Aval Consulting Group.

Noise Impact Assessment

45 Market Street, West Yorkshire, WF16 0EU

Client Name: Aji Joseph

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1. Introduction

1.1 Overview

AVAL Consulting Group Limited (ACGL) has been commissioned to carry out a Noise Impact Assessment for the proposed development at 45 Market Street, West Yorkshire, WF16 0EU. The proposal consists of the conversion of the first-floor storage area and roof space to create one flat. This is hereafter referred to as “the proposed development”.

Detailed site drawings are presented in Appendix B.

1.2 Objective

The planning process requires evidence from a noise impact assessment that mitigation measures can ensure that noise can be reduced to acceptable levels within the premises. BS:8223 guidance suggests that prior to developing a scheme, details of the measures should be considered so that internal sound levels within all habitable rooms do not exceed 35 dB(A) $L_{Aeq,16hours}$ (07:00- 23:00); and internal sound levels within all bedrooms that do not exceed 30 dB(A) $L_{Aeq,\ 8hours}$ (23:00-07:00).

The purpose of the noise impact assessment is to ensure that the proposed scheme and its usage are suitable for habitation in relation to the prevailing noise in the surrounding area’s environment. If needed, mitigation measures to accompany the planning application will be provided.

1.3 Site Location

Figure 1.1 shows the proposed site location. The site is bound by Market Street to the east and by other residential properties to the north and south. Various sources of noise are likely to exist from the surrounding areas but the most predominant sources of noise that could have adverse impacts on the proposed residential units are considered to be the:

- Noise from Market Street (Traffic)

Figure 1.1: Proposed site location (image source: Google Maps)

2. Relevant Noise Standards

This section summarises all legislation, policy, statutory and non-statutory guidelines relevant to the proposed development. Furthermore, the latest regional and local planning policy guidance specifically applicable to the proposed development has been reviewed.

2.1 The 'National Planning Policy Framework (NPPF)

The updated 2021 version of the 'National Planning Policy Framework (NPPF)'[1] contains information and general guidance to Local Authorities in relation to considering and taking into account noise. The National Planning Policy Framework (NPPF) guidance reinforces that noise should be taken into account considering planning policies and decisions. Some of the guidance contained in the 'National Planning Policy Framework (NPPF)' includes the following:

- Paragraph 174e: "…*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*…"
- Paragraph 185a,b: "*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;…*"
- Paragraph 187: *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.*

In conjunction with the 'National Planning Policy Framework (NPPF)', 'The Noise Policy Statement for England (NPSE)'[2], dated March 2010, states the following regarding a long-term vision of government noise policy:

"Noise Policy Statement for England Aims:

- *The first aim of the NPSE:*

  Avoid significant adverse impacts on health and quality of life from environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development.

[1] The National Planning Policy Framework (2018/19) https://www.gov.uk/guidance/national-planning-policy-framework
[2] Noise Policy Statement for England (NSPE) https://www.gov.uk/government/publications/noise-policy-statement-for-england

- *The second aim of the NPSE:*

  Mitigate and minimize adverse impacts on health and quality of life from environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development.

- *The third aim of the NPSE:*

  Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour, and neighbourhood noise within the context of Government policy on sustainable development."

In terms of the NPSE, the impact of noise can be categorised by the following terms:

- NOEL – No Observed Effect Level – The level where no effect can be detected
- LOAEL – Lowest Observed Adverse Effect Level – The level where adverse effects on health and quality of life can be detected
- SOAEL – Significant Observed Adverse Effect Level – The level where significant adverse effects on health and quality of life may occur.

The NPSE further states 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."

No specific guidance is detailed or given in the 'National Planning Policy Framework (NPPF)', or 'The Noise Policy Statement for England (NPSE)' in terms of acceptable acoustic criteria/noise criteria in order to achieve the 'NOEL, LOAEL, or SOAEL'. Therefore, it is considered necessary to refer to alternate national guidance, preferably standardised or regulated such as an appropriate British Standard (BS), or in the absence of this, alternate World Health Organisation (WHO) guidelines, etc.

The British Standard 8223: Sound Insulation and Noise Reduction for Buildings/Code of Practice BS 8223: Sound Insulation and Noise Reduction for Buildings/Code of Practice states that for different spaces, there might be a range of noise levels that are considered acceptable.

2.2 WHO 'Guidelines for Community Noise'

Where noise is assessed against the 'Absolute Level', then this can be split into separate daytime and night-time legislation. The WHO 'Guidelines for Community Noise' state in 4.2.7 "Annoyance Responses" that:

"During the daytime, few people are seriously annoyed by activities with L_{Aeq} levels below 55 dB; or moderately annoyed with L_{Aeq} levels below 50dB. Sound pressure levels during the evening and night should be 5-10 dB lower than during the day…."

The guidance goes on to provide a daytime[3] internal acoustic criteria relative to critical health effect(s) that of 35 dB $L_{Aeq,16\ hour}$, and a night-time[4] level of 30 dB $L_{Aeq,8\ hour}$ / 45 dB L_{AFmax} linked with dwelling indoors. Therefore, assuming a maximum external noise level of 50 dB $L_{Aeq,t}$

[3] daytime is typically between 07:00 h and 23:00 h.
[4] night-time is between 23:00 h and 07:00 h.

during the daytime, (considering a 15 dB reduction in noise via a partially open window) an internal noise level of 35 dB $L_{Aeq,t}$ should be achieved.

During the night-time periods, a further publication; WHO Night Noise Guidelines For Europe' published in 2009 states that:

"Below the level of 30 dB $L_{night,outside}$, no effects on sleep are observed except for a slight increase in the frequency of body movements during sleep due to night noise. There is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night,outside}$ are harmful to health. However, adverse health effects are observed at the level above 40 dB $L_{night,outside}$, such as self-reported sleep disturbance, environmental insomnia, and increased use of somnifacient drugs and sedatives. Therefore, 40 dB $L_{night,outside}$ is equivalent to the LOAEL for night noise….. The LOAEL of night noise, 40 dB $L_{night,outside}$, can be considered a health-based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise."

Therefore, where absolute levels need to be referenced, a maximum daytime noise limit of 50 dB $L_{Aeq,t}$ can be considered, with the LOAEL for night of 40 dB $L_{night,outside}$ being considered.

2.3 IEMA (Institute of Environmental Management & Assessment)

IEMA also defines the sensitivity of receptors according to the table below

Table 2.1 Effect Descriptors (Guidelines For Environmental Noise Assessment, 2014)

Very Substantial	Greater than 10 dB L_{Aeq} change in sound level perceived at a receptor of great sensitivity to noise
Substantial	Greater than 5 dB L_{Aeq} change in sound level at a noise-sensitive receptor, or a 5 to 9.9 dB L_{Aeq} change in sound level at a receptor of great sensitivity to noise
Moderate	A 3 to 4.9 dB L_{Aeq} change in sound level at a sensitive or highly sensitive noise receptor, or a greater than 5 dB L_{Aeq} change in sound level at a receptor of some sensitivity
Slight	A 3 to 4.9 dB L_{Aeq} change in sound level at a receptor of some sensitivity
None/Not Significant	Less than 2.9 dB L_{Aeq} change in sound level and/or all receptors are of negligible sensitivity to noise or marginal to the zone of influence of the proposals

2.4 The British Standard 8223: Sound Insulation and Noise Reduction for Buildings/Code of Practice

BS 8223: Sound Insulation and Noise Reduction for Buildings/Code of Practice provides acceptable noise levels. Table 4 of British Standard BS 8223 reproduced below (Table 2.1) provides appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

Table 2.2: British Standard recommended indoor noise levels for dwellings (Source: British Standard BS: 8223)

Activity	Location	07:00 to 23:00 (Day Time)	23:00 to 07:00 (Night Time)
Resting	Living Room	35 dB $L_{Aeq,\ 16\ hour}$	-
Dinning	Dining Room/area	40 dB $L_{Aeq,\ 16\ hour}$	-
Sleeping (Daytime Resting)	Bedroom	35 dB $L_{Aeq,\ 16\ hour}$	30 dB $L_{Aeq,\ 8\ hour}$

In addition, the WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009 makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}. The number of individual noise events should also be taken into account and the WHO guidelines suggest that indoor noise levels from such events should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night. The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces, and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq}.

BS 8223 also states that the ambient noise levels in non-domestic buildings should not normally exceed the design ranges in the table below.

Table 2.2: Typical Noise levels in non-Domestic Buildings (Source: British Standard BS: 8223)

Activity	Location	Design Range dB $L_{Aeq,T}$
Speech or telephone communications	Department store, Cafeteria, canteen, Kitchen	50-55
	Concourse Corridor, circulation space	45-55
Study and work requiring concentration	Library, gallery, museum	40-50
	Staff/meeting room, training room	35-45
	Executive office	35-40
Listening	Place of worship, counselling, meditation, relaxation	30-35

2.5 BS 4142: 2014; Methods for rating and assessing industrial and commercial sound

In terms of industrial/commercial development, guidance is set out in BS 4142: 2014, ‘Methods for rating and assessing industrial and commercial sound’. BS 4142 requires the noise from the process/equipment (in LA_{eq}) to be compared with the background sound level (LA_{90}) in conjunction with the new noise source.

BS 4142 states that if the rated noise level exceeds the LA_{90} background sound level by around +10 dB or more, then it is likely that the resultant noise may have a significant adverse impact, a difference of around +5 dB over the background sound level is likely to have an adverse impact, and where the rating level does not exceed the background sound level it is an indication that the resultant noise is likely to have a low adverse impact.

BS 4142: 2014 provides a method for assessing whether an industrial or commercial sound source (e.g. fixed mechanical plant) is likely to cause a disturbance to persons living near to the sound source.

The 2014 document introduces three main acoustic features:

- **Tonality:** Defined as more sound in the 1/3 octave band than those nearby 1/3 octave bands or more sound in a given frequency than in those nearby frequencies. The tonality feature correction +6dB and can be applied using subjective method or an objective method using 1/3 octave bands.
- **Impulsivity:** defined as sound that increases by a rate of at least 10dB per second, regardless of its duration. The impulsivity feature correction range from 0-9 dB and can be applied using a subjective method or an objective method using a sound level meter capable of sampling sound at either once every 0.01s interval or once every 0.025s interval.
- **Intermittency:** Defined as sound that can be identified as being on/off during the measurement period in which case the correction factor that is applied to the specific sound source (e.g. fume extraction system) is +3 DB.

BS 4142 assesses potential significant effect by comparing the source noise (extractor duct vent noise) with the measured background noise level (LA90). The standard provides a penalty (correction factor) for acoustic features for instance bangs or tonal qualities that can increase the likelihood of noise complaints and in these cases, the standard requires a correction to be added to the source noise level. The source noise level along with the correction factor is referred to as the 'rating level'. The rating level is then compared with the background level (La90). BS 4142:2014 advocates the use of LAeq,T - a level, which is directly measurable and termed the Specific Sound Level.

