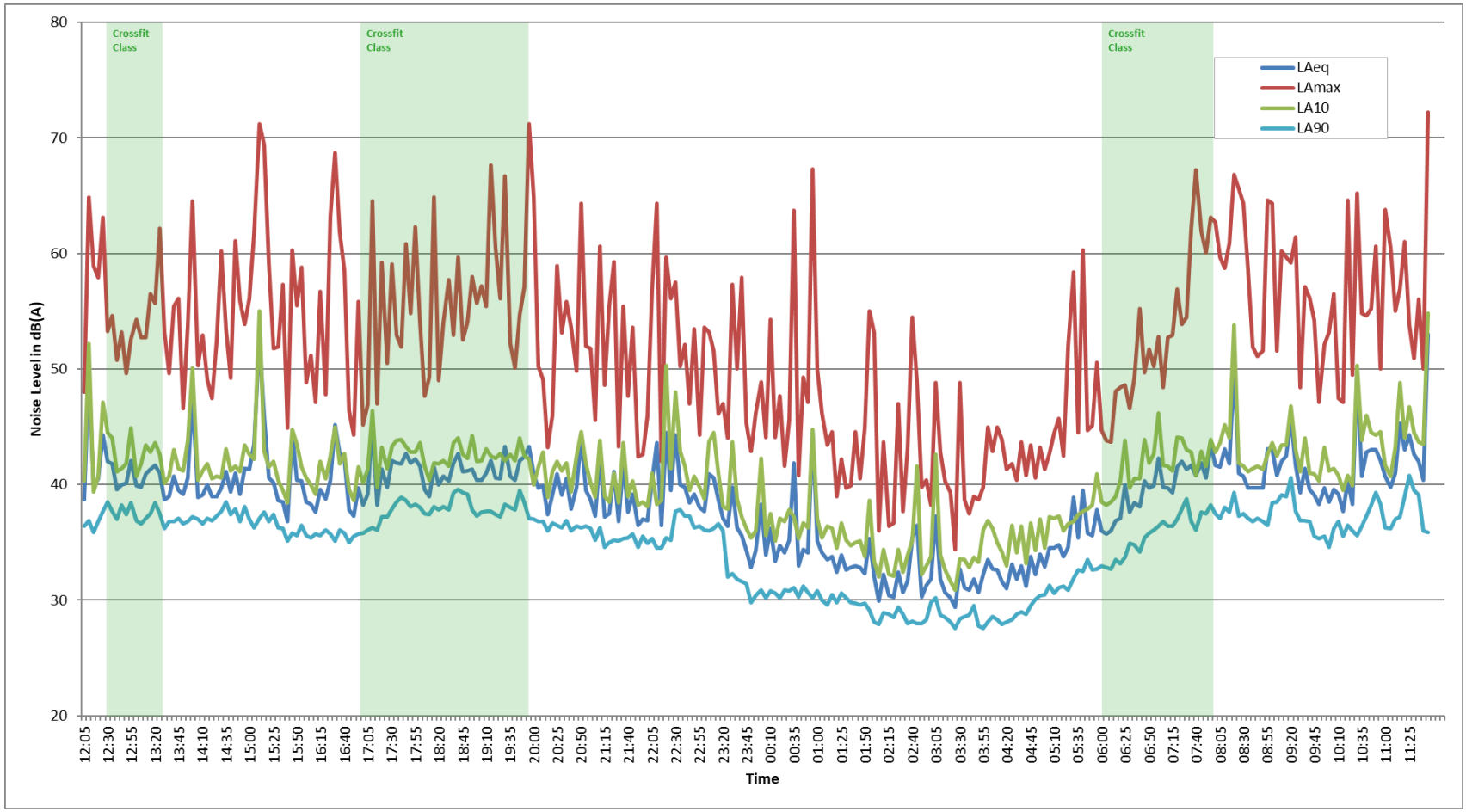


It is understood that the gymnasium operates between 6:30am and 1:30pm and reopens from 5pm and until 5pm Monday to Friday and on weekends, the gym will only operate between 9am and 1pm. The noise measurement data is detailed in **Appendix 3** and summarised in **Figure 4.2** and **Table 4.2**. Periods where classes are in session are highlighted green.

Table 4.2: Summary of the External Sound Level Measurements

Period (hours)	Measured Facade Sound Level, dB			
	$L_{Aeq.T}$	Range $L_{Aeq.15mins}$	Range $L_{Amax.15mins}$	Range $L_{A90.15mins}$
Daytime (7am to 11pm)	42.1	36.5 – 53.0	42.0 – 72.2	34.5 – 40.8
Nighttime (11pm to 7am)	35.8	29.4 – 44.7	34.4 – 67.3	27.6 – 36.6

Figure 4.2: 24hr Noise Measurements



4.2.2. Internal Noise Measurements at Gottfried Mews

Since the southern wall of the gym is adjacent to the 1–2 Gottfried Mews development, it was necessary to consider the potential transmission of airborne sound through this shared boundary. In 2011, full planning permission was granted for the construction of a new building at 1–2 Gottfried Mews, which included 1no. 1 bedroom and 1no. 2 bedroom self-contained flats (Class C3). Given that Gottfried Mews is a more recent development, it would be expected that noise from surrounding sources, including the gym, would have been taken into account during its design and construction.

While this has not been independently verified, the gym has reported that the southern wall does not form a direct party wall with 1 or 2 Gottfried Mews. Instead, a small air gap exists between the two buildings. This separation likely provides a high degree of sound insulation, although the precise level of sound attenuation is unknown.

