Hawkins environmental

Acoustic Impact Assessment:

234-240 Grafton Road, Camden

Grafton234 Ltd

23rd December 2024

Report Details:

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1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Grafton234 Ltd to undertake an acoustic impact assessment for proposed 2no. Air Source Heat Pumps (ASHPs) at 234-240 Grafton Road in, located in the Kentish Town area 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 proposed 2no. ASHPs 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 proposed new plant 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 British Standard BS 4142: 2014 +A1:2019 *'Methods for rating and assessing industrial and commercial sound'.*

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

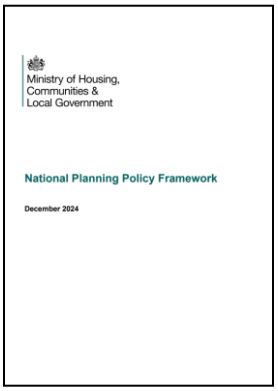
1.3. Site Description

The development site is situated along Grafton Road and is bounded by Dale Road to the North and Cressfield Close to the South. The site is also situated 20m south of the St. Pancras to Chesterfield Line. Part of the proposed scheme at 234-240 Grafton Road will see the installation of 2no. ASHP units on the rooftop of the proposed single storey upwards extension of the existing building. 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).

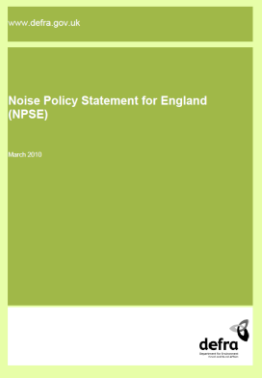
The NPPF states that in the planning system *"Planning policies and decisions should contribute to and enhance the natural and local environment by… e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels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

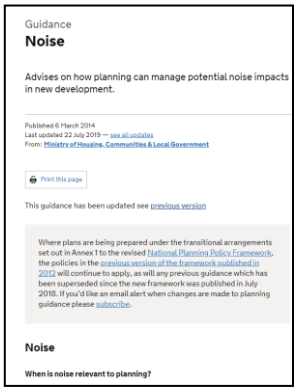
- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible contribute to the improvement of health and quality of life."

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;*

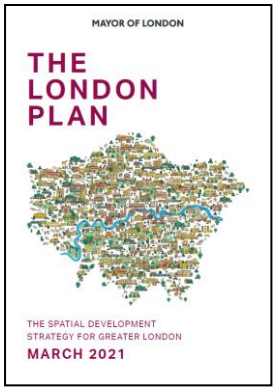
- *where external amenity spaces are an intrinsic part of the overall design, the acoustic environment of those spaces should be considered so that they can be enjoyed as intended.*
- *some commercial developments including restaurants, hot food takeaways, night clubs and public houses can have particular 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.*

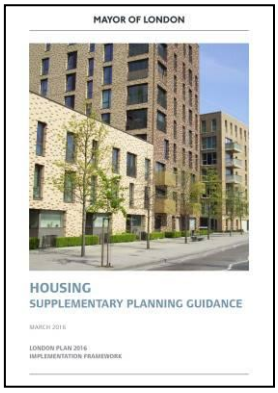
B. *Boroughs, and others with relevant responsibilities, should identify and nominate new Quiet Areas and protect existing Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations".*

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. London Plan – Housing Supplementary Planning Guidance (2016)



The Housing SPG, published in March 2016 highlights the elements of the London Plan that are relevant to housing development, and where applicable, provides more detail. The SPG states:

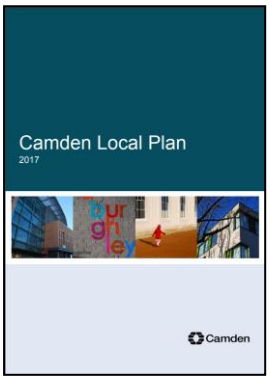
"Noise

Standard 30 (and Policy 7.15) – The layout of adjacent dwellings and the location of lifts and circulation spaces should seek to limit the transmission of noise to sound sensitive rooms within dwellings.

2.3.42 - Policy 7.15 Reducing and Managing Noise, Improving and Enhancing the Acoustic Environment and Promoting Appropriate Soundscapes requires development proposals to seek to reduce noise and manage the effects of noise to improve health and quality of life. It is another important aspect of retreat and privacy in a dwelling. Noise from the street and adjoining properties can cause stress, sleep disturbance and friction between neighbours as recognised in the NPPF.

2.3.43 - All dwellings should be built with acoustic insulation and tested to current Building Regulations standards. However, acoustic insulation should not be relied upon as the only means of limiting noise and the layout and placement of rooms within the building should be considered at an early stage in the design process to limit the impact of external noise on bedrooms and living rooms. The impact of noise should also be considered in the placement of private external spaces."

2.6. 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"*.

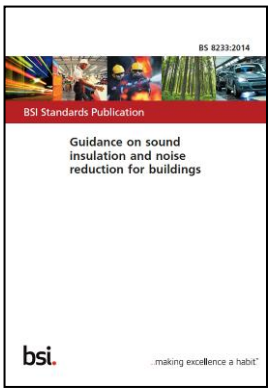
In relation to industrial and commercial noise sources, the guidance states that:

"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.

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 $L_{Aeq.8hour}$

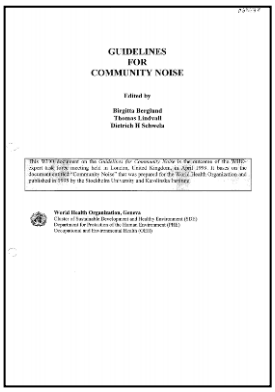
When considering the noise level criteria considered in **Table 3.1**, the following points should be noted:

- 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**.