- Subjectively the Specific Sound Level may be corrected as follows:

The Specific Sound Level is subject to a correction for tonality between 0dB to +6dB for sound ranging from not tonal to prominently tonal. Subjectively, this can be converted to a penalty of 2dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6dB where it is highly perceptible.

The Specific Sound Level may be also corrected to impulsivity. A correction of up to +9dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level. Subjectively, this can be converted to a penalty of +3dB for impulsivity which is just perceptible at the noise receptor, 6dB where it is clearly perceptible, and 9dB where it is highly perceptible.

Other sound characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, can have a penalty of 3dB applied.

Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections ought normally to be added in a linear fashion.

Further corrections may be applied due to intermittency. When the specific sound has identifiable on/off conditions, the specific sound level ought to be representative of the time period of length equal to the reference time interval which contains the greatest total amount of on time. This can necessitate measuring the specific sound over a number of shorter sampling periods that are in combination less than the reference time interval in total, and then calculating the specific sound level for the reference time interval allowing for time when the specific sound is not present. If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3dB can be applied.

If the subjective method is not sufficient for assessing the audibility of tones in sound or the prominence of impulsive sounds, BS4142:2014 suggests using the one-third octave method and/or the reference methods, as appropriate.

The one-third octave method tests for the presence of a prominent, discrete-frequency spectral component (tone) typically compares the LZeq,T sound pressure level averaged over the time when the tone is present in a one-third-octave band with the time-average linear sound pressure levels in the adjacent one-third-octave bands. For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference. The level differences between adjacent one-third-octave bands that identify a tone are:

• 15 dB in the low-frequency one-third-octave bands (25Hz to 125Hz);

• 8 dB in the middle-frequency one-third-octave bands (160Hz to 400Hz); and

• 5 dB in the high-frequency one-third-octave bands (500Hz to 10,000Hz).

- The reference (objective) method.

If the presence of audible tones is in dispute, a special measurement procedure can be used to verify their presence. Based on the prominence of the tones this procedure also provides recommended level adjustments. The aim of the reference method is to assess the prominence of tones in the same way as listeners do on average. The method is based on the psychoacoustic concept of critical bands, which are defined so that sound outside a critical band does not contribute significantly to the audibility of tones inside that critical band. The method includes procedures for steady and varying tones, narrow-band sound and low-frequency tones, and the result is a graduated 0dB to 6dB adjustment. It is known as the Joint Nordic Method 2 and is to be found in ISO 1996-2. The reference method is also described in BS4142:2014.

Specific Sound Level with (or without) added contentions is termed the Rating Level. When used to assess industrial or commercial sound, the Rating Level is determined and the LA90 background level is subtracted from it. Typically, the greater this difference, the greater the magnitude of the impact.

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

A difference of around +5dB 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.

In addition to above, based on the Guidance of Control of Odour and Noise from Commercial Kitchen Exhaust Systems (2018), there are two fundamental categories of noise source are of relevance. The first is the noise produced by the fan, which is a function of the type of fan (axial, centrifugal, mixed flow, etc), the rate of the airflow and the pressure drop. For these calculations, the octave band sound power from the fan is required. This can normally be obtained from the manufacturer.

The second category of noise is generated by turbulence as the air passes within the ducts or through the exit grille or louvre. In this case, the amount of noise is determined by the design of duct, grille, or louvre, the pressure drop across terminations, the velocity of the air (this can be variable across the duct, grille, or louvre) and the area of the duct or opening. The problem with this form of noise, especially at terminations, is that in most situations it can only be controlled at its source. For example, at the feature that is generating the noise as there is no further length of duct in which to install noise control equipment.

In some situations, a third source may need to be considered. This is where noise generated within the building breaks into the ductwork and is radiated from the outlet. The area of the duct walls, the acoustic properties of the duct walls, and the area of any inlets determine the amount of break-in noise. Once this noise has broken into the ducts it can be treated as if it were an additional component of the fan noise. However, the nature of this additional noise is such that it usually contains a relatively high level of low-frequency sound which can be difficult to attenuate.

The attenuation of fan noise (and break-in noise) provided by the ductwork is determined by the length of the ducts, the presence of any bends, changes in cross-section, the presence of any plenum chambers and termination effects (including sound-attenuating louvres if present and the attenuation provided by any change in cross-section). A balance has to be struck between the acoustic benefit of bends and louvres etc and the pressure drop that these create, possibly requiring a larger fan.

The sound energy components arising from fan noise, turbulence within the duct and at outlets, and from noise break-in, combine to produce an acoustic source at the outlet. The energy will then propagate away from the outlet in a manner determined by the nature and geometry of surrounding buildings and terrain. The nature, temporal characteristic and level of the resultant sound that reaches the ears of people in the vicinity (usually quantified by considering the noise at façades), and its level relative to the background noise, all contribute to its potential to cause disturbance and complaint. These factors should be taken into account at the planning stage as a matter of course. They form the basis of BS 4142 “Rating industrial noise affecting mixed residential and industrial areas” which is also used by Local Authority as support to the issue of a Noise Abatement Notice under the Environmental Protection Act.

3. Noise Survey

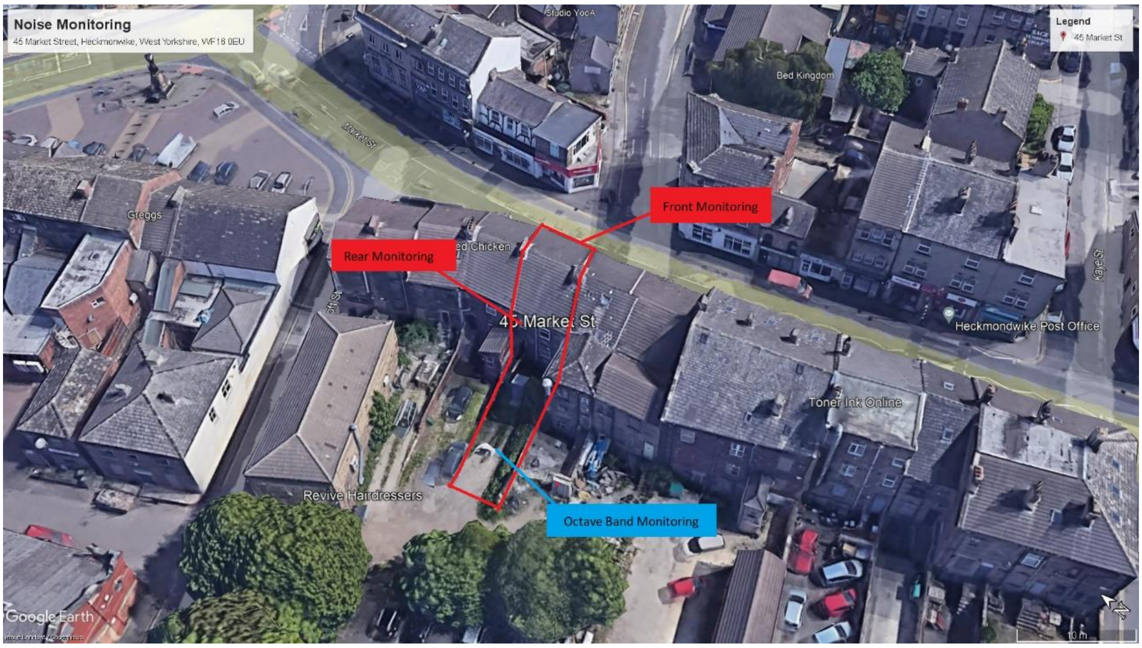
3.1 Overview

This section provides the details of the methodological approach taken to assess the prevailing acoustic environment at the site where new noise-sensitive receptors (residential units) will be introduced. To establish the current acoustic environment and the monitoring of noise levels at the site, the key noise indicators namely $L_{Aeq\ 1min}$, L_{A90}, L_{Amax}, L_{den}, L_{night}, and $L_{evening}$ are used where applicable and are described in Appendix A.

3.2 Noise Monitoring Locations

Noise, for the specific site, was monitored for 24hr at the location shown in figure 3.1. The monitoring location was deemed suitable to capture the prevailing traffic noise as well as other prevailing noises in the area. The noise data has not been considered to be representative of free-field conditions due to the distance between the monitor and the building façade being less than 3.5m; therefore, appropriate acoustic corrections have been applied to the presented noise data as per BS7445 guidance. It should be noted that all measurements were also carried out as per the requirements of BS7445. Octave band monitoring has also been implemented to capture noise from the neighbouring commercial spaces.

Figure 3.1 Noise Monitoring Location



3.3 Noise Survey Periods

The details and noise survey periods have been tabulated below.

Table 3.2 Noise Survey Periods

Noise Monitoring Location	Start Date	Start Time	End Date	End Time
Front	20/09/22	15:00	21/09/22	15:00
Rear	20/09/22	15:00	21/09/22	15:00
Backyard (Octave Band)	20/09/22	13:30	20/09/22	14:30

3.4 Details of Noise Monitoring Equipment

The details of the equipment used for the noise monitoring have been tabulated below. Please note that all equipment are class 1 monitors and have been calibrated before and after surveys.

Table 3.3 Noise Equipment Details

Equipment Details		Serial Number	Last Calibrated
Monitor	BSWA 308 Class 1	590144	25/10/21
Monitor	BSWA 308 Class 1	580273	01/02/21
Calibrator	CA111	550282	03/08/21

3.5 Weather Conditions and Observations

Weather conditions during the survey periods were suitable for environmental noise monitoring and are not considered to significantly affect any of the results.

During the noise survey periods, the weather conditions were clear and dry with little to no wind (< 4 m/s). The temperature ranged from approximately 9°C to 20°C

It is noted that a neighbours security alarm did sound during the hours of approximately 03:00 to 06:00.