Residents of both 1 and 2 Gottfried Mews have stated that they generally do not hear any noise from the gym. Specifically, they reported no audible music or vocal instruction from gym staff. Some occasional impact sounds have been noted; however, these sounds were infrequent, non-directional, and the residents were unable to confirm whether the gym was the source of the noise, or if this might have been caused by the neighbouring resident.

To further assess potential noise transmission, sound measurements were taken within the bedrooms of both 1 and 2 Gottfried Mews, which are closest to the gym. A typical class was scheduled between 12:30 PM and 1:30 PM during the monitoring period. The first 30 minutes of the class were observed from the upstairs bedroom at 2 Gottfried Mews, and the final 30 minutes from the downstairs bedroom at 1 Gottfried Mews.

During the monitoring period, no airborne or impact noise from the gym was audible in either location, and no measurable noise levels attributable to the gym were detected. It should be noted that at 1 Gottfried Mews, some building services noise was audible and was not able to be avoided during the noise measurements. However, as noted in **Table 4.3**, this results in internal noise levels that are higher than at 2 Gottfried Mews.

A summary of the measurements are presented below in **Table 4.3**.

Table 4.3: Summary of the Internal Sound Level Measurements – Gottfried Mews

Monitoring Location	Period (hours)	Measured Internal Sound Level, dB			
		$L_{Aeq.T}$	Range $L_{Aeq.15mins}$	Range $L_{Amax.15mins}$	Range $L_{A90.15mins}$
2 Gottfried Mews	12:30 to 13:00	32.2	31.1 – 34.1	38.5 – 48.6	30.2 – 31.0
1 Gottfried Mews	13:00 to 13:30	37.9	32.8 – 39.0	38.7 – 46.9	30.7 – 38.3

5. ANALYSIS

5.1. Consultation with the London Borough of Camden

Prior to the commencement of the noise assessment, the London Borough of Camden was consulted in relation to appropriate methodologies and criteria to use in the assessment. In correspondence, Edward Davis (a Pollution Planning Officer at the London Borough of Camden) has confirmed that they are happy with our proposals. In general we proposed:

- *"to use the guidance contained within the Institute of Acoustic's ProPG: Gym Acoustics Guidance (March 2023). Since the gym is already in existence and operational, it is possible for us to characterise noise from the gym in accordance with Method 2 of the ProPG: GAG, which gives a methodology for assessing noise from gym equipment. We propose that we would assess this equipment both externally to the gym (i.e. in an outdoor space adjacent to the gym) as well as within 2 Gottfried Mews…"*
- Internal noise within the adjacent properties should not exceed the "*entertainment and plant noise rating curves of NR25 at night and NR35 during the daytime"* as set out in Appendix 3 of Camden's Local Plan
- For external noise which *"is likely to consist of music and speech from instructors during the classes. We consider the most appropriate criteria to use would be the "Entertainment Noise" criteria in the Appendices to Camden's Local Plan, which gives recommendations regarding noise levels in gardens used for amenity, during the day, evening and night-time period".*
- We also noted that *"regarding vibration, we are not specifically proposing to measure or assess vibration from activities within the gym. Vibration from gym activities are only generally a problem through party floors, i.e. if a gym is to be located above a residence, which is not the case here"*.

5.2. Gym Activities

The ProPG GAG document comments upon CrossFit *"these types of studios produce substantially high impact forces into a building structure. The high intensity group training exercise classes combine aerobic exercises with repetitive power lifting of barbells and other heavy weights. It is not uncommon that during a Cross-Fit class, 50 kg - 150 kg barbells (depending on the participants' varying strengths) are repeatedly lifted above head height and dropped deliberately onto the floor/a mat. This would be considered onerous for just one user, but when considering an entire class of typically 5-20 participants, this can become acoustically problematic and requires substantial mitigation measures. It is rare for this type of studio/Gym activity to occur or be viable within the same building that would also include residential dwellings."*

Specifically in regards to the activities at CrossFit Tufnell Park, the gym incorporates methods to substantially mitigate and minimise the effects of noise. Particularly with a focus on minimising the necessity to drop weights. Further details of the existing mitigation measures are presented below in **Section 6**.

The gym timetable typically features a class at 6:30am, 7:30am, 12:00pm or 12:30pm, 1pm, 5pm, 6pm and 7pm. Each class is typically one hour in length with the first 30-40 minutes featuring instruction from the

coaches and the remaining 20-30 minutes is when the participants will work out and music will be played as part of the workout. It should be noted that no amplified music will be played before 7am. Therefore, any potential impacts of noise would be limited to only the daytime hours between 7am and 11pm.

It is understood that the workouts comprise of both aerobic and power lifting exercises. However, the gym has taken precaution to ensure that weights are not typically dropped. However, some workout routines may require weights to be dropped on occasion, particularly for health and safety reasons.

5.3. External Noise Measurements

5.3.1. Overview

The external 24-hour unattended noise measurements as presented in **Figure 4.1** and **Table 4.2** show that there are no significant identifiable periods of increased noise during periods where classes are in session.

Upon reviewing the corresponding audio files attributable to periods when classes are ongoing, it is evident that some voice from the instructors as well as music is just perceptible within the courtyard area. However, this is frequently masked by other environmental noise sources. Such as road traffic noise from Brecknock Road (A5200) and surrounding plant noise from the adjacent commercial premises which front Fortess Road.

5.3.2. Observed Adverse Effect Level in Gardens & Outdoor Amenity Space

The noise data shows that the external façade airborne noise would be 45.3 dB(A), or 42.3 dB(A) when converting to a freefield sound level.

When considering the entertainment noise criteria of the London Borough of Camden Local Plan (2017), it is shown that during the daytime and evening periods when the gym is operational and noisy activities may occur, the levels of noise generated by the gym would be considered below the Lowest Observed Adverse Effect Level (LOAEL).