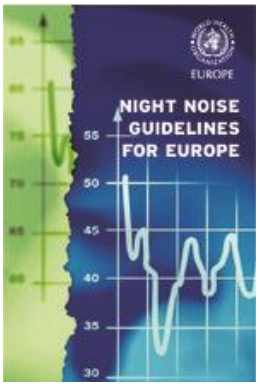

GUIDELINES
FOR
COMMUNITY NOISE

Edited by
Birgitta Berglund
Thomas Lindvall
Dietrich H Schwela

Table 3.2: Summary of Noise Criteria: WHO

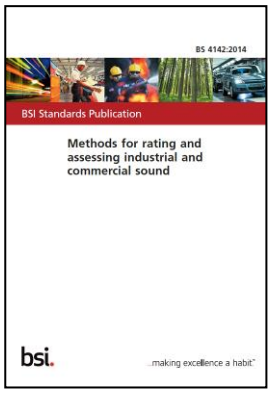
Residential Environment	Critical Heath Effect	L_{Aeq}	L_{AFmax}	Time Base
Outdoor living area	Serious annoyance, daytime and evening	55	-	07:00-23:00
	Moderate annoyance, daytime and evening	50	-	07:00-23:00
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening	35	-	07:00-23:00
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. BS 4142:2014+A1:2019 'Methods for Rating and Assessing Industrial and Commercial Sound'



British Standard BS 4142: 2014 +A1:2019 *"Methods for rating and assessing industrial and commercial sound"* provides a method for the measurement and rating of industrial noise or noise of an industrial nature and background noise levels outside dwellings in mixed residential and industrial areas. The rating level (defined in the BS) is used to rate the industrial noise source outside residential dwellings (this is defined as the "specific noise source").

The procedure defined in BS 4142 for predicting the likelihood of complaints is based on establishing the difference between the rating level and the background level outside the residential property of interest. The greater the difference the greater the likelihood of complaints and more specifically:

- *"A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;*

- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*
- *Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."*

The guidance goes on to state that *"where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*" Consequently, when considering the impact of a BS 4142 assessment, it is often also necessary to consider the absolute noise levels experienced at the receptor location in relation to BS 8233 and World Health Organisation guidelines.

3.5. BS 4142:2014+A1:2019 Technical Note (2020)

In March 2020, Acoustic and Noise Consultants (the ANC) published a guidance note to accompany BS 4142.

The Technical Note states *"remain concerns for some users of BS 4142 and this guidance is designed to assist readers with a reasonable interpretation and application of BS 4142 as a whole"*. It notes *"In the production of this guidance, the ANC Working Group (WG) has reviewed BS 4142 and attempted to address any content regarded as ambiguous"*. Consequently, whilst not an official guidance document, the Technical Note provides advice of the interpretation of BS 4142 and provides examples of best practice with regards to the application of the BS.

The following sub-sections contain clarifications from the Technical Note that are particularly pertinent to this assessment.

3.5.1. Internal Noise Levels

The Technical Note notes "*BS 4142 'is not intended to be applied to the assessment of indoor sound levels' (Subclause 1.3) and cannot, therefore, be used for façade design. Whilst BS 4142 can be used to assist in the determination of the likelihood of an adverse or significant adverse impact, guidance on internal design criteria and mitigation is provided elsewhere".* The Technical Note goes on to state that in conjunction with BS 4142, the use of BS 8233 may be appropriate to determine internal noise levels "*although recognition should be given to the associated scope and/or limitations".*

3.5.2. Introduction of a New Noise-Sensitive Receptors

One of the major short-comings of BS 4142 is the lack of differentiation between the assessment of new noise sources verses the assessment of new noise-sensitive receptors. Subclause 8.5 of BS 4142 states *"Where a new noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In*

such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation".

The Technical Note clarifies this position by noting "*where BS 4142 is used in this situation, its fundamental principles, in terms of what constitutes the residual, background and specific sources, should not be compromised. Where other standards or guidance document are used, care should be taken with regard to their own stated scope or limitations. Examples of such guidance might include:*

- *BS8233: 2014 where an industrial/commercial sound source is constant and new residential development is proposed nearby;*
- *Elements of ProPG where the impact of regular night time maximum sound events is the critical consideration;*
- *DMRB where impacts relate solely to changes to vehicular movements within or around a site; or*
- *BS 5228 where activities are temporary and of a similar nature to the construction activities considered by that Standard.*

These documents, or others, may help to inform the contextual elements of a BS 4142 assessment or help where a numerical assessment fully in accordance with BS 4142 may not be possible".

In this regard the Technical Note that when assessing new noise-sensitive receptors close to commercial noise sources, it may not be possible to use BS 4142 as difficulties in disaggregating *"legitimate commercial residual sources to the background sound level could potentially lead to unrepresentatively adverse outcomes"*. Consequently, *"alternative guidance and standards should be referenced, although care should be taken not to apply them beyond their own stated scope or limitations"*. It goes on to note that *"different approaches might be adopted depending on whether the industrial/commercial source is continuous or intermittent, whether there are ancillary sources present, or where one particular industrial/commercial premises dominates"*.

3.5.3. Background Sound Levels

BS 4142 does not provide a definitive method for calculating or determining a background sound level. The Technical Note does not a definitive method either, but does provide more clarification. It notes *"it was the view of the WG that it is not always appropriate to define a singular background sound level for use in an assessment. In such cases, a range of values over one or more time periods may be more appropriate. An assessment should generally focus on the sound levels measured during the period of greatest interest, which may be the quietest part of the night, or the time period relating to a complaint. Determining the period of greatest interest should be judged on a case-by-case basis"*.

The Note points out that "*it is important that the established background sound level is representative of typical conditions*". It goes on to provide a number of examples whereby time history, histogram and cumulative distribution data is presented, along with the range of values selected by the WG as being representative. *"These examples are included to illustrate the range of views in the WG as to how best to identify representative background sound levels for particular datasets and serve to highlight the sensitivity of the outcome to individual interpretations of measurement data. It must be remembered that there are no 'correct' answers, only judgement and justification. In many instances, additional information beyond that presented in these examples would be required to inform the judgement of representative levels".*

3.5.4. Context

The criteria used to determine the acceptability of an impact with BS 4142 talks about the requirement to consider "*context*". However, BS 4142 does not provide much detail as to what one might consider in relation to context.

BS 4142 notes that absolute levels of sound can be of significance, where residual values are both high and low. In particular, BS 4142 notes that absolute levels may be as, or more, important than relative outcomes where background and rating levels are low, but does not provide further commentary.