4. Noise Survey Results

4.1 Ambient noise results

A summary of the noise results as well as daytime and night-time representative of the noise results can be seen below. It should be noted that the values presented for noise monitoring for both locations have been corrected for façade reflections (with a correctional value of -3 dB as per BS7445 criteria)

Table 4.1 Summary of Noise Results at Noise Monitoring Locations Front and Rear

	Noise measured at Front		Values Corrected to Freefield Conditions	
Indicator	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)
L_{Aeq}	72	63	69	60
L_{A10}	72	67	69	64
L_{A90}	58	33	55	30
L_{Amax}	103	89	100	86
	Noise measured at Rear		Values Corrected to Freefield Conditions	
Indicator	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)	Daytime (07.00-23.00) All values in dB(A)	Night-time (23.00-07.00) All values in dB(A)
L_{Aeq}	55	49	52	46
L_{A10}	56	51	53	48
L_{A90}	51	47	48	44
L_{Amax}	81	76	78	73

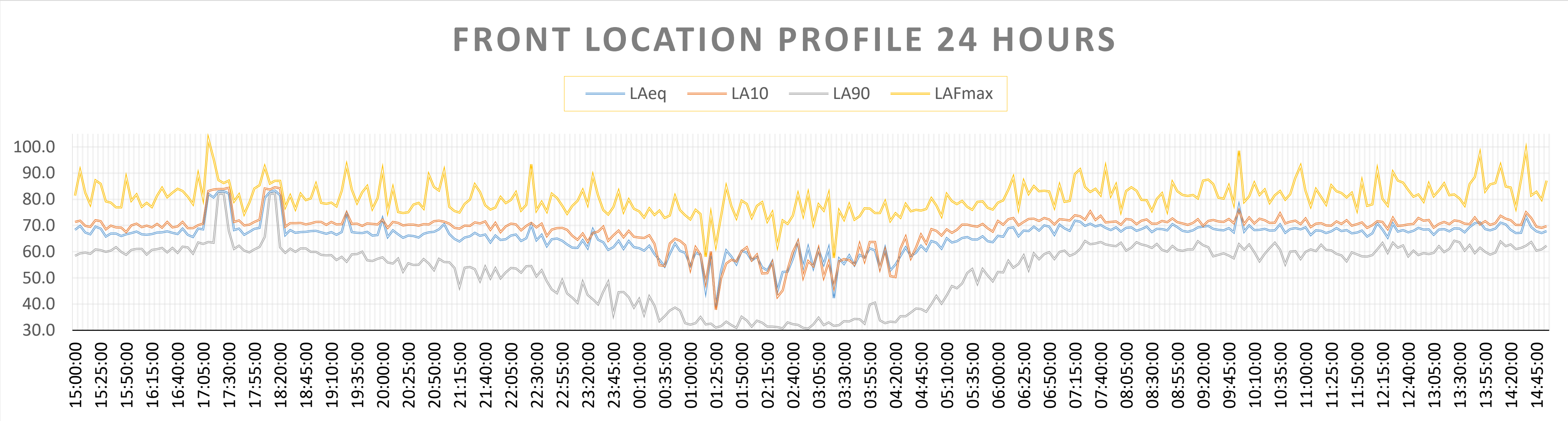
4.2 Octave Band results

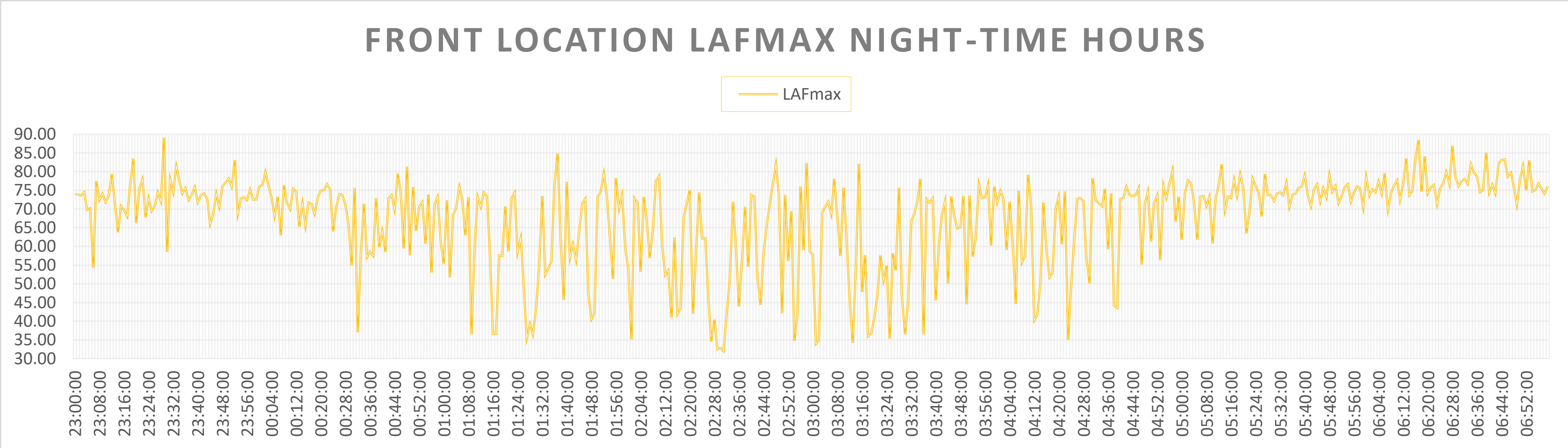
To account for possible plant noise at the rear of the proposed development, octave band monitoring was also carried out for 1hr during the day-time (when the plants were in operation). A summary of noise results has been presented below.

Table 4.2 Summary of Octave Band results at the backyard

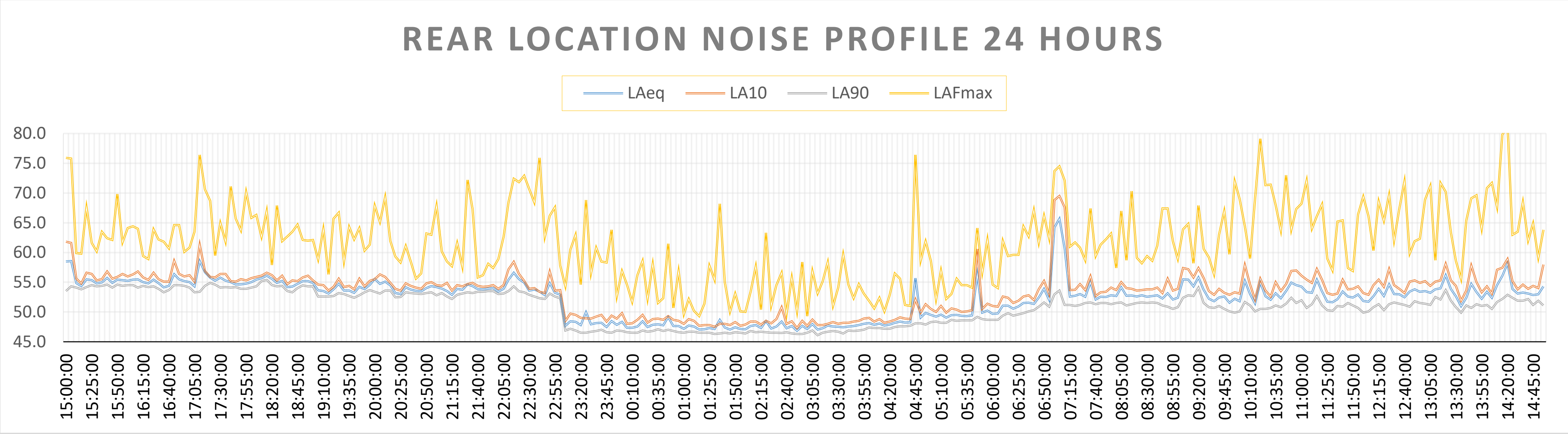
Frequency	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
Noise Levels dB	64.72	61.94	57.77	54.073	49.60	43.92	43.29	39.20

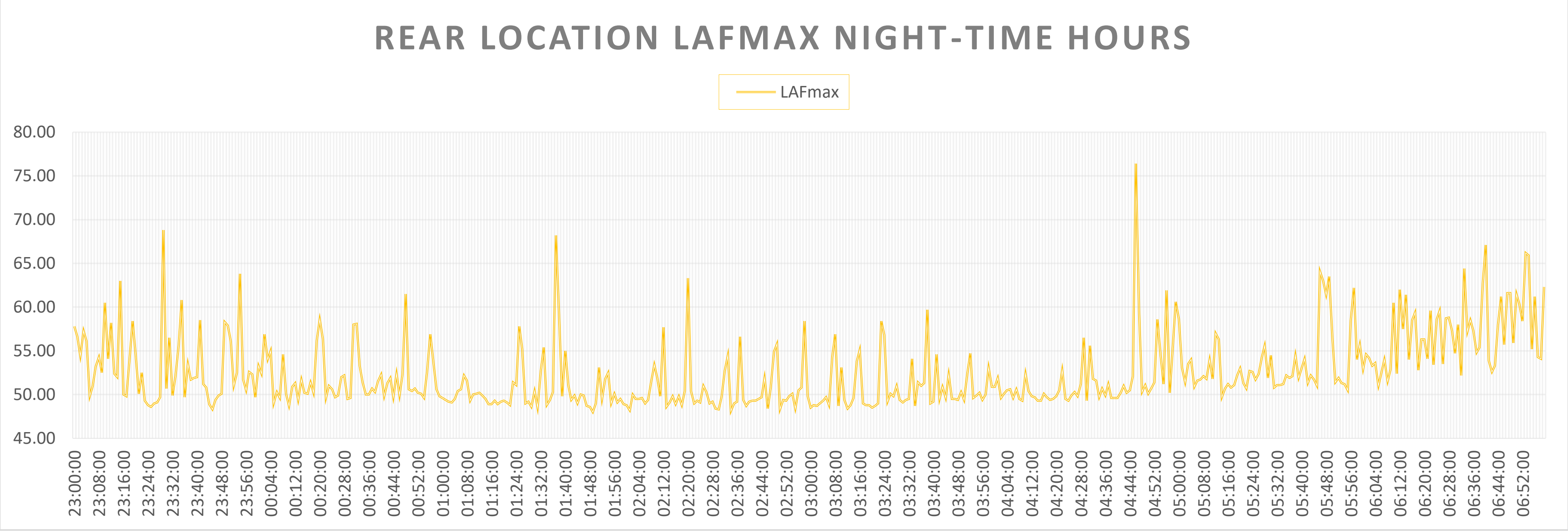
Graphs 4.1 Monitoring location at Front (not in free-field conditions)





Graphs 4.2 Monitoring location at Rear (not in free-field conditions)





5. Noise Impact Assessment

The predicted external noise levels have been compared with the WHO and BS:8223 target internal noise levels (see Section 2 of this Report) to derive the required noise reduction of façade/windows.

The internal target levels for bedrooms are based on guidelines laid out by BS:8223

- Day-time (07.00-23.00 hrs): 35dB(A)
- Night-time (23.00-07.00 hrs): 30dB(A)

5.1 Noise Impact of External Noise on Front of Residential Development

Referring to Section 4 of this Report and considering the nature of the noise from the external surroundings, the prevailing levels of noise recorded were compared to the BS8233 criteria mentioned above.

It was found that a minimum attenuation level of 69 – 35 = 34 dB is required during daytime and a minimum attenuation of 60 - 30 = 30 dB during the night- time. It should be noted that due to the monitoring location being on the proposed façade, distance corrections were required and the noise levels recorded were deemed as representative of the noise impact levels at the most sensitive facade.

ProPG and the WHO community noise guidelines also recommend that the peak noise in bedrooms should not exceed 45 dB LAmax more than 10 times per night. ProPG, Section 2.11 mentions that if there may be more than 10 noise events at night (2300 – 0700) with $L_{Amax,F}$ > 60 dB, the site should not be regarded as having a negligible risk. It further mentions that “behavioural awakening, is likely to occur where the maximum sound level at the façade of a building with partially open windows is above:

- 85 dB $L_{Amax,F}$ (where the number of events exceeding this value is ≤ 20); or
- 80 dB $L_{Amax,F}$ (where the number of events exceeding this value is > 20)”

Based on the night-time LAmax value recorded (refer to LAFmax graphs in Section 4), the proposed development cannot be defined as having a negligible risk for sleep disturbance. Based on the L_{Amax} values recorded and to provide a robust assessment and it was found that a minimum attenuation level of 86 – 45 = 41 dB is required to meet the above-mentioned Pro Pg and WHO criteria.