When the levels of noise are below the LOAEL, noise can be heard but does not cause any change in behaviour or attitude. Noise may also slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life. This description of the noise is verified when observing the audio recordings at the measurement position during the periods when the classes are in operation.

Since the noise generated by the gym is below the LOAEL, no specific measures would be required.

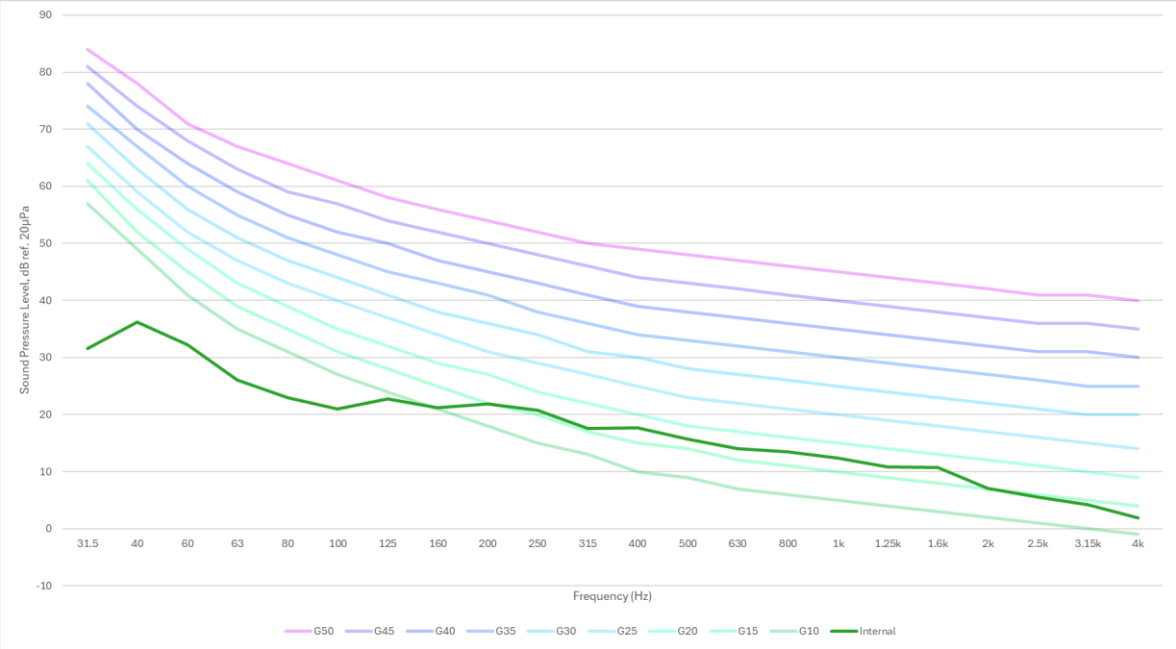
5.3.3. Internal Noise & Comparison to the ProPG GAG G-Curve Criteria

The G-Curve criteria of the ProPG GAG allows for graphical analysis of airborne sound and heavy impact sound from within the nearest noise sensitive receptors. For noise to be acceptable from the gym, the 1/3 octave band data should be less than the G25 curve when considering the internal noise during the daytime, or otherwise below the G20 curve when considering internal noise during the nighttime.

Figure 5.1 shows the predicted internal noise levels within surrounding properties based upon the externally measured noise levels, assuming a partially opened window with a minimum sound reduction of 15 dB.

In **Figure 5.1**, the predicted internal 1/3 octave band noise levels are generally below the G20 curve. Therefore, when considering the G-Curve criteria of the ProPG GAG, noise levels from the gym would be considered acceptable during both the nighttime and daytime periods.

Figure 5.1: Noise Measurements with Surrounding Dwellings (assuming an open window)



5.3.4. Internal Noise & Comparison to the Noise Rating Criteria

As well as providing a criteria to determine the observed adverse effect level of the noise in gardens and outdoor amenity space, the London Borough of Camden Local Plan (2017) also provides a Noise Rating curve criteria of NR25 during the nighttime and NR35 during the daytime to assess the impact within dwellings.

It should be noted that the ProPG GAG states *"the octave bands for the NR curves for low frequency impact noise from gyms (approximately 20 Hz to 300 Hz) do not provide sufficient resolution when attempting to select the appropriate remedial measures/specifications. Therefore, the G-curves were proposed, as third octave bands, as NR curves are not readily available (or were at least not found) and it was necessary to establish an alternative a uniform curve. Loosely based on the NR curve, when log-summed for each centre band frequency, the G Curve would approximate to the NR value (G Curves being within 0.3 to 1.8 dB, depending on octave band centre frequency); for example, log-summing the third octave bands of 50 Hz, 63 Hz and 80 Hz would give an octave band value at 63 Hz similar to the NR value."*

Since the Noise Rating curves are within a 0.3 to 1.8 dB tolerance of the G-curves, this suggests that the since the 1/3 octave band data is less than the G20 curve, the 1/1 octave band data would therefore be below the NR25 curve. Therefore, the levels of noise emanating from the gym would also be acceptable when considering the daytime and nighttime noise rating curve criteria of the London Borough of Camden Local Plan.

5.4. Internal Noise Measurements at Gottfried Mews

During classes where the gym would be expected to generate the highest levels of noise, it is observed that at 1 and 2 Gottfried Mews, noise from the gym was not perceptible or measurable through the party wall.