The Technical Note points out that "*BS 4142 does not indicate how the initial estimate of impact should be adjusted when background and rating levels are low, only that the absolute levels may be more important than the difference between the two values. It is likely that where the background and rating levels are low, the absolute levels might suggest a more acceptable outcome than would otherwise be suggested by the difference between the values. For example a situation might be considered acceptable where a rating level of 30dB is 10dB above a background sound level of 20dB, i.e. an initial estimate of a significant adverse impact is modified by the low rating and background sound levels.*

There may be situations where the opposite is true, and it is for the assessor to justify any modifications to the initial estimate of impact.

BS 4142 does not define 'low' in the context of background sound levels nor rating levels. The note to the Scope of the 1997 version of BS 4142 defined very low background sound levels as being less than about 30 dB L_{A90}, and low rating levels as being less than about 35 dB $L_{Ar,Tr}$.

The WG suggest that similar values would not be unreasonable in the context of BS 4142, but that the assessor should make a judgement and justify it where appropriate".

The Technical Note suggests other areas one might consider when looking at context:

- *"character of a particular neighbourhood;*
- *former uses at or close to a site;*
- *legitimacy of the industrial use, e.g. planning permissions or environmental permits;*
- *implementation of best practicable means for a given process or activity; or*
- *local convention or perceptions".*

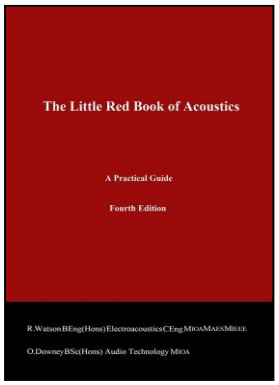
It goes on to provide two examples:

"For example; a former industrial use may be less relevant if it ceased 10 years previously, than a use that ceased within the previous six months. Setting out the context in this way is important so that the reader is fully aware of the point being made".

"For example; a coffee shop with drive thru facility located adjacent to a fairly busy road with traffic lights and constant stop/start traffic, with residential properties nearby. In these circumstances the noise climate is unlikely to change in any perceptible way due to the addition of vehicles moving and idling in the drive thru area. However, during the evening, the gaps in the general traffic could reduce the background sound level sufficiently that an adverse or significant adverse impact is suggested. An intermittency correction could also be

considered appropriate. In this example, the assessor might legitimately take the view that the context is at odds with the initial (numerical) assessment, and substantially adjust the conclusions of the assessment on the basis of the context".

3.6. The Little Red Book of Acoustics (4th ed.) (2024)



First published in 2007, *'The Little Red Book of Acoustics: A Practical Guide'* remains an industry-standard textbook. Appreciated by professionals and beginners alike for being clear and straightforward, the book has also been included in recommended reading lists for Institute of Acoustics accredited courses.

The 4th edition of the book was published in September 2004 and includes recent updates to standards such as BS 8233 and BS 4142, in addition to presenting a new method to assess and determine the representative background sound levels as part of a BS 4142 assessment.

The book recognises that BS 4142 does not give a single fixed method for assessing the representative background sound level and proposes the *'LRB Method'* which considers a modal approach with a distribution threshold criterion.

The LRB Method requires each of the background sound level integer values to be counted. The analysis of the candidate values for the background sound level first starts with the candidate with the highest number of occurrences. If there are multiple values with the same number of occurrences, then the analysis will first consider the lowest of these candidate values.

Each candidate value is tested based on whether or not there is less than or equal to 45% of the data below the candidate value. If the candidate value features more than 45% of the data below the candidate value, then it should be rejected. Once the candidate value features less than or equal to 45% of the data below the candidate value, then it should be accepted as the representative background sound level.

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 in order to determine the background sound levels for the day and night time periods.

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 background noise survey was conducted between Thursday 19th and Friday 20th December 2024. The noise monitoring was conducted by Mathew Vaughan of Hawkins Environmental Limited. Mathew is an Associate 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

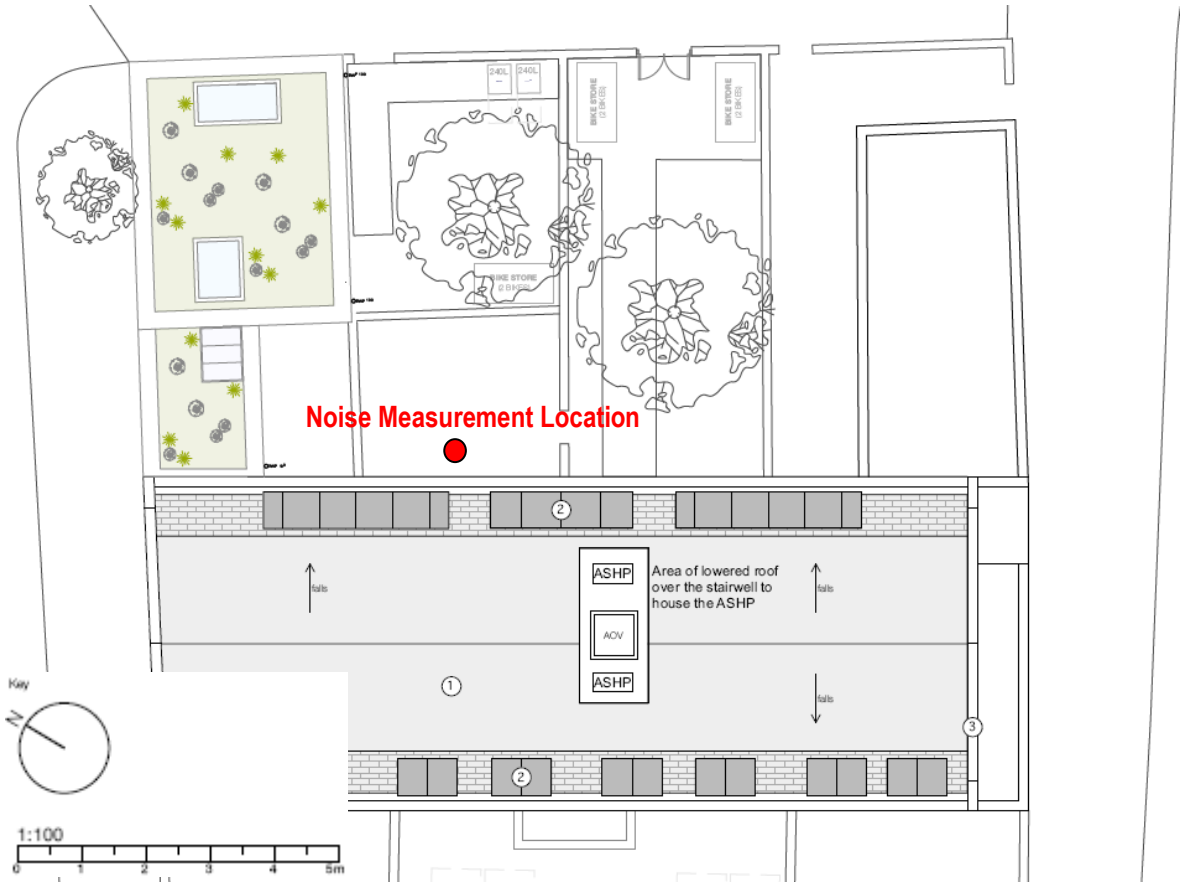
General Description	The measurement periods were warm, with some sunshine during the day with light winds.
Windspeed	Over the measurement period, the average windspeed was around 1 m/s, with peak windspeeds around 3 m/s
Temperature	Highs of 9˚C, lows of 1˚C.
Precipitation	No precipitation was observed during the measurement period.