Therefore, on the overall, a minimum noise attenuation of 41 dB(A) is required for all the building facades.

5.2 Noise Impact of External Noise on Rear of Residential Development

It was found that a minimum attenuation level of 52 – 35 = 17 dB is required during daytime and a minimum attenuation of 46 - 30 = 16 dB during the night- time. It should be noted that due to the monitoring location being on the proposed façade, distance corrections were required and the noise levels recorded were deemed as representative of the noise impact levels at the most sensitive facade.

Based on the night-time LAmax value recorded (refer to LAFmax graphs in Section 4), the proposed development cannot be defined as having a negligible risk for sleep disturbance. Based on the L_{Amax} values recorded and to provide a robust assessment and it was found that a minimum attenuation level of 73 – 45 = 28 dB is required to meet the above mentioned Pro Pg and WHO criteria.

Therefore, on the overall, a minimum noise attenuation of 28 dB(A) is required for all the building facades.

The octave band noise levels monitored at the rear have also been considered and compared to the BS8233 internal requirements during day-time (which is approximately NR29 as per BS8233) to account for any lower frequency noise that could be present and the results have been tabulated below.

Table 5.1 Noise reduction required based on octave band measurements

Frequency	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
Noise Levels dB	64.72	61.94	57.77	54.07	49.60	43.92	43.29	39.20
NR 29	58.4	47.2	39	33.0	29.0	25.9	23.7	21.9
Noise Reduction Required	6.3	14.7	18.8	21.1	20.6	18.0	19.6	17.3

5.2.1 Ventilation and Overheating Risk Assessment

Based on the findings in Sections 4 and 5 of this report, the internal noise levels with open windows were evaluated as 69 - 15 = 54 dB during the day-time and 60 - 15 = 45 dB during night-time for the front and 52 - 15 = 38 dB during the day-time and 46 - 15 = 31 dB during night-time for the rear (assuming a partially open window attenuates 15dB as mentioned in BS8233).

In conjunction with the Acoustics and Ventilation Residential Design Guide 2020, the proposed development was found to have a high risk during daytime and a high risk during night-time for the front and no/low risk for the rear.

6. Proposed Mitigation Measures

Mitigation measures need to be in place to minimise the potential negative impacts in order to ensure that the internal noise limits are achieved, we would recommend the following scheme of mitigation measures as outlined below.

6.1 Non-Glazed Elements

It is currently understood that the non-glazed building façade elements of the proposed residential development would be comprised of masonry. To ensure robust mitigation, it is proposed that all external non-glazed elements of the building façade should be able to provide a sound reduction performance of at least 41 dB as deduced in section 5 of this report. This should be easily achieved as part of the design since the minimum acoustic performance required by the separating walls for purpose-built dwellings is 45dB (according to Part E of the Building Regulations 2010).

6.2 Glazed Elements

It is proposed that secondary glazing with a minimum acoustic performance of 41 dB(A) should be implemented to the front of the proposed development. It will also be ensured that the glazed elements at the rear of the development should have an acoustic performance of at least 28dB where the lower frequencies involved will also be considered as per the noise reduction values given in table 5.1. Examples showing the performance of such glazed elements have also been provided in Appendix C.

6.3 Ventilation Strategy

In consideration of the findings in Section 5.2.1 of the report, it is proposed that the use of acoustic trickle vents with attenuation characteristics ≥ 19 dB at the front and attenuation characteristics ≥ 3 dB at the rear, $D_{n,e,w.}$ can be implemented as a means for a continuous ventilation strategy and the required internal BS8233 noise criteria (refer to Section 5 of this report) will in turn be achieved with closed windows.

It is also proposed that a mechanical ventilation system can be used for a rapid purge at the front. The proposed system is a Vent Axia Lo-Carbon Sentinel Kinetic BH unit (See Appendix C) assumed to be running at 60% speed and the location of the unit can be seen in Appendix B.

Since the noise emission levels are mostly flat across all the frequency spectrums, no penalties have been imposed and the noise emission levels have been considered as the rating levels as per BS4142. The cumulative noise emission levels have been retrieved from the manufacturer, 36 dB (in the kitchen) and the noise impact level at the nearest bedroom façade (approximately 7m away) has been calculated using the formula below:

$$\mathbf{L_p = L_s - 20\log (R_1/R_2) = 29\ dB}$$

Where $\mathbf{L_p}$ *is the sound pressure level,*

$\mathbf{L_s}$ *is the sound level at source,*

$\mathbf{R_1}$ *is the distance between receptor and source (7m)*

$\mathbf{R_2}$ *is the distance between source and recorded distance (3m)*

The resulting noise impact level has been evaluated as 29dB (at bedroom façade) and this there will not be any adverse noise due to a standard wall partition would provide approximately 25 - 30 dB of noise reduction. Hence no further mitigation is required for the mechanical purge ventilation unit.

6.4 Construction Phase Mitigation Measures

6.4.1 Noise

The effects of noise can vary from a person to person. The negative impacts include a sensation of loudness, potential interference with speech communication, disturbance of work or leisure, and disturbance of sleep. It should be noted that within any neighbourhood, some individuals will be more sensitive to noise than others.

In order to assess instantaneous noise levels at any time, the instantaneous A-weighted sound pressure level, L_{pA} can be used. This will give an indication of the loudness and degree of speech interference from noise.

The most commonly used descriptor, however, is the equivalent continuous A-weighted sound pressure level, $L_{Aeq,T}$. The time period involved should always be stated as the figure is a mathematical average of all individual contributions of various sources during the reference period T. When assessing noise from individual events that may not always be present during a longer period L_{Aeq}, it can be useful to use a short reference period (e.g. 5min). As an alternative descriptor, the maximum sound pressure level, $L_{A(max)}$, or the one percentile level, L_{A01}, may be used.

Concerning noise levels, it is proposed that the absolute limit would be determined in accordance with BS5228-1:2009 and would be subject to an overall daytime noise limit of 75dB L_{Aeq}.

6.4.2 Vibration

The sensitivity of the human frame to vibration varies according to the axis of vibration relative to the human body (e.g. x, y, or z-axis) and the frequency of vibration. In general, except at very low frequencies, sensitivity is greater in the z-axis (i.e. head to foot). When setting vibration control targets it is reasonable to assume that people will normally be sitting or standing during the day and lying down during the night.

With an impulsive source of vibration, it is usual to measure the peak value attained from the beginning to the end of a drive. It is also usual to measure in terms of peak particle velocity (P.P.V) if the risk of damage to the building is the primary concern and there is also an interest in human reaction. If the concern is purely for human tolerance, then acceleration is the preferred parameter.

Vibrations, even of very low magnitude, may be perceptible to people and can interfere with the satisfactory conduct of certain delicate activities, e.g. operating theatres, use of very sensitive laboratory weighing equipment, etc.

Nuisance from vibration is frequently associated with the assumption that, if vibrations can be felt, then damage is consequently inevitable; however, considerably greater levels of vibration are required to cause damage to buildings and structures than to be perceived by the human body.

Vibrations from site activities to the neighbourhood may, therefore, cause anxiety as well as annoyance and can disturb sleep, work, or leisure activities. As with noise, in any neighbourhood, some individuals will be more sensitive to vibration than others.

6.4.3 Noise and Vibration Monitoring Technology

The following factors are typically used to assess the likelihood of disturbance caused by noise and vibration generating activities.

- Site location

The relative location of a site in relation to noise or vibration-sensitive receivers will be a determining factor. The closer a site is to sensitive premises, the higher the likelihood of complaints due to noise and vibration emanating from the site.

- Ambient noise and vibration levels

It is understood that the site surrounding is generally representative of a typical busy urban mixed-use adjacent to an ‘A’ road. The ambient noise and vibration are predominantly related to the existing road traffic movement.

- Duration of site operations

In general, the longer the duration of all on-site operations, the more likely it is that noise or vibration from the site will potentially be an issue. In this respect, good public relations are very important. Local residents may be willing to accept a new status of noise and vibration if they know and understand the source and the duration of all operations. Therefore, all site operations are to be carried out according to a stated schedule. Changes are to be notified to the local authority in advance.

- Hours of work

For any noise-sensitive premises, some periods of the day will be more sensitive than others. Times of site operation outside normal weekday working hours will also need consideration.

Noise control targets for the evening period in such cases will need to be stricter than those for the daytime and, when noise limits are set, the evening limit may have to be as low as 10 dB(A) below the daytime limit. Very strict noise control targets should be applied to any site which is to operate at night.

- Site Operation

People's attitudes to noise are always influenced by their attitudes to the noise source itself. Noise and vibration generated from a site will tend to be accepted more willingly by local residents if they consider that the site operator is adopting the best practicable means to avoid unnecessary noise.

- Noise and vibration characteristics

In many cases, the particular identity of noise and vibration will affect people’s judgement and appreciation of the signal itself. For example, the presence of a high-amplitude impulsive noise, accompanied by a vibration sensation would render the overall assessment slightly more onerous as “penalties” would need to be employed. These would comprise weightings to signals (e.g. 5dB (A) to a highly tonal or intermittent noise source).

6.4.4 Proposed Control Measures for Construction Noise

The contractor to ensure The Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974) will be used to reduce noise and vibration levels at all times.

Where practicable the control measures set out in BS 5228:2009 + A1:2014 Part 1 & Part 2, Section 8 will also be implemented.

The following noise and vibration control measures to be included as a minimum:

- Choice of methodology/technique for operations (including site layout) will be considered in order to eliminate or reduce emissions at sensitive locations;
- Fixed items of construction plant will be electrically powered in preference to diesel or petrol-driven;
- If any specialise fabrication is required, this will be undertaken off-site if possible;
- Noisy plant will be kept as far away as possible from sensitive areas;
- Each item of the plant used will comply with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 where reasonably available;
- Equipment will be well-maintained and will be used in the mode of operation that minimizes noise and shut down when not in use;
- Vehicles shall not wait or queue on the public highway with engines running (unless the engine is required to power the operation of the vehicle e.g. concrete wagon);
- Where possible deliveries will be arranged on a just-in-time basis to prevent vehicles from queuing outside of the site and
- All materials will be handled in a manner that minimizes noise.

6.4.5 Temporary Noise Barrier or Noise Insulation

Table E2 of BS 5228-1:2009+A1:2014 provides an example of time periods, averaging times, and noise levels associated with the determination of eligibility for noise insulation.

Noise insulation, or the reasonable costs thereof, will be offered by the developer or promoter to owners, where applied for by owners or occupiers, subject to meeting the other requirements of the proposed scheme, where the construction of the development causes, or is expected to cause, a measured or predicted airborne construction noise level that exceeds either of the following at property lawfully occupied as a permanent dwelling: the noise insulation trigger levels presented in Table E.2 for the corresponding times of day; and a noise level 5 dB or more above the existing pre-construction ambient noise level for the corresponding times of day; whichever is the higher; and for a period of 10 or more days of working in any 15 consecutive days or for a total number of days exceeding 40 in any 6 consecutive months.”