Since the noise survey at 1 and 2 Gottfried Mews did not give rise to any audible impacts of noise emanating from the gymnasium, this aligns with the above analysis of the external noise measurements which suggests that the internal noise from the nearest receptors would be acceptable with noise levels below the LOAEL and internal noise levels below the G20 curve and NR25 curve. Consequently, noise from the gym is therefore not currently deemed a constraint at 1 or 2 Gottfried Mews when considering the direct and indirect paths of transmission between the two properties.

6. MITIGATION

The assessment has shown that noise from the gym currently does not cause an unacceptable impact to surrounding properties. Therefore, this assessment does not recommend the necessity for any additional mitigation.

However, at present, the gym takes its responsibilities to minimise and mitigate noise very seriously and has tailored the gym to eliminate any impacts of noise to the nearest noise sensitive receptors. The gym features a number of existing mitigation measures to ensure that any egress of noise is minimal. By incorporating mitigation, this also reduces any residual risk.

Measures taken are as follows:

- The gym operates from 6:30am to 1:30pm and re-opens from 5pm to no later than 9pm. At weekends, the gym is open from 9am and closes no later than 3pm.
- Music within the gym is played through multiple small-diameter loudspeakers which do not reproduce low frequency sound well. The system is zoned, which allows the gym to reduce the loudness of the speakers closest towards the residential properties. Additionally, there are strict limits on amplitude, and equalisation by ensuring that the loudspeakers do not reproduce any significant low frequency content. Since there are multiple small speakers that disperse sound well throughout the gym, the playback level does not need to be excessive for music to be intelligible and a suitable volume to be achieved.
- Music will not be played during the nighttime period between 11pm and 7am.
- Double glazing and thickened doors to reduce noise egress from the windows and doors of the building.
- The outdoor area to the north of the site is only used for storage and is not accessible between 5pm and 8:30am.
- Approximately 50 people may access the site each day at various times. This is not a high number of people and therefore is easily integrated with the existing footfall of adjacent premises.
- Intercom entry door installed and open access waiting area at the front of the building so that people can wait off the main street and within the premises where required.
- The front balcony facing towards Fortess Road is only accessible to staff and no earlier than 10am.
- Acoustic ceiling rafts, floor mats and gym furniture helps to reduce reverberation throughout the building and reduce the overall sound pressure levels.
- Metal weight plates and dumbbells are forbidden, instead specialist rubber weight plates and dumbbells are used to help further reduce any impact sounds in the event weights would be dropped.
- Replacement of all ‘Virgin’ rubber Olympic bumper plates with ‘Hi-Impact’ specialist bumper plates with increased dampening.

- Installation of a 30mm impact absorbent matting with a 6mm Regupol Sonus 3912 impact noise reduction acoustic mat underlay;
- Use of specialist drop mats where weight-dropping forms part of a workout routine or is otherwise considered a risk as part of a specific exercise or activity.
- Prohibiting activities occurring within 4 metres closest to the southern most wall of any activity with weights to further reduce the risk of
- Boiler moved from an outdoor shed in the northern external amenity area to within the building walls and cowl covers installed over ventilation fans to reduce noise egress.
- Deliveries are limited to several times a month and are managed through Fortess Road entrance. This is very discrete and occurs during the daytime at anytime between 8am and 8pm, typical for adjacent commercial premises.
- Collection of refuse is undertaken via the Fortress Road entrance and part of the regular public service for the wider neighbourhood.

The above mitigation measures demonstrate that the gym takes any potential impact of noise to the nearest noise sensitive receptors seriously.

7. OVERALL CONCLUSIONS AND RECOMMENDATIONS

A detailed sound measurement study has been carried out to determine whether the existing gym operations are likely to be acceptable in terms of noise and whether complaints are considered likely.

Using the guidance and calculation methods contained within the 2023 ProPG: Gym Acoustics Guidance document and The London Borough of Camden Local Plan (2017), the levels of noise generated by the gym would be considered acceptable with noise levels below the Lowest Observed Adverse Effect Level (LOAEL).

When considering the G-Curve criteria of the ProPG Gym Acoustics Guidance, the 1/3 octave band data shows that the estimated internal noise levels of the nearest noise sensitive receptors would be below the G20 curve. The data also suggests that the levels of noise emanating from the gym would be below the NR25 curve of the entertainment noise criteria of the London Borough of Camden Local Plan. Therefore, the levels of noise emanating from the gym would be considered acceptable when considering the daytime and nighttime noise rating criteria of the London Borough of Camden Local Plan and the G-curve criteria of the ProPG Gym Acoustics Guidance document.

When considering the transmission of airborne sound, observations and measurements conducted within 1 and 2 Gottfried Mews confirm that no noise is perceptible from the gym during a representative worst-case period where a gym class was in session.

The above is a positive indication that any resulting noise from the gym activities is appropriately mitigated based on the existing activities and mitigation measures and is unlikely to give rise to complaints of noise. Since the levels of noise also adhere to the specified criteria within the ProPG Gym Acoustics Guidance and the London Borough of Camden Local Plan (2017), the levels of noise generated by the gym would be considered acceptable.