4.2. Background Sound Levels

BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'* requires the determination of background sound levels at a location representative of the potentially affected receptors.

Sound measurements were conducted at a first floor window to the rear of the building; facing onto the rear external amenity area. The measurement location is marked on **Figure 4.1**. It is considered that background noise measurements conducted at this location will be representative of the surrounding dwellings, without the contribution of the proposed ASHP units. The sound monitoring location was considered to be a façade location.

Figure 4.1: Noise Measurement Location



It is understood that the proposed ASHP units could operate at any time. Consequently, background noise measurements have been conducted over a typical representative 24-hour period. The noise measurement data is detailed in **Appendix 3** and summarised in **Figure 4.2** and **Table 4.2.**

Table 4.2: Summary of the 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)	57.3	53.6 – 61.6	69.3 – 86.8	37.0 – 48.4
Nighttime (11pm to 7am)	51.5	38.5 – 57.8	52.8 – 77.8	33.4 – 39.7

The background sound levels have been calculated in accordance with BS 4142:2014, which represents the most up-to-date guidance on the subject. Prior to the publication of the 2014 version of BS 4142, acousticians would use the lowest measured background sound levels; however, BS 4142: 2104 provides substantially more guidance on the determination of background sound levels. Section 8.1 of BS 4142: 2014 states that "*for this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods. Among other considerations, diurnal patterns can have a major influence on background sound levels and, for example, the middle of the night can be distinctly different (and potentially of lesser importance) compared to the start or end of the night-time period for sleep purposes*". The guidance goes on to say that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value"*.

In order to determine the background sound levels for the daytime periods, the background sound levels have been analysed over the appropriate time periods, i.e. 1 hour for daytime. **Figure 4.3** details the distribution of the background sound levels as described in BS 4142: 2014 for the daytime period.

It can be seen from **Figure 4.3** during the daytime, the $L_{A90.15mins}$ sound levels range between 37 – 44 dB(A). Within the range of values, the highest number of occurrences are at 39 dB $L_{A90.15mins}$. Less than 45% of the data is below this value. Therefore, 39 dB(A) is accepted as the representative background sound level during the daytime.

It can be seen from **Figure 4.4** during the nighttime, the $L_{A90.15mins}$ sound levels range between 33 – 40 dB(A). Within the range of values, the highest number of occurrences are at 35 dB $L_{A90.15mins}$. Less than 45% of the data is below 35 dB(A). Therefore, 35 dB(A) is accepted as the representative background sound level during the nighttime.

It should be noted that at the time of the noise survey, the building is occupied with residents occasionally using the rear external amenity space. This may result in occasional brief periods of elevated levels of noise.