Table 6.1: An extract from BS Standard (Table E2 of BS 5228-1:2009+A1:2014)

Examples of time periods, averaging times and noise levels associated with the determination of eligibility for noise insulation

Time	Relevant time period	Averaging time, T	Noise insulation trigger level dB $L_{Aeq,T}$ [A)]
Monday to Friday	07.00 – 08.00	1 h	70
	08.00 – 18.00	10 h	75
	18.00 – 19.00	1 h	70
	19.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Saturday	07.00 – 08.00	1 h	70
	08.00 – 13.00	5 h	75
	13.00 – 14.00	1 h	70
	14.00 – 22.00	3 h	65
	22.00 – 07.00	1 h	55
Sunday and Public Holidays	07.00 – 21.00	1 h	65
	21.00 – 07.00	1 h	55

A) All noise levels are predicted or measured at a point 1 m in front of the most exposed of any windows and doors in any façade of any eligible dwelling.

6.4.6 Proposed Vibration Control Measures

This section presents an assessment of the potential risk regarding vibration generated by the construction works detailed in this document and the associated adverse effects on the surrounding area.

Estimated vibration levels have been evaluated against guidance presented in relevant British Standards to assess the likelihood of both structural damages to neighbouring buildings and the human response of the occupants.

Building Damage

According to BS 7385 Part 2 for residential or light commercial buildings, the threshold for the onset of potential cosmetic damage (i.e. formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces) to buildings varies with frequency. This ranges from a PPV of 15 mm/s at 4Hz, rising to 20mm/s at 15 Hz, and to 50 mm/s at and above 40Hz for transient vibration. BS 7385: Part 2 also states that the probability of building damage tends towards zero at 12.5 mm/s peak component particle velocity.

Subjective Response

According to guidance provided in BS 5228 Part 2, the threshold of vibration perceptible to humans lies around 0.14 to 0.3 mm/s. The Standard also indicates that a PPVs of around 1 mm/s in residential environments, as a first estimate, are likely to cause complaints, but can be tolerable provided prior warning and explanation of the works is given to residents; whilst, vibration magnitudes of around 10 mm/s are likely to be intolerable for more than a very brief exposure to this level.

As the exact equipment that will be used during the construction phase is not known, we propose the following criteria:

- 5 mm/s p.p.v. 'soft' limit; when exceeded, the contractor should temporarily halt works. Works should only be resumed after consultation with the local residents, and with extreme caution and
- 10 mm/s p.p.v. 'hard' limit; when exceeded, the contractor should stop work. Works should only continue after a thorough structural examination of the adjacent property, subsequent consultation with the local residents, and then with extreme caution. Should significant damage be identified, alternative methods of land remediation operations should be adopted.

6.4.7 Noise and Vibration Monitoring Equipment

A class 1 continuous noise monitor is proposed for the duration of the monitoring period. The location of the monitor should be placed to the site boundary adjacent to the nearest receptor located at the south of the proposed development.

For the vibration monitor, it is proposed that a suitable ground vibration monitor to be installed for the duration of the construction period.

A continuous alarm system will operate to ensure the site manager is alerted when the trigger level is exceeded.

6.5 Residual Impact

6.5.1 Construction Phase

Following the implementation of mitigation measures in accordance with the BS 5228-1 & 2 guidance, the residual impact is considered negligible. The construction management plan will reaffirm that the construction operations shall be limited to the following days and hours:

- 08:00 to 18:00hrs Monday to Friday;
- 08:00 to 13:00hrs Saturday;
- No construction operations on Sundays or public holidays;
- HGV movements shall not be permitted outside these hours during the construction phase without prior written approval from the Local Planning Authority; and
- Installation of equipment on-site shall not be permitted outside these hours without prior written approval from the Local Planning Authority.

7. Conclusions

An environmental noise survey has been undertaken for the proposed development at 45 Market Street, West Yorkshire, WF16 0EU, allowing the assessment of daytime and night-time levels likely to be experienced by the proposed development.

Predicted noise levels allowed a robust noise insulation proposal to be made to comply with a minimum value for required attenuation, which would, in turn, provide internal noise levels for all residential environments of the development commensurate to the relevant design standard.

Mitigation measures have also been provided for the construction phase as per BS5228.

Trickle vents will be required continuous ventilation and mechanical system ventilation will be required for the front rooms for mitigation measures should be required in order to protect the proposed habitable spaces from external noise intrusion.

It can, therefore, be concluded that the proposed development is not considered to conflict with any national, regional, or local noise planning policy.

Appendices

AVAL

Appendix A: Noise Indicators and Acoustic Terminology

Decibel scale - dB

In practice, when sound intensity or sound pressure is measured, a logarithmic scale is used in which the unit is the 'decibel', dB. This is derived from the human auditory system, where the dynamic range of human hearing is so large, in the order of 10^{13} units, that only a logarithmic scale is the sensible solution for displaying such a range.

Decibel scale, 'A' weighted - dB(A)

The human ear is less sensitive at frequency extremes, below 125Hz and above 16Khz. A sound level meter models the ears variable sensitivity to sound at different frequencies. This is achieved by building a filter into the Sound Level Meter with a similar frequency response to that of the ear, an A-weighted filter where the unit is dB(A).

Octave Bands

In order to completely determine the composition of a sound it is necessary to determine the sound level at each frequency individually. Usually, values are stated in octave bands. The audible frequency region is divided into 11 such octave bands whose centre frequencies are defined in accordance with international standards. These centre frequencies are: 16, 31.5, 63, 125, 250, 500, 1000, 2000, 4000, 8000 and 16000 Hertz.

Reference Time Interval, T

The specified time interval over which an equivalent continuous A-weighted sound pressure level is determined.

$L_{Aeq,T}$

The A-weighted equivalent continuous sound level. This is the sound level of a notionally steady sound having the same energy as the fluctuating sound over a specified measurement period, T.

$L_{A10,T}$

The A-weighted sound level exceeded for 10% of the specified measurement period, T.

L_{Amax}

The highest short duration A-weighted sound level recorded during a noise event.

L_{den}

The Lden (Day Evening Night Sound Level) or CNEL (Community Noise Equivalent Level) is the average sound level over a 24 hour period, with a penalty of 5 dB added for the evening hours or 19:00 to 22:00, and a penalty of 10 dB added for the nighttime hours of 22:00 to 07:00.

L_{night}

The A-weighted, Leq (equivalent noise level) over the 8 hour night period of 23:00 to 07:00 hours, also known as the night noise indicator.

L_{A90}

The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T.

Addition of noise from several sources

Noise from different sound sources combines to produce a sound level higher than that from any individual source. Two equally intense sound sources operating together produce a sound level which is 3dB higher than a single source and 4 sources produce a 6dB higher sound level.

Attenuation by distance

Sound which propagates from a point source in free air attenuates by 6dB for each doubling of distance from the noise source. Sound energy from line sources (e.g. stream of cars) drops off by 3dB for each doubling of distance.

Subjective impression of noise

Hearing perception is highly individualised. Sensitivity to noise also depends on frequency content, time of occurrence, duration of sound and psychological factors such as emotion and expectations. The following table is a guide to explain increases or decreases in sound levels for many scenarios.

Change in sound level (dB)	Change in perceived loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice as loud

Transmission path(s)

The transmission path is the path the sound takes from the source to the receiver. Where multiple paths exist in parallel, the reduction in each path should be calculated and summed at the receiving point. Outdoor barriers can block transmission paths, for example traffic noise. The effectiveness of barriers is dependent on factors such as its distance from the noise source and the receiver, its height and construction.

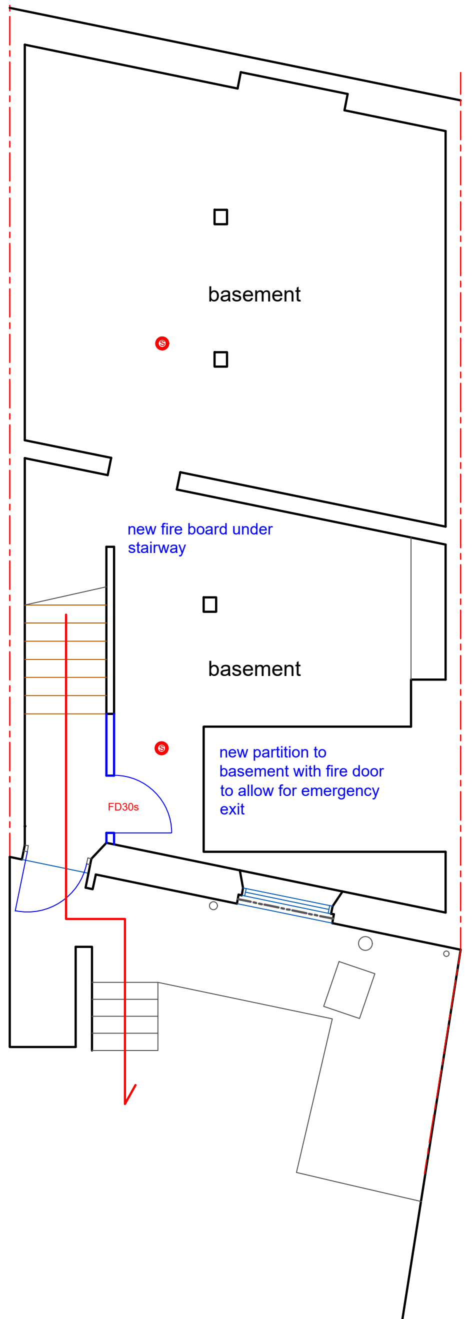
Ground-borne vibration

In addition to airborne noise levels caused by transportation, construction, and industrial sources, there is also the generation of ground-borne vibration to consider. This can lead to structure-borne noise, perceptible vibration, or in rare cases, building damage.