Appendix 1
Glossary of Acoustic Terms

Appendix 1: Glossary of Acoustic Terms

Decibel (dB)	This is a tenth (deci) of a bel. Decibel can be a measure of the magnitude of sound, changes in sound level and a measure of sound insulation. Decibels are not an absolute unit of measurement but are an expression of the ratio between two quantities expressed in logarithmic form.
dB(A)	A-weighted decibels, i.e. decibel level 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.
Freefield	A situation in which the radiation from a sound source is completely unaffected by the presence of any reflecting boundaries.
Hertz (Hz)	Unit of frequency, equal to one cycle per second. The frequency of sound waves refers to the number of pressure fluctuations per second. Frequency is related to the pitch of a sound.
$L_{Aeq,T}$	The equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over the given period, T. For example, daytime noise is generally measured over a 16 hour period, so T is 16 hours. $L_{Aeq,T}$ can be measured directly with an integrating sound level meter.
L_{A10}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 10 percent of a given time and is the $L_{A10,T}$. The L_{A10} is used to describe the levels of road traffic noise at a particular location.
L_{A50}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 50 percent of a given time and is the $L_{A50,T}$.
L_{A90}	The 'A'-weighted sound pressure level of the residual noise in decibels exceeded for 90 percent of a given time and is the $L_{A90,T}$. The L_{A90} is used to describe the background noise levels at a particular location.
L_{Amax}	The 'A'-weighted maximum sound pressure level measured over a measurement period.
R_w (or SRI)	The weighted sound reduction index as a single number laboratory measured rating used to describe the sound insulation of building elements.

Appendix 2
Schedule of Equipment

Appendix 2: Schedule of Equipment

Hawkins Noise Kit 2 - Equipment Set 5199:

Equipment Type	Manufacturer	Serial Number	Calibration Certification Number	Calibration Type	Date of Last Calibration Check	Date of Next Calibration Check
Nor-140 Type 1 Sound Level Meter	Norsonic	1405199	U42092	UKAS Calibration: 0789	6th October 2022	October 2024
Nor-1209 Pre-amplifier	Norsonic	15117	U42092	UKAS Calibration: 0789	6th October 2022	October 2024
Nor-1225 Microphone	Norsonic	151240	42091	UKAS Calibration: 0789	6th October 2022	October 2024
Nor-1251 Sound Calibrator	Norsonic	32849	U45865	UKAS Calibration: 0789	3rd November 2023	October 2024
Nor-1284 Dehumidifier	Norsonic	222	Not Applicable			
Nor- 1212 Weather Protection Kit	Norsonic	Not Applicable				
Nor1408A/10 Extension Cable	Norsonic/Lemo	Not Applicable				

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

Certificate of Calibration and Conformance

Certificate number: **U42092**

Test Object: **Sound Level Meter, BS EN IEC 61672-1:2003 Class 1**

Producer: Norsonic AS.
Type: 140
Serial number: 1405199
Customer: Hawkins Environmental
Address: The Square, Basing View, Basingstoke, RG21 4EB
Contact Person: Nick Hawkins
Order No: PO-H5563

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	Norsonic	1225	151240	42091
Calibrator*	Norsonic	1251	32849	U42090
Preamplifier	Norsonic	1209	15117	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.

Instruction Manual: Im140_1Ed8R0En Firmware Version: 3.0.1866 The test object is a single channel instrument.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	102.12 ±0.02	23.20 ±0.25	45.05 ±0.5

Calibration Dates:

Received date:	28/09/2022	Reviewed date:	06/10/2022
Calibration date:	06/10/2022	Issued date:	06/10/2022

Technicians: (Electronic certificate)

Calibrated by: *Martyna Silva*

Reviewed by: *Jenny Crawford*

Doc ref: Slm-Cert-Master-V3-05

Certificate of Calibration and Conformance

Continuation of Certificate number: **U42092**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN IEC 61672-1:2003**
Periodic Tests:	**BS EN IEC 61672-3:2006**
Pattern Evaluation:	**BS EN IEC 61672-2:2003**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - IEC61672-3 Ed.1 #9	Passed
Self-generated noise - IEC 61672-3 Ed.1 #10.2	Passed
Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 #11	Passed
Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 #12	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 #13	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.1 #14	Passed
Toneburst response - IEC 61672-3 Ed.1 #16	Passed
Peak C sound level - IEC 61672-3 Ed.1 #17	Passed
Overload indication - IEC 61672-3 Ed.1 #18	Passed

Comments
Correct level with associated calibrator is 113.9dB(A).

Statement of Conformance
The sound level meter submitted has successfully completed the periodic tests of the standard listed for the environmental conditions under which the tests were performed. As public evidence(1) was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with the manufacturer's standard to demonstrate that the model of sound level meter fully conformed to the requirements of the said standard, the sound level meter submitted for testing conforms to the relevant class of the said standard.
(1 - evidence is held on file at the calibration laboratory)

Observations
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements. Details of the uncertainty for each measurement are available from the Calibration Laboratory upon request. Details of the sources of corrections and their associated uncertainties that relate to this verification are contained within the test report accompanying this certificate.

Decision Rule
Basic Meter Function - The decision rules will be applied in accordance with the procedure as described in BS EN 61672-3:2006.

This certificate relates only to the items tested above.

** End of Certificate **

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: **42091**

Test Object: **Measurement Microphone**

Producer: **Norsonic AS.**
Type: **1225**
Serial number: **151240**
Customer: **Hawkins Environmental**
Address: **The Square, Basing View, Basingstoke, RG21 4EB**
Contact Person: **Nick Hawkins**
Order No: **PO-H5563**

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-26.14*	*49.31*	*21.47*
Measurement 2	*-26.13*	*49.38*	*21.48*
Measurement 3	*-26.13*	*49.37*	*21.49*
Result (Average):	***-26.13***	***49.36***	***21.48***
Expanded Uncertainty:	0.10		1.00
Degree of Freedom:	>100		>100
Coverage Factor:	2		2

The stated sensitivity is the pressure sensitivity at 250Hz, S250, and is valid at reference conditions. The following correction factors have been applied during the measurement:
Pressure:uncertainty dB/kPa Temperature:-0.005 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	102.164 ± 0.042	22.7 ± 0.1	44.6 ± 1.0