Figure 4.2: Noise Measurements

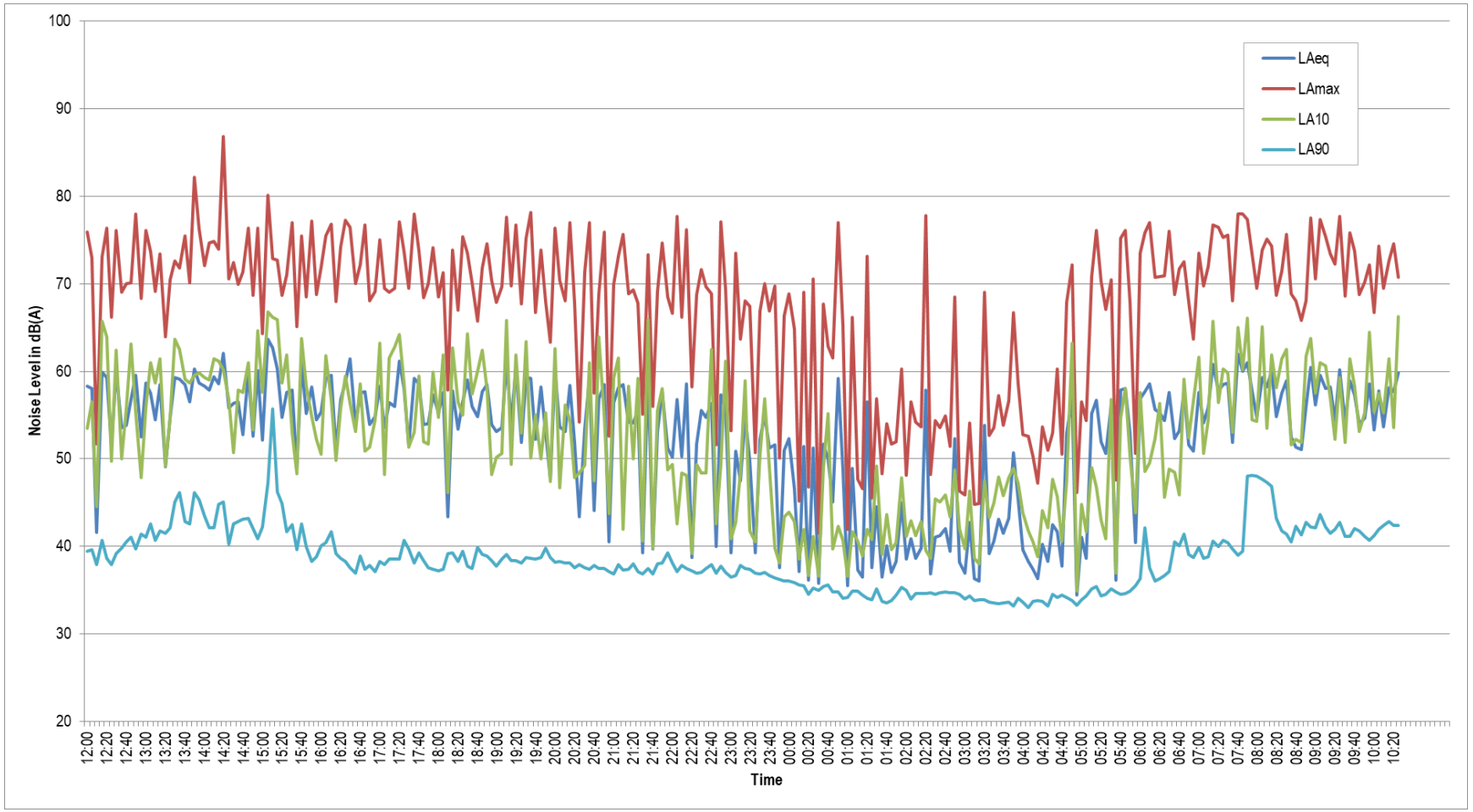


Figure 4.3: Distribution of Day Time $L_{A90.1hour}$ Sound Levels

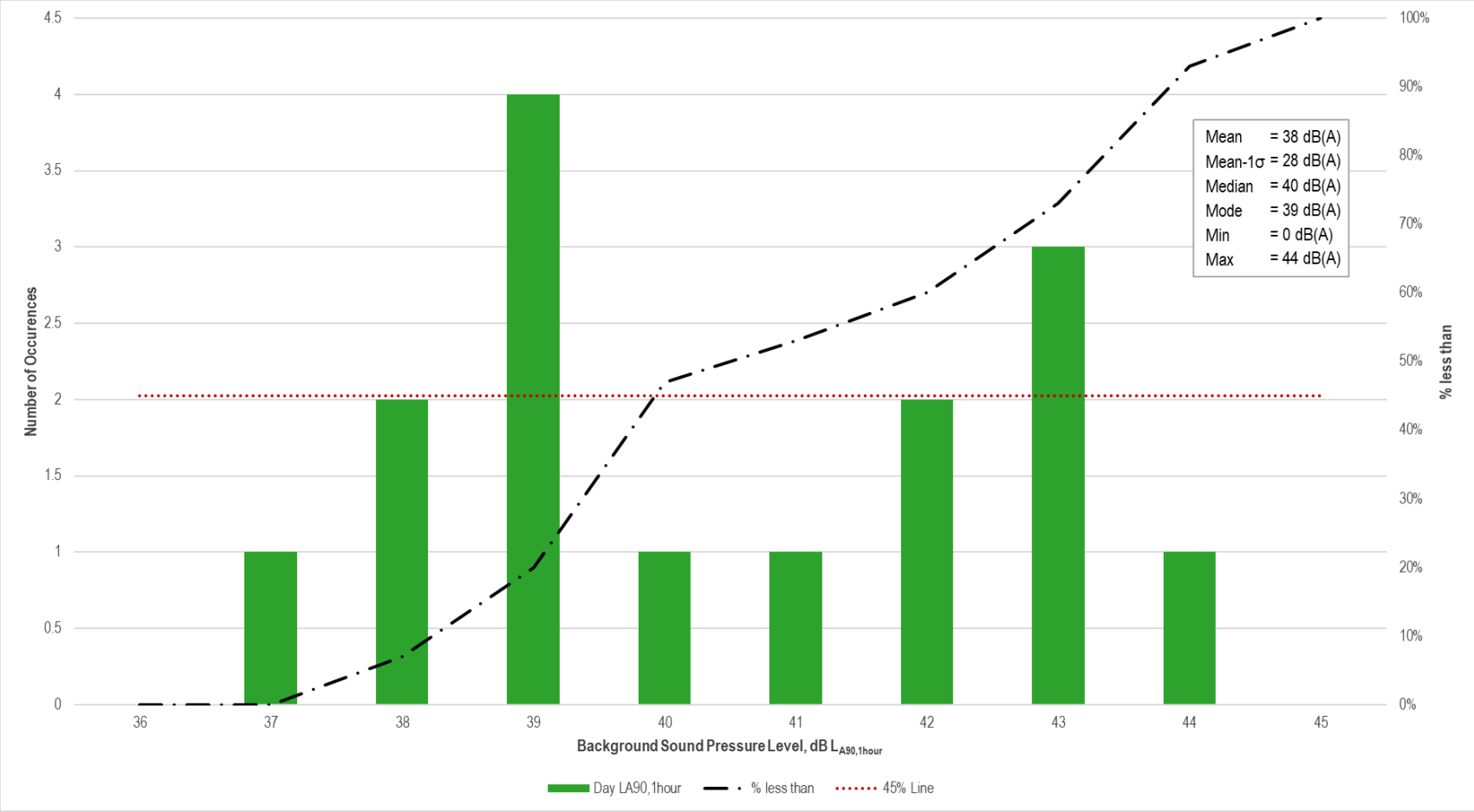
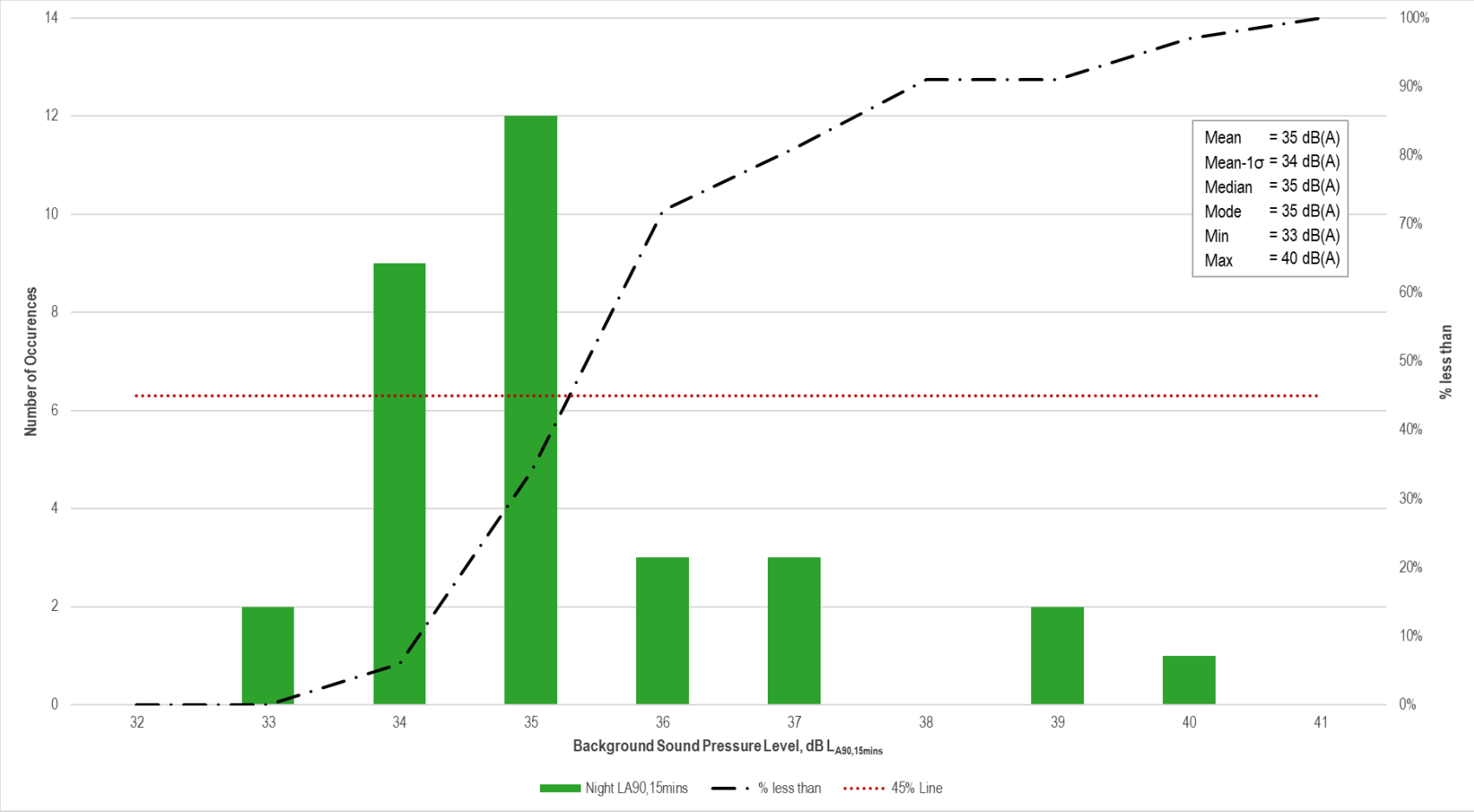