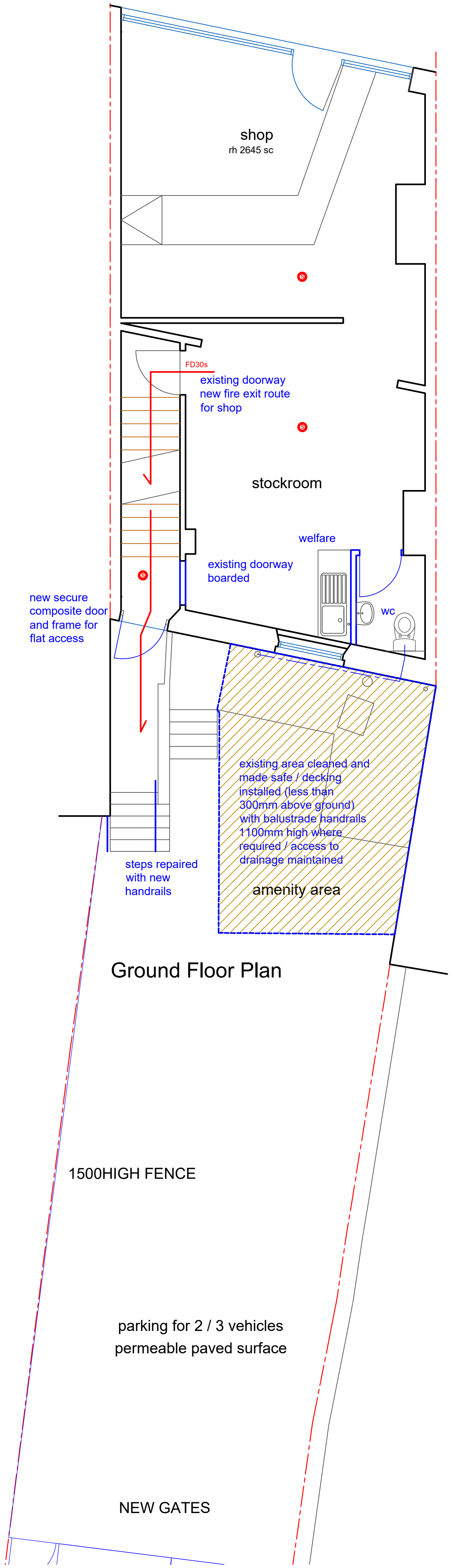
Sound insulation - Absorption within porous materials

Upon encountering a porous material, sound energy is absorbed. Porous materials which are intended to absorb sound are known as absorbents, and usually absorb 50 to 90% of the energy and are frequency dependent. Some are designed to absorb low frequencies, some for high frequencies and more exotic designs being able to absorb very wide ranges of frequencies. The energy is converted into both mechanical movement and heat within the material; both the stiffness and mass of panels affect the sound insulation performance.

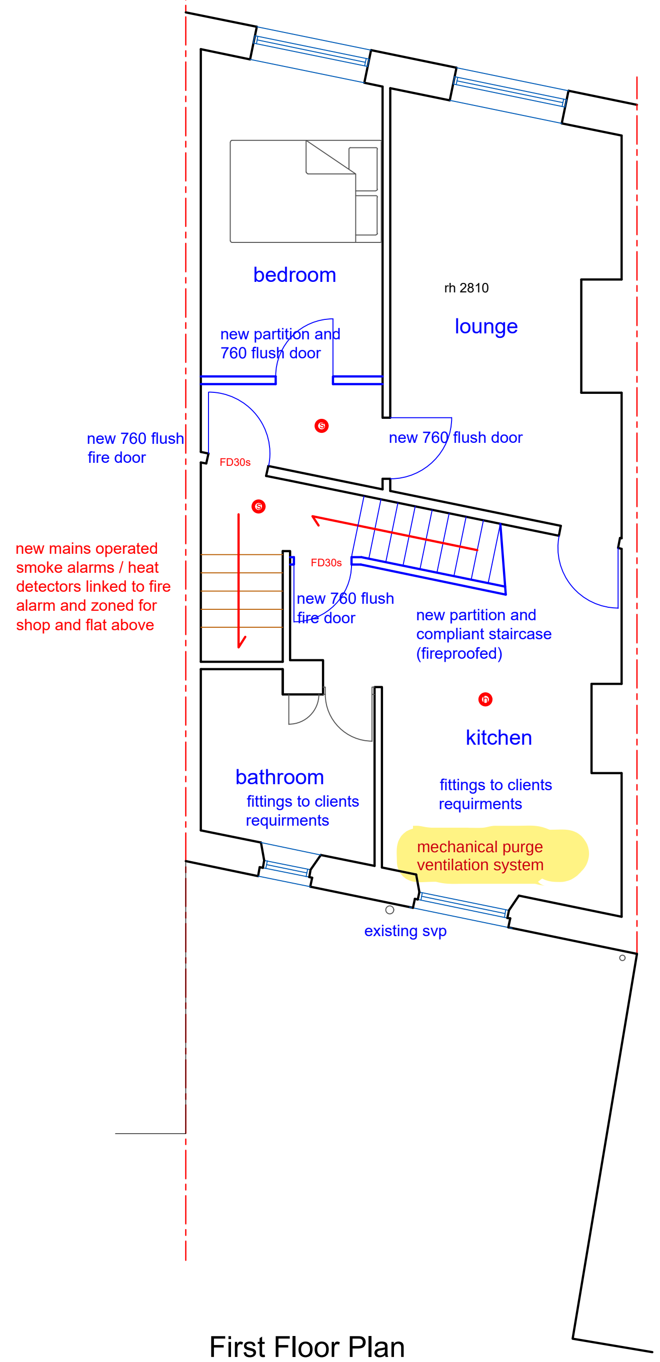
Appendix B: Site Drawings and Equipment Location



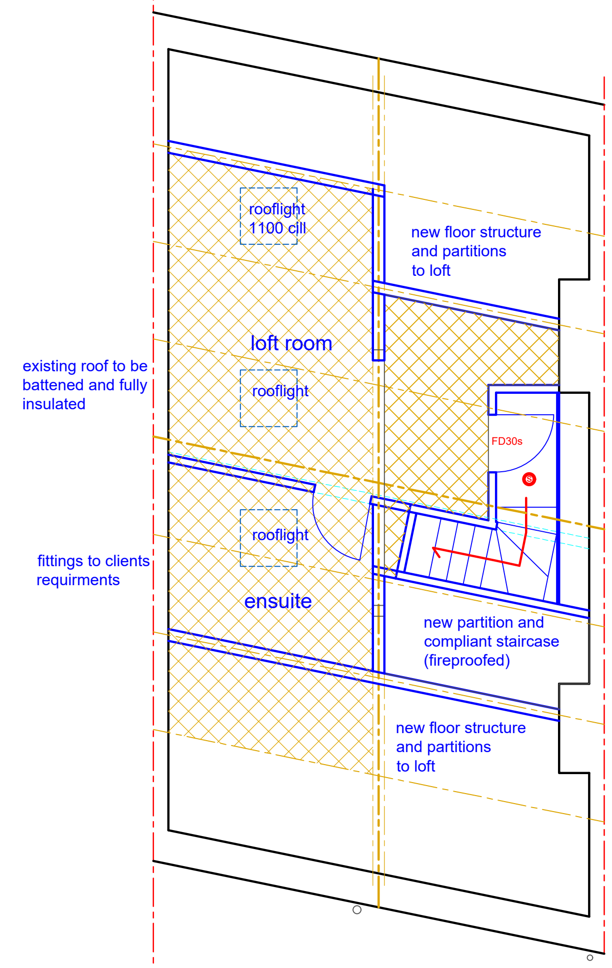
Basement Floor Plan



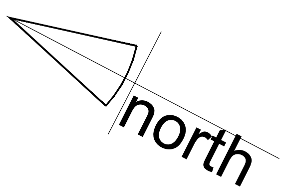
Ground Floor Plan



First Floor Plan



Loft Floor Plan



Status: Planning

Date: June 2021

Scale: 1:100

Drg No: MS04.#

Title: Proposed Plans

Project: Change of Use 45 Market Street, Heckmondwike

Appendix C: Proposed Mitigation

Vent-Axia®

The UK's Leading Ventilation Company

Acoustic Solution for New Build Residential

Edition 1.3

www.vent-axia.com/acousticsolution

No Noise, No Problem

Poor Indoor Air Quality (IAQ) has been linked to thousands of deaths every year in the UK – the quality of air in our homes is not only linked to the particles within the air but also the noise that travels through it. The effect of noise in the home is not just a mere inconvenience; research suggests that raised noise levels in the home can be hazardous to both physical and mental health.

The World Health Organization (WHO) claims that increased exposure to noise can lead to cardiovascular disease, cognitive impairment and negative effects on sleep. As a result of these findings, local authorities are under ever increasing pressure to tighten planning requirements around noise in residential new builds. The responsibility of achieving these reduced noise levels then falls to the acoustic consultants, under the guidance of BS 8233 and WHO guidelines.

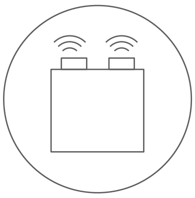
As well as being the most energy efficient option, Mechanical Ventilation with Heat Recovery (MVHR) is also the most effective form of ventilation to control IAQ in the home. Our MVHR products can filter the supply air down to PM2.5, and when used with our Pure Air Filter range can also offer NOX filtration. The Vent-Axia Sentinel Kinetic MVHR range also offers a full Acoustic Solution to reduce MVHR noise in the home, therefore ensuring reduced noise levels from the system – even with challenging targets.

With a comprehensive acoustic and filtration solution, Vent-Axia can offer a truly healthy indoor environment.

Vent-Axia®

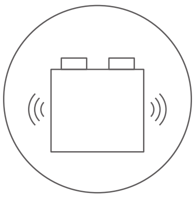
The Acoustic Solution

for reduced breakout and in-duct noise



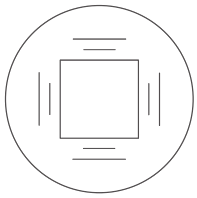
Reduced In-duct Noise

The Acoustic Top Box reduces in-duct noise in living areas, bedrooms and wet rooms. It also provides a neat enclosure for ductwork at the point of installation.



Reduced Breakout Noise

The Acoustic Enclosure reduces breakout noise from the MVHR unit, ensuring occupants are not disturbed by system noise throughout the dwelling.

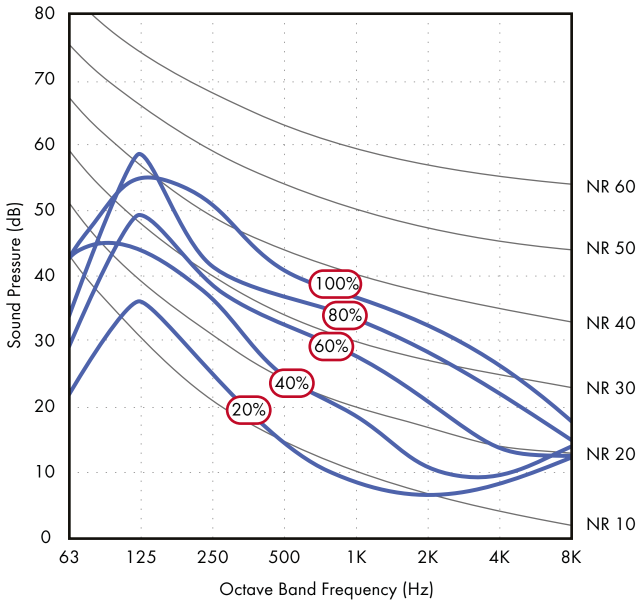


Anti-Vibration

The Acoustic Enclosure features internal anti-vibration mounts which prevent vibration passing from the unit through the fabric of the building.