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:	28/09/2022	Reviewed date:	06/10/2022
Calibration date:	06/10/2022	Issued date:	06/10/2022

Technicians: (Electronic certificate)
Calibrated by: *Martyna Silva*
Reviewed by: *Jenny Crawford*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

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

Page 1 of 4

Certificate of Calibration

Continuation of Certificate number: **42091**

Reference Calibrator: WSC1 - Nor1253-24269
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\NOR1225_151240_M1.nmf

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability
The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations
The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration
The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency σCombined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity σS250 with the uncertainty of the actuator / or LF pressure response at any other frequency σAct,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\sigma Combined,Fn = 2\sqrt{(\sigma 2S250 + \sigma 2ActFn)}$$

Appendix to this certificate
Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Laboratory Location

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

0789

Certificate of Calibration and Conformance

Certificate number: **U45865**

Test Object: **Sound Calibrator**

Producer: **Norsonic AS.**
Type: **1251**
Serial number: **32849**
Customer: **Hawkins Environmental Ltd**
Address: **The Square, Basing View, Basingstoke, Hants. RG21 4EB.**
Contact Person: **Nick Hawkins.**
Order No: **H663**

Measurement Results	Level dB	Level Stability dB	Frequency Hz	Distortion %
Measurement 1	114.05	0.04	999.80	0.35
Measurement 2	114.06	0.04	999.80	0.35
Measurement 3	114.07	0.04	999.80	0.35
Result (Average):	**114.06**	**0.04**	**999.80**	**0.35**
Expanded Uncertainty:	0.1	0.02	1	0.25
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:0.0005 dB/kPa Temp:0.003 dB/°C Humi:0 dB/%RH Load volume: 0.0003 dB/mm3

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	97.565 ±0.040	21.8 ±0.1	49 ±1.6

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\NOR1251_32849_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:	02/11/2023	Reviewed date:	03/11/2023
Calibration date:	03/11/2023	Issued date:	03/11/2023

Technicians: (Electronic certificate)
Calibrated by: *Michael Tickner*
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-V3-06

Page 1 of 2

Certificate of Calibration and Conformance

Continuation of Certificate number: U45865

Reference Microphone: WSM8 (A) - GRAS-40AG.147852

Measurements

The calibrator has been tested as described in the following annexes to BS EN IEC60942:2003 Sound Calibrators; B3.4 for sound pressure level, B3.5 for frequency, B3.6 for total distortion and A4.4 for short term stability of the pressure level.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Comments

Statement of Conformance and Calibration
As public evidence was available*, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in annex A of BS EN IEC 60942:2003, the sound calibrator tested is considered to conform to all the class 1 requirements of that BS EN IEC 60942:2003.

*This evidence is held on file at the calibration laboratory.

Notes:
The sound pressure level generated by the calibrator in its ½ inch configuration was measured five times and averaged by a WS2P working standard microphone for class 1 or 2 devices or a LS2P reference microphone for class 0 or LS devices as specified in the International Standard BS EN 61094-4. The results of three replications and the mean of the measurements obtained are given in the measurement results table of this certificate. The frequency and distortion were measured in a similar manner. The figures in BOLD are the final results; a small correction factor may need to be added to the sound pressure level quoted here if the device is used to calibrate a sound level meter that is fitted with a free field response microphone. See manufacturer's handbooks for full details of this and other corrections that may be applicable.

Observations:

Decision Rule:
The decision rules have been applied in accordance with the procedure as described in BS EN 60942:2003

This certificate relates only to the items tested above.

** End of Certificate **

Hawkins Noise Kit 3 - Equipment Set 2918:

Equipment Type	Manufacturer	Serial Number	Calibration Certification Number	Calibration Type	Date of Last Calibration Check	Date of Next Calibration Check
Nor-140 Type 1 Sound Level Meter	Norsonic	1402918	U47824	UKAS Calibration: 0789	16th May 2024	May 2026
Nor-1209 Pre-amplifier	Norsonic	12207	U47824	UKAS Calibration: 0789	16th May 2024	May 2026
CEL 1922-F Microphone	CEL	28241	U47823	UKAS Calibration: 0789	16th May 2024	May 2026
Nor-1251 Sound Calibrator	Norsonic	31233	U47822	UKAS Calibration: 0789	16th May 2024	May 2025
Nor-1284 Dehumidifier	Norsonic	222	Not Applicable			
Nor- 1212 Weather Protection Kit	Norsonic	Not Applicable				
Nor1408A/10 Extension Cable	Norsonic/Lemo	Not Applicable				

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

0789

Certificate of Calibration

Certificate number: **U47824**

Test Object: **Sound Level Meter, BS EN IEC 61672-1:2003 Class 1**

Producer: **Norsonic AS.**
Type: **140**
Serial number: **1402918**
Customer: **Hawkins Environmental Ltd**
Address: **The Square, Basing View, Basingstoke, Hampshire. RG21 4EB.**
Contact Person: **Nick Hawkins**
Order No: **PO-0376**

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	CEL	192/2F	28241	U47823
Calibrator*	Norsonic	1251	31233	U47822
Preamplifier	Norsonic	1209	12207	Included

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

Additional items that have also been submitted for verification:

Wind shield	Norsonic	Nor1451 (ø 60mm)
Attenuator	N/A	
Extension cable	N/A	

These items have been taken into account wherever appropriate.

Instruction Manual: Im140_1Ed8R0En Firmware Version: v2.1.670 The test object is a single channel instrument.