Figure 4.4: Distribution of Night Time $L_{A90.1hour}$ Sound Levels



5. IMPACT OF THE PLANT

5.1. Overview

The assessment is carried out in accordance with BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'*.

5.2. Proposed Plant

At the proposed development, it is proposed to install 2no. PUZ-WM60VAA(-BS) Ecodan R32 Monobloc Air Source Heat Pumps manufactured by Mitsubishi Electric. According to the published manufacturer sound level data, the sound power level of the plant is 58 dB(A). Under real world free-field conditions, the sound pressure level of the plant at a distance of 1m is 45 dB(A). The manufacturer data is replicated in **Appendix 4**.

5.3. Specific and Rating Sound Level

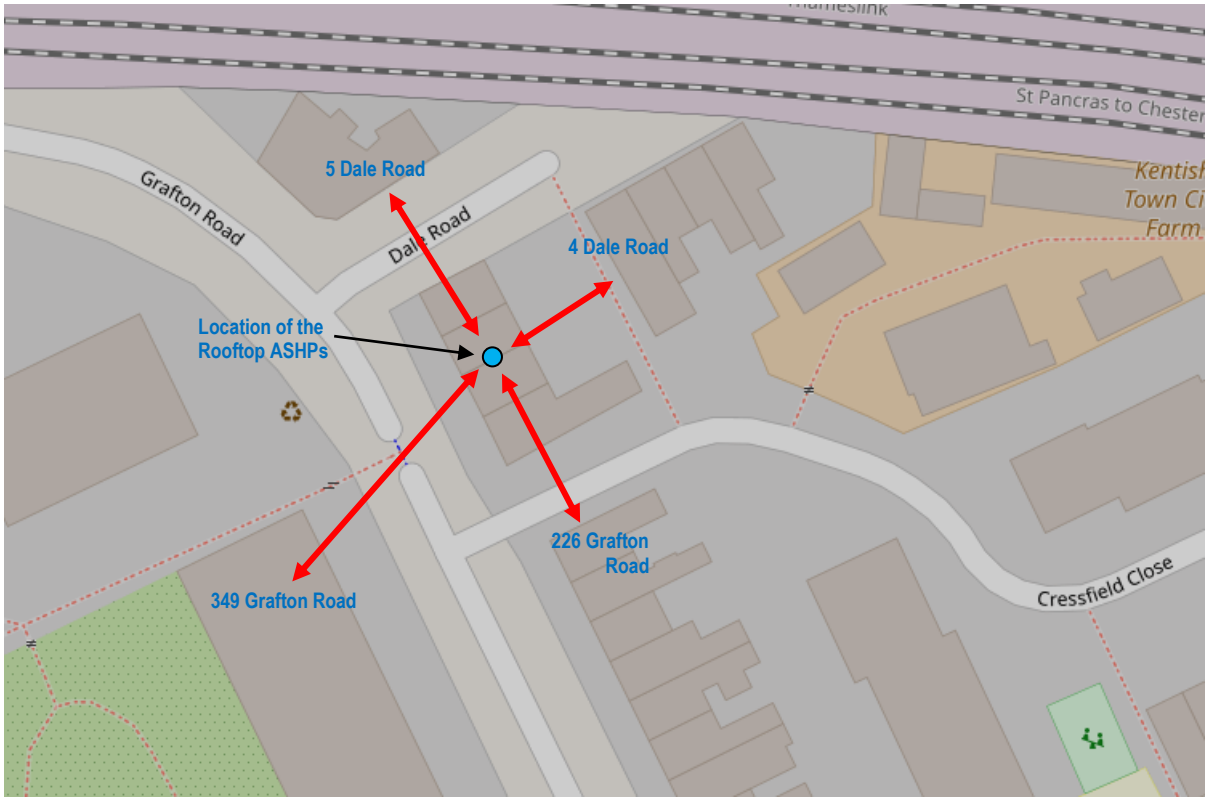
Using the location of the proposed ASHP units and based on the published sound pressure level of 45 dB(A) at 1m, the cumulative noise level from both ASHPs has been calculated for the nearest three dwellings. **Figure 5.1** shows the location of the closest receptors.

Table 5.1 shows the calculated sound levels for these locations based on standard point source distance attenuation.

Table 5.1: Receptor Specific Sound Levels

Location	Distances to Receptors	Façade Specific Sound Level in dB(A)
5 Dale Road	24m	23
4 Dale Road	19m	25
226 Grafton Road	21m	25
349 Grafton Road	31m	21

Figure 5.1: Locations of the Sensitive Receptor



When considering the 2017 London Borough of Camden Local Plan, the guidance clarifies that the assessment Rating sound level should be at least 10 dB lower than the background noise level, or 15 dB if tonal components are audible.

In accordance with Section 9 of BS 4142, the rating sound level is calculated by applying a character correction to the calculated receiver sound level. For this assessment, the character correction was specified using the "Subjective Method", where it is necessary to *"consider the subjective prominence of the character of the specific sound at the noise-sensitive locations and the extent to which such acoustically distinguishing characteristics will attract attention."*

BS 4142 goes on to highlight the subjective correction that one could apply; these corrections are summarised in **Table 5.2** below:

Table 5.2: Subjective Character Corrections

Category	Comments
Tonality	*"2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible".*
Impulsivity	*"a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible"*
Other sound characteristics	*"Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*
Intermittency	*"If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied."*

Since at the closest receptors the specific sound level of the proposed 2no. ASHPs would be 10 dB or more below the night-time background sound level, it would be anticipated that at the identified residential receptors, the sound from the proposed plant is unlikely to be audible. Since any tones, impulsivity, intermittency or other characteristics are unlikely to be discernible against the pre-existing acoustic environment, the rating sound level of the proposed plant is considered to be equivalent to the specific sound level. **Table 5.3** determines the rating sound levels at the receptor locations.

Table 5.3: Receptor Rating Sound Levels

Location	Façade Rating Sound Level in dB(A)
5 Dale Road	23
4 Dale Road	25
226 Grafton Road	25
349 Grafton Road	21

5.4. Adherence to Sound Criteria

To assess the impact of the proposed plant, the predicted sound levels have been compared to the criteria in BS 4142. **Table 5.4** below considers the sound levels in a BS 4142 assessment during the period when the plant will be operational. In a BS 4142 assessment, the 'industrial' sound is rated by comparison against the background sound level. The difference between the rating sound level and lowest background sound level gives an indication of the likelihood of complaint.

Table 5.4: BS 4142 Assessment

	Background Sound Level L_{A90}	Specific Sound Level L_{Aeq}	Rating Sound Level L_{Aeq}	Difference between Rating and Background Sound Level
5 Dale Road	35	23	23	-12
4 Dale Road	35	25	25	-10
226 Grafton Road	35	25	25	-10
349 Grafton Road	35	21	21	-14

Note: All sound levels are façade sound measurements.

BS 4142: 2014 suggests that *"The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context"*. Consequently, it is possible to conclude that unmitigated, the proposed ASHPs are unlikely to have an adverse impact on the closest residential receptors and that complaints would be unlikely.

Since the rating sound level of the proposed plant would be at least 10 dB below the background sound level, it is considered that the proposed scheme with the installation of 2no. rooftop ASHPs would be in compliance with the 2017 London Borough of Camden Local Plan

6. OVERALL CONCLUSIONS AND RECOMMENDATIONS

A detailed sound measurement study has been carried out to determine whether the proposed scheme for the installation of 2no. ASHPs on the rooftop of 234-240 Grafton Road is likely to be acceptable in terms of noise when considering BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'* and the 2017 London Borough of Camden Local Plan and whether complaints are considered likely.

Using the guidance and calculation methods contained within BS 4142, the rating sound level has been calculated to be at least 10 dB(A) below the background sound level at the closest dwellings at 4 Dale Road and 226 Grafton Road. Consequently, it is possible to conclude that unmitigated, the proposed ASHPs are unlikely to have an adverse impact on the closest residential receptors and that complaints would be unlikely.