Sound Data

Sentinel Kinetic Advance with Acoustic Solution NR Breakout Curves



Duty sound pressure curves shown @ 1m

Sentinel Kinetic Advance with Acoustic Solution

Speed	Test mode	Octave Band (Hz) Sound Power Levels, dB 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	54.7	50.5	41.5	30.8	18.6	14.7	18.2	24.0	38.0	20.5
	Extract	54.8	41.7	31.4	20.2	15.2	13.8	18.3	24.3	31.9	14.4
	Breakout	36.6	47.3	38.0	24.7	19.3	16.6	19.1	23.6	34.0	13.5
40%	Supply	61.0	57.7	56.0	39.0	27.5	16.6	18.4	24.1	48.9	31.4
	Extract	55.7	50.8	44.6	26.8	19.1	15.0	18.2	24.0	39.2	21.7
	Breakout	55.9	55.2	48.2	35.5	29.9	20.9	20.4	25.3	42.6	22.1
60%	Supply	64.5	64.3	56.2	48.6	36.0	22.8	19.0	24.2	52.3	34.8
	Extract	59.4	57.3	46.6	36.0	25.6	17.4	18.6	24.5	43.9	26.4
	Breakout	43.5	60.5	49.5	43.5	39.0	32.0	23.8	23.7	47.6	27.1
80%	Supply	68.9	65.9	59.9	53.9	41.4	29.3	21.6	24.7	55.9	38.4
	Extract	63.1	69.3	52.6	43.0	33.4	23.7	20.2	24.6	54.5	37.0
	Breakout	48.3	69.8	52.7	48.3	44.7	39.8	33.2	25.9	57.1	36.6
100%	Supply	72.5	70.5	63.1	56.1	43.9	33.0	23.7	25.2	59.3	41.8
	Extract	70.3	61.9	56.2	45.4	36.6	28.0	22.9	24.6	51.5	34.0
	Breakout	54.3	67.1	63.3	51.3	47.9	43.9	38.5	28.7	57.7	37.2

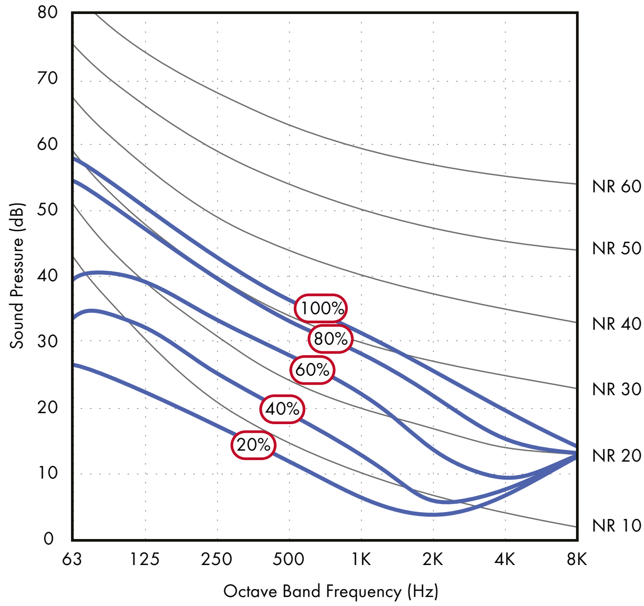
Sentinel Kinetic Advance without Acoustic Solution

Speed	Test mode	Octave Band (Hz) Sound Power Levels, dB 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	52.9	50.9	46.8	43.0	34.6	27.1	19.2	25.4	43.9	26.4
	Extract	50.3	49.0	36.0	31.5	23.6	16.1	18.9	25.3	36.4	18.9
	Breakout	34.6	34.8	35.7	34.9	29.6	25.1	21.0	25.3	36.0	15.5
40%	Supply	59.5	56.5	59.4	55.0	48.2	42.6	31.8	26.1	55.9	38.4
	Extract	51.9	51.3	50.4	41.2	35.0	25.3	19.8	25.4	44.8	27.3
	Breakout	40.2	42.6	46.5	45.4	41.0	36.2	25.5	25.3	46.5	26.0
60%	Supply	66.9	62.4	63.3	62.0	57.9	53.5	43.4	34.2	63.2	45.7
	Extract	60.6	60.3	54.2	49.5	44.4	36.2	27.9	26.3	51.7	34.2
	Breakout	45.5	49.8	52.5	53.1	49.7	46.7	36.2	26.9	54.5	34.0
80%	Supply	82.4	67.6	65.2	67.6	64.2	60.8	50.8	43.2	69.2	51.7
	Extract	75.5	68.6	59.3	56.0	48.3	44.2	36.9	31.3	58.6	41.1
	Breakout	59.2	55.0	56.8	60.0	55.4	53.9	44.1	33.4	61.0	40.5
100%	Supply	79.4	69.6	66.6	75.1	64.9	63.6	53.4	45.7	73.7	56.2
	Extract	72.4	70.5	60.5	56.4	49.8	46.3	39.0	33.4	59.5	42.0
	Breakout	63.0	57.1	58.5	63.7	56.8	55.9	46.4	36.2	63.5	43.0

Tested according to BS EN 13141-7:2010. Breakout quoted spherical. Supply and Extract quoted hemispherical. For in-duct data, end reflections are added based on the spigot size of the unit.

Sound Data

Sentinel Kinetic BH & V with Acoustic Solution NR Breakout Curves



Duty sound pressure curves shown @ 1m

Sentinel Kinetic BH & V with Acoustic Solution

Speed	Test mode	Octave band, Hz, dB SWL 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	57.1	44.6	36.4	27.9	20.6	14.8	18.1	23.8	35.2	17.7
	Extract	54.4	40.1	29.6	22.2	17.5	14.5	17.8	23.5	31.1	13.6
	Breakout	37.5	33.8	29.1	22.9	17.0	14.0	17.8	23.6	27.7	7.2
40%	Supply	64.9	56.3	46.4	36.1	28.2	15.4	18.1	23.8	44.6	27.1
	Extract	60.2	46.8	35.7	28.2	21.9	14.8	18.1	23.7	36.6	19.1
	Breakout	46.0	43.6	36.3	30.4	23.9	15.9	18.1	23.6	33.5	13.0
60%	Supply	72.3	63.0	55.6	43.1	34.1	19.5	18.6	24.0	51.9	34.4
	Extract	61.4	53.3	43.4	34.7	27.2	15.5	18.1	23.8	41.4	23.9
	Breakout	52.2	50.5	44.4	38.2	33.5	23.8	19.3	23.8	41.0	20.5
80%	Supply	73.8	67.9	61.6	50.0	38.6	23.4	20.2	25.2	56.8	39.3
	Extract	68.6	58.2	50.5	40.5	31.1	17.2	18.2	23.9	47.5	30.0
	Breakout	65.6	55.5	50.5	43.8	39.7	32.7	24.9	24.0	47.4	26.9
100%	Supply	77.3	70.8	64.9	53.8	41.4	26.3	21.9	26.8	60.1	42.6
	Extract	71.5	60.6	53.5	43.9	33.4	19.1	18.5	24.0	50.5	33.0
	Breakout	69.0	58.4	53.4	47.1	43.0	37.5	29.9	24.9	51.1	30.6

Sentinel Kinetic BH & V without Acoustic Solution

Speed	Test mode	Octave band, Hz, dB SWL 63	125	250	500	1k	2k	4k	8k	LwA	SPL dB(A) @ 3m
20%	Supply	52.9	52.9	46.5	41.7	39.3	29.3	19.3	22.8	44.4	26.9
	Extract	50.7	41.9	37.4	34.5	29.8	17.7	17.4	22.7	35.7	18.2
	Breakout	36	34.5	33.6	34.3	33.8	27.2	22.2	25.3	37.2	16.7
40%	Supply	57.1	64.1	56.8	50.6	49.7	41.1	32.8	26.4	54.7	37.2
	Extract	55.2	50.3	44.9	43	38.3	27.7	19.8	22.9	43.8	26.3
	Breakout	43.5	41.7	40.4	41.3	41.7	36.1	27.8	26.2	44.7	24.2
60%	Supply	71.3	72.5	68.5	57.6	56.4	51.1	42.7	38.1	63.6	46.1
	Extract	60.2	56.3	52	48.8	44.8	35.5	26.9	24.4	50.2	32.7
	Breakout	50.7	47.8	47.7	47.7	48.3	44.9	36.7	30	51.8	31.3
80%	Supply	66.3	74.8	71.2	62.8	61	56.3	49.8	46.7	67.3	49.8
	Extract	63.8	59.4	57.6	53.8	49.2	41.2	33.5	29	55.0	37.5
	Breakout	54.4	52.7	54	52.7	53.5	50.3	43.6	37.7	57.2	36.7
100%	Supply	70.3	75.7	73.9	66.3	63.5	59.7	53.2	50.6	70.0	52.5
	Extract	66.6	63.9	60.9	56.5	51.2	44.2	36.8	32.6	57.9	40.4
	Breakout	59.1	55.2	56.8	55.6	56.1	53.5	47.1	41.6	60.1	39.6

Tested according to BS EN 13141-7:2010. Breakout quoted spherical. Supply and Extract quoted hemispherical. For in-duct data, end reflections are added based on the spigot size of the unit.

Sound insulation data for Pilkington **Optiphon™**

Glass	Sound reduction index (dB)									
	Octaveband Centre Frequency (Hz)						R_w (C; C_{tr})	R_w	R_w+C	R_w+C_{tr}
	125	250	500	1000	2000	4000				
Single glazing										
6.8 mm Pilkington **Optiphon™**	22	26	31	37	40	40	36 (-1; -4)	36	35	32
8.8 mm Pilkington **Optiphon™**	27	29	34	38	40	43	37 (0; -2)	37	37	35
10.8 mm Pilkington **Optiphon™**	26	30	35	39	40	46	38 (-1; -3)	38	37	35
12.8 mm Pilkington **Optiphon™**	29	32	36	41	42	51	40 (-1; -3)	40	39	37
16.8 mm Pilkington **Optiphon™**	31	33	38	41	43	54	41 (-1; -3)	41	40	38
Insulating glass units										
6 mm / 16 mm argon / 6.8 mm Pilkington **Optiphon™**	21	28	37	48	48	54	40 (-2; -6)	40	38	34
6 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon™**	25	27	38	48	47	55	41 (-2; -6)	41	39	35
8 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon™**	21	30	39	47	50	55	42 (-3; -8)	42	39	34
10 mm / 16 mm argon / 8.8 mm Pilkington **Optiphon™**	28	31	42	45	50	58	44 (-2; -6)	44	42	38
10 mm / 20 mm argon / 8.8 mm Pilkington **Optiphon™**	28	36	43	47	49	58	46 (-2; -6)	46	44	40
8.8 mm Pilkington **Optiphon™** / 16 mm argon / 12.8 mm Pilkington **Optiphon™**	28	36	45	53	56	64	48 (-2; -7)	48	46	41
10.8 mm Pilkington **Optiphon™** / 24 mm argon / 16.8 mm Pilkington **Optiphon™**	35	41	48	53	55	65	52 (-2; -6)	52	50	46
12.8 mm Pilkington **Optiphon™** / 20 mm argon / 16.8 mm Pilkington **Optiphon™**	35	45	49	50	54	65	51 (-1; -4)	51	50	47

Measurements undertaken in accordance with BS EN ISO 10140 and Rw (C; C_{tr}) determined in accordance with BS EN ISO 717-1.
For insulating glass units, there is little difference in the sound insulation for cavity widths in the range 6 to 16 mm.
To calculate performance data for Pilkington products, please use our Spectrum online calculator at https://spectrum.pilkington.com/
For glass combinations to achieve an R_w value higher than 52 dB, please contact us for more details.