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	99.89 ±0.01	23.05 ±0.85	55.25 ±2.55

Calibration Dates:

Received date:	10/05/2024	Reviewed date:	16/05/2024
Calibration date:	16/05/2024	Issued date:	16/05/2024

Technicians: (Electronic certificate)

Calibrated by: *Martyna Silva*

Reviewed by: *Jenny Crawford*

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

Certificate of Calibration

Continuation of Certificate number: **U47824**

The statements of conformance and observation notes detailed in this certificate are made with reference to the following standards in respect of the calibration of the test object.

Manufactured:	**BS EN IEC 61672-1:2003**
Periodic Tests:	**BS EN IEC 61672-3:2006**
Pattern Evaluation:	**Not Applicable**

Conformance:
From markings on the sound level meter or by reference to the manufacturer's published literature it has been determined that the instrument submitted for verification was originally manufactured to the listed standard and similarly that the associated sound calibrator conforms to the BS EN IEC 60942 standard.

Measurement Summary:

Indication at the calibration check frequency - IEC61672-3 Ed.1 #9	Passed
Self-generated noise - IEC 61672-3 Ed.1 #10.2	Passed
Acoustical signal tests of a frequency weighting - IEC 61672-3 Ed.1 #11	Passed
Electrical signal tests of frequency weightings - IEC 61672-3 Ed.1 #12	Passed
Frequency weightings: A Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: C Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency weightings: Z Network - IEC 61672-3 Ed.1 #12.3	Passed
Frequency and time weightings at 1 kHz IEC 61672-3 Ed.1 #13	Passed
Level linearity on the reference level range - IEC 61672-3 Ed.1 #14	Passed
Toneburst response - IEC 61672-3 Ed.1 #16	Passed
Peak C sound level - IEC 61672-3 Ed.1 #17	Passed
Overload indication - IEC 61672-3 Ed.1 #18	Passed

Comments
Correct level with associated calibrator is 113.9dB(A).

Statement of Conformance
The sound level meter submitted for testing has successfully completed the periodic tests for the environmental conditions under which the tests were performed. However, no general statement of conclusion can be made about conformance of the sound level meter to the full requirements of the manufactured standard because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in the manufacturer's standard and because the periodic tests completed cover only a limited subset of the specifications in the relevant standard

Observations
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k = 2, providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements. Details of the uncertainty for each measurement are available from the Calibration Laboratory upon request. Details of the sources of corrections and their associated uncertainties that relate to this verification are contained within the test report accompanying this certificate.

Decision Rule
Basic Meter Function - The decision rules will be applied in accordance with the procedure as described in BS EN 61672-3:2006.

This certificate relates only to the items tested above.

** End of Certificate **

Page 2 of 2

Laboratory Location

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

0789

Certificate of Calibration and Conformance

Certificate number: **U47823**

Test Object: **Measurement Microphone**

Producer: CEL
Type: 192-2F
Serial number: 28241
Customer: Hawkins Environmental Ltd
Address: The Square, Basing View,
Basingstoke, Hampshire. RG21 4EB.
Contact Person: Nick Hawkins
Order No: PO-0376

Measurement Results	Sensitivity (dB re 1V/Pa)	Sensitivity (mV/Pa)	Capacitance (pF)
Measurement 1	*-25.53*	*52.90*	*24.85*
Measurement 2	*-25.54*	*52.87*	*24.96*
Measurement 3	*-25.54*	*52.83*	*24.98*
Result (Average):	***-25.54***	***52.86***	***24.93***
Expanded Uncertainty:	0.10		2.01
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:-0.001 dB/kPa Temperature:0.01 dB/°C Humidity:0 dB/%RH

Conditions	*Pressure kPa*	*Temperature °C*	*Humidty %RH*
Reference conditions	101.325	23	50
Measurement conditions	99.88 ± 0.040	21.0 ± 0.1	60.7 ± 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. The uncertainty has been determined in accordance with UKAS requirements.

Calibration Dates:

Received date:	10/05/2024	Reviewed date:	16/05/2024
Calibration date:	16/05/2024	Issued date:	16/05/2024

Technicians: (Electronic certificate)

Calibrated by: *Palanivel Marappan BEng(Hons), MSc*
Reviewed by: *Jenny Crawford*

This certificate is issued in accordance with the CA Quality Management system. It provides traceability of measurement to recognized national standards, and to the units of measurement realized at the National Physical Laboratory or other recognized national standards laboratories. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

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

Page 1 of 4

Certificate of Calibration and Conformance

Continuation of Certificate number: **U47823**

Reference Calibrator: WSC9 (C) - Nor-1253.21816
Measurement Record: K:\C A\Calibration\Nor-1504\Nor-1017 MicCal\CEL192-2F_28241_M1.nmf

Preconditioning
The equipment was preconditioned for more than 12 hours at the specified calibration temperature and humidity.

Instruments and Program
A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Traceability
The measured values for sound pressure, frequency, voltage, capacitance, temperature, humidity and ambient pressure are traceable to an accredited national physical laboratory.

Observations
The differences between the two results at 100 Hz are within normal limits bearing in mind the different test methods and are taken into account in arriving at the uncertainties of measurement.

Method of Calibration
The open circuit sensitivity of the microphone has been determined at 250 Hz against a reference laboratory standard measurement microphone by insert voltage techniques using a laboratory standard sound calibrator as a transfer standard. The electrostatic actuator frequency response was then obtained for frequencies above 100 Hz as described in BS EN IEC 61094-6. In addition, where requested the optional free field frequency response over the range 2 – 100 Hz has been obtained using a pressure chamber; in this case the reference frequency is 100 Hz. All of these results and their associated uncertainties are detailed in the table on page 3 of this certificate. See the observations field below for details of any discrepancies between the 100 Hz results obtained via the electrostatic actuator and pressure chamber.