Since the rating sound level of the proposed plant would be at least 10 dB below the background sound level, it is considered that the proposed scheme with the installation of 2no. rooftop ASHPs would be in compliance with the 2017 London Borough of Camden Local Plan

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 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 **

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

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

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

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

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

Time	L_{Aeq}	L_{Amax}	L_{A10}	L_{A50}	L_{A90}
07:00	58.8	78.0	59.0	44.5	41.1
08:00	57.3	77.5	58.2	46.4	43.8
09:00	57.5	77.7	57.7	44.8	41.8
10:00	57.3	74.6	58.3	45.7	42.2
11:00	-	-	-	-	-
12:00	57.2	78.0	55.7	43.4	39.6
13:00	57.8	82.2	58.7	49.5	43.1
14:00	58.3	86.8	58.6	49.0	42.7
15:00	59.0	80.1	59.0	48.0	43.3
16:00	57.5	77.3	54.9	41.8	38.7
17:00	57.3	78.0	57.2	41.5	38.6
18:00	56.4	75.4	57.3	41.7	38.5
19:00	57.0	78.2	54.3	41.4	38.6
20:00	55.9	77.0	53.0	39.7	37.8
21:00	55.9	75.7	53.2	39.9	37.6
22:00	54.7	77.7	49.1	38.9	37.4
23:00	50.9	73.5	45.9	38.3	36.8
00:00	51.5	77.0	42.4	36.2	35.2
01:00	47.2	73.2	41.7	35.6	34.4
02:00	48.7	77.8	43.1	36.3	34.6
03:00	46.2	69.0	44.7	36.0	33.7
04:00	48.1	72.2	44.2	35.3	33.8
05:00	53.9	76.1	47.2	36.7	34.7
06:00	55.8	77.0	51.8	41.2	38.5
Day	**57.3**	**86.8**	**56.3**	**43.7**	**40.3**
Night	**51.5**	**77.8**	**45.1**	**36.9**	**35.2**

Appendix 4
Fan Data from Manufacturer

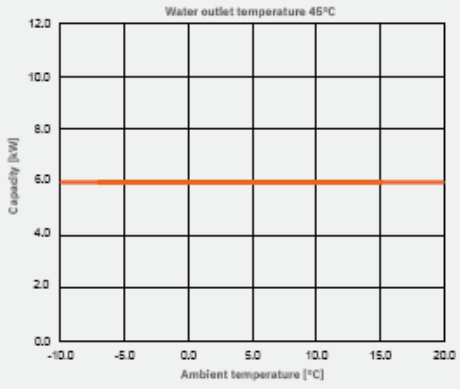
Appendix 4: Fan Data from Manufacturer

Heating | **Product Information**

PUZ-WM60VAA(-BS)
Ecodan R32
Monobloc Air Source Heat Pump

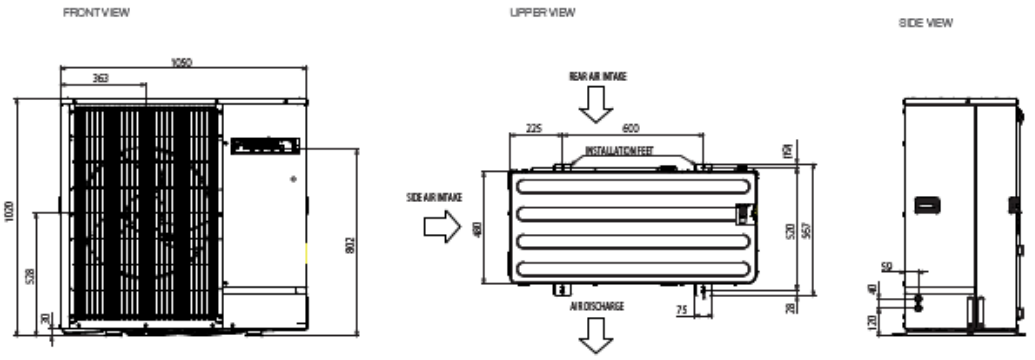
OUTDOOR UNIT		PUZ-WM60VAA(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A+++
	η_s	142%
	SCOP (MCS)	3.57
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+++
	η_s	190%
	SCOP (MCS)	4.81
HEAT PUMP COMBINATION HEATER - Large Profile*1	ErP Rating	A+
	η_{wh}	145%
HEATING*2 (A-7/W35)	Capacity (kW)	6.0
	Power Input (kW)	1.88
	COP	3.20
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA*3	Pressure Level at 1m (dBA)	45
	Power Level (dBA)*4	58
WATER DATA	Pipework Size (mm)	22
	Flow Rate (l/min)	17
	Water Pressure Drop (kPa)	8.0
DIMENSIONS (mm)	Width	1050
	Depth	480
	Height	1020
WEIGHT (kg)		98
ELECTRICAL DATA	Electrical Supply	220-240V, 50Hz
	Phase	Single
	Nominal Running Current (MAX) (A)*5	5.68 [13]
	Fuse Rating - MCB Sizes (A)*6	16
REFRIGERANT CHARGE (kg) / CO_2 EQUIVALENT (t)	R32 (GWP 675)	2.2 / 1.49

NOMINAL HEATING CAPACITY



Notes:
*1 Combination with EPT120K Cylinder
*2 Under normal heating conditions at outdoor temp: -7°CDB / -8°CWB, outlet water temp 35°C, inlet water temp 30°C.
*3 Under normal heating conditions at outdoor temp: 7°CDB/ 6°CWB, outlet water temp 55°C, inlet water temp 47°C as tested to BS EN14511.
*4 Sound power level tested to BS EN12102.
*5 Under nominal heating conditions at outdoor temp: 7°C, outlet water temp: 35°C.
*6 MCB Sizes BS EN60898-2 & BS EN60947-2.
η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

PUZ-WM60VAA(-BS) DIMENSIONS



All dimensions (mm)

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IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (00353)

Note: Refer to 'Installation Manual' and 'Instruction Book' for further 'Technical Information'. The fuse rating is for guidance only and please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/ electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP=2088), R32 (GWP=675), R407C (GWP=1774), R134a (GWP=1430), R513A (GWP=631), R454B (GWP=466), R1234ze (GWP=7) or R1234yf (GWP=4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.836/2011 from IPCC 3rd edition, these are as follows. R410A (GWP=1975), R32 (GWP=550), R407C (GWP=1650) or R134a (GWP=1300).

Effective as of August 2020

Green Gateway greengateway.mitsubishielectric.co.uk