The overall uncertainty at any frequency Combined,Fn may be obtained by combining the uncertainty of the open circuit sensitivity S250 with the uncertainty of the actuator / or LF pressure response at any other frequency Act,Fn where Fn is the uncertainty at the frequency of interest using the relationship:

$$\text{Combined,Fn} = 2\sqrt{(2S250 + 2\text{ActFn})}$$

Appendix to this certificate
Where data is available from the microphone manufacturer to correct the actuator / pressure frequency response to obtain the random incidence and / or free field response it is shown in the appendix to this certificate. The uncertainty information relating to these corrections is the responsibility of the microphone manufacturer and when it is available the total uncertainty for the corrected frequency response at each point may then be obtained by including the correction uncertainty in the root-sum-square formula given above. These responses are outside the UKAS accredited scope, but are provided for information.

Observations

Laboratory Location

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

0789

Certificate of Calibration

Certificate number: **U47822**

Test Object: **Sound Calibrator**

Producer: **Norsonic AS.**
Type: **1251**
Serial number: **31233**
Customer: **Hawkins Environmental Ltd**
Address: **The Square, Basing View, Basingstoke, Hampshire. RG21 4EB.**
Contact Person: **Nick Hawkins**
Order No: **PO-0376**

Measurement Results	Level dB	Level Stability dB	Frequency Hz	Distortion %
Measurement 1	114.10	0.05	1000.56	0.43
Measurement 2	114.09	0.04	1000.57	0.43
Measurement 3	114.09	0.05	1000.57	0.44
Result (Average):	**114.09**	**0.05**	**1000.56**	**0.43**
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:0.0005 dB/kPa Temp:0.003 dB/°C Humi:0 dB/%RH Load volume: 0.0003 dB/mm3

Conditions	*Pressure kPa*	*Temperature °C*	*Humidity %RH*
Reference conditions	101.325	23	50
Measurement conditions	99.88 ±0.040	21.4 ±0.1	59.3 ±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\NOR1251_31233_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:	10/05/2024	Reviewed date:	16/05/2024
Calibration date:	16/05/2024	Issued date:	16/05/2024

Technicians: (Electronic certificate)
Calibrated by: *Palaniwel 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

Page 1 of 2

Certificate of Calibration

Continuation of Certificate number: **U47822**

Reference Microphone: WSM11 (C) - GRAS40AG-291442

Measurements

The calibrator has been tested as described in the following annexes to BS EN IEC60942:2003 Sound Calibrators; B3.4 for sound pressure level, B3.5 for frequency, B3.6 for total distortion and A4.4 for short term stability of the pressure level.

Instruments and Program

A complete list of instruments, hardware and software that have been used for this calibration is available from the calibration laboratory

Comments

Statement of Calibration

The sound calibrator has been shown to conform to the class 1 requirements for periodic testing, described in annex B of BS EN IEC 60942:2003 for the sound pressure levels and frequencies stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in annex A of BS EN IEC 60942:2003, no general statement of conclusion can be made about conformance of the sound calibrator to the requirements of BS EN IEC 60942:2003.

Notes:

The sound pressure level generated by the calibrator in its ½ inch configuration was measured five times and averaged by a WS2P working standard microphone for class 1 or 2 devices or a LS2P reference microphone for class 0 or LS devices as specified in the International Standard BS EN 61094-4. The results of three replications and the mean of the measurements obtained are given in the measurement results table of this certificate. The frequency and distortion were measured in a similar manner. The figures in BOLD are the final results; a small correction factor may need to be added to the sound pressure level quoted here if the device is used to calibrate a sound level meter that is fitted with a free field response microphone. See manufacturer's handbooks for full details of this and other corrections that may be applicable.

Observations:

Decision Rule:

The decision rules have been applied in accordance with the procedure as described in BS EN 60942:2003

This certificate relates only to the items tested above.

** End of Certificate **

Appendix 3
Summary of Sound Measurements

Appendix 3: Summary of Sound Measurements

24hr External Noise Monitoring Location

Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A50}	L_{A90}
07:00	41.4	67.2	42.8	39.4	37.2
08:00	43.3	66.8	43.4	39.6	37.4
09:00	41.6	64.3	42.8	39.7	37.5
10:00	42.7	65.2	43.1	39.2	36.7
11:00	45.6	72.2	45.2	40.5	37.7
12:00	43.2	64.9	43.4	39.3	37.4
13:00	40.3	62.2	42.1	39.0	37.0
14:00	41.4	64.5	42.1	38.8	37.4
15:00	44.6	71.2	42.9	38.5	36.5
16:00	40.6	68.7	41.2	37.5	35.6
17:00	41.7	64.5	42.7	39.4	37.4
18:00	41.0	64.9	42.5	40.0	38.3
19:00	41.6	71.2	42.5	39.7	37.8
20:00	40.2	64.9	41.5	38.0	36.5
21:00	39.2	60.6	40.0	36.9	35.3
22:00	40.9	64.3	41.7	37.4	36.1
23:00	37.7	57.9	39.3	35.3	33.4
00:00	38.1	67.3	37.7	33.0	30.7
01:00	33.6	55.0	35.7	31.9	30.0
02:00	32.5	54.5	33.9	30.0	28.4
03:00	32.3	48.8	34.0	30.1	28.6
04:00	32.6	45.0	35.3	30.6	28.8
05:00	36.2	60.3	37.3	33.7	31.8
06:00	38.3	55.2	40.6	36.6	34.2
Day	**42.1**	**72.2**	**42.5**	**38.9**	**37.0**
Night	**35.8**	**67.3**	**36.7**	**32.6**	**30.7**