Acoustic Ventilation

Noise attenuating ventilation

About Acoustic Ventilation

Fresh air in or out – no noise.

The Acoustic Ventilation range ensures the required level of ventilation is provided whilst reducing the transfer of noise when dwellings are situated close to busy roads and airports. A full range of window and wall ventilators are available, including the highest performing product in the UK.

Need help specifying a product?

If you can't work out which product you need, or how to provide ventilation in the most efficient way for your homes we can help you! Our dedicated team of Area Managers and Technical Advisors understand the impact of specifying products into new and existing homes.

Call us with your questions or email us at

orders@greenwood.co.uk

Head Office

01276 605800

Customer Services

01276 408404

Technical Services

01276 408402

Noise pollution

Noise is a nuisance and the last thing that you want in the comfort of your own home. In new build, particularly, it has become an increasing issue as a result of brownfield re-development and density planning guidance notes. What this has meant is that homes have more probability of being sited close to busy roads, railways and airports, meaning more noise which has an impact on the domestic environment.

Noise guidance covers three specific areas;

- Planning permission
- Internal noise levels
- Ventilation system noise levels

All three are relevant to ventilation as all systems require external penetrations in the façade of the building which can allow noise transfer.

Considering noise and domestic ventilation together

If life was simple then noise issues would be simply dealt with by swapping standard products for acoustic products.

In some circumstances, this may be achievable. However, the nature of acoustic products means that they are generally larger than their standard counterparts, meaning a like-for-like installation cannot always be achieved. Multiple installations, to achieve higher ventilation rates, of the same product can also affect acoustic performance.

With this in mind, noise and ventilation must be considered together at the design stage, especially as the noise factor may actually pre-determine the method of ventilation that can be used within the dwelling. This sometimes means that certain building elements can no longer be used as a source of ventilation, e.g. windows.

In this instance it may be essential to provide acoustic ventilation solutions that provide the necessary airflow, but reduce noise transfer.

Whole house systems that have limited penetrations in the façade of a building often work well, however a whole range of individual products, such as airbricks and wall ventilators, are available with reductions of up to 55dB.

The best thing to do is ask – too often buildings have been built and then acoustic ventilation has been thought about, thus reducing options and sometimes meaning costly re-works on-site.

What is acceptable noise?

"It is imperative that acoustic ventilation is considered at the design stage, as the noise factor may pre-determine the entire method of ventilation that is most suitable for the dwelling."

Measuring sound and attenuation

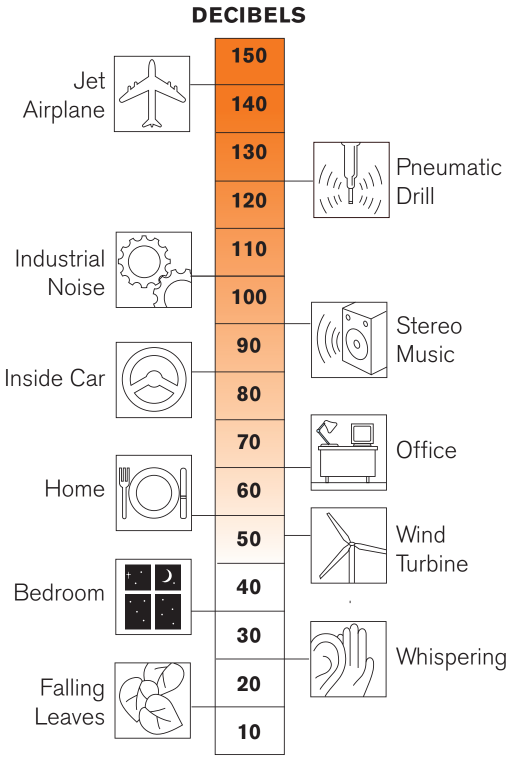
Sound can be measured in two ways:

- Intensity/loudness of sound is measured in decibels (dB)
- Pitch of sound is measured in frequency of vibrations per second

The decibel scale runs from the faintest sound the human ear can detect (0dB) to over 180dB that is similar to the noise a rocket creates during a launch.

Acoustic ventilation solutions from Greenwood have been independently tested to the latest test standard: BS EN ISO 717-1: 1997 and include varying performance as different frequencies, e.g. pink noise/white noise.

Copies of all test data are available on request.



Acoustic values and denominations

Dn,e,w: Single value 'weighted average' of the total single Dn,e values within the frequency range. This value denotes the characteristic of the acoustic element and acoustic consultants prefer using this as reference for product requirements. All Greenwood passive solution performance information is presented as Dn,e,w.

Dn,e: Single acoustic insulation value at a given frequency, measured during acoustic test for small building elements. Frequency range from 100 – 3150Hz in 1/3 octave bands.

C: Known as 'pink noise'. Refers to internal noise and some specific external noise sources.

Types of noise: Railway traffic at medium/high speeds, highway road traffic > 80km/h, jet aircraft at short distance and factories emitting medium and high frequency noise.

Ctr: Known as 'road traffic noise' or the transfer of outdoor noise to indoor noise and focuses on the lower spectrum of the frequency range.

Types of noise: Urban road traffic, railway traffic at low speeds, jet engines at large distance, disco music and factories emitting low and medium frequency noise.

Note: Both C and Ctr are commonly referenced together with Dn,e,w values for example Dn,e,w 35(-1;-3) meaning the product provides 34dB insulation for C noise and 32dB for Ctr noise.

Noise transfer

BS8233: 1999 Sound Insulation and Noise Reduction in Buildings defines a reasonable standard of internal noise for habitable rooms:

Room type	BS8233 design criterion road traffic noise; LAeqT		Time period
	Good	Reasonable	
Living/Dining	30dB	40dB	Daytime 07.00–23.00
Bedroom	30dB	35dB	Nighttime 23.00–07.00

The issue of noise

Since the 1950s the development of home entertainment products, brownfield sites and growth in transport has increased noise levels within the domestic environment. This increase has coincided with a decline in community spirit between neighbours and, with people becoming less tolerant of noise, complaints have increased.

Section 79 of the Environmental Protection Act (England & Wales) and Control of Pollution Act (Scotland) both cover statutory nuisances including 'noise emitted from premises so as to be prejudicial to health or a nuisance'.

Regulations, standards and guidelines in respect of planning building design, construction and use are numerous and becoming more complex. This has led to a review of existing methodology and the controls used to ensure compliance.

Building Regulations ADF 2010

Noise from continuously running systems has also moved up the agenda and suggested sound power levels where continuously running systems are used should not exceed the following levels:

Bedroom/living rooms

An upper limit of 30dB(A) weighted sound power level

Kitchens/bathrooms

An upper limit of 35dB(A) weighted sound power level

2500EA / 5000EA

Acoustic window ventilator

Physical specification

All measurements in millimetres unless otherwise indicated

Materials: Aluminium Alloy

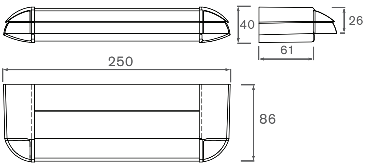
Installation

1. Prepare the window frame with the correct slot sizes.

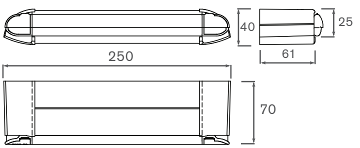
2. Use the self tapping screws to install the acoustic parts.

3. Use standard pyramid vent screws to install the canopy and vent.

2500EA Acoustic

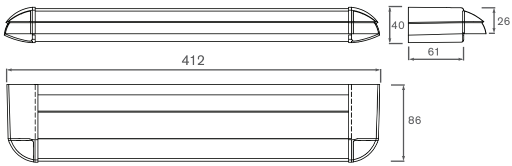


External

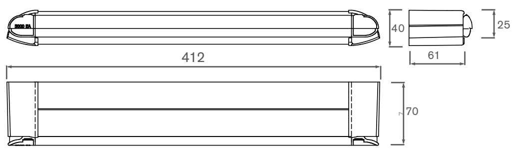


Internal

5000EA Acoustic



External



Internal

2500EA Acoustic slot size

Height: 13mm

Length
192mm

5000EA Acoustic slot size

Height: 13mm

Length	Central gap	Length
172mm	10mm	172mm

The best of both worlds... achieves Building Regulations' EA requirements along with fantastic acoustic performances up to 45dB(A)

Features and benefits

- Smallest acoustic window vents providing 2500mm² or 5000mm² equivalent area ventilation on the market
- Achieves the best acoustic performance for window ventilators available within the UK – up to 45dB(A)
- A simple, yet adaptable, solution to meet required specification/ Building Regulation requirements incorporating both high levels of equivalent area ventilation and acoustic noise reduction
- Modularity of acoustic sets provides flexibility for installation and acoustic performance
- Aesthetically pleasing design which is easy to open and control by the homeowner
- Excellent airtightness performance with upward air deflection to reduce the risk of draughts
- May require add on section in some window installations

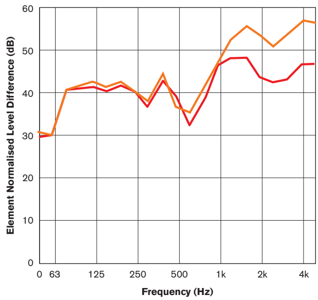
Sets comprise of:

1 EA vent + 1 external acoustic module – providing noise reduction with discreet internal aesthetics.

1 EA vent + 2 acoustic modules (for internal and external install) – providing maximum noise reduction.

Performance

2500EA acoustic performance

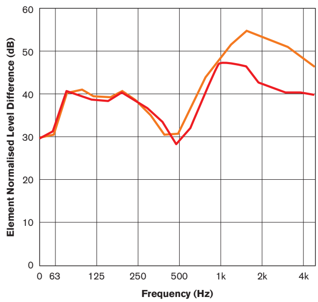


Key

2500EAW.AC1

2500EAW.AC2

5000EA acoustic performance



Key

5000EAW.AC1

5000EAW.AC2

Models, control options and key data

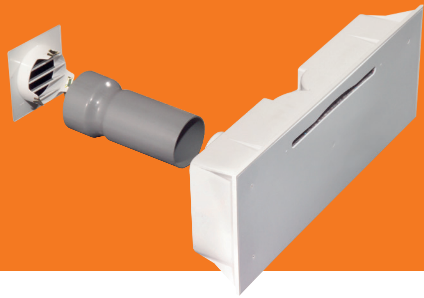
Product code	Description	Controls	Acoustic performance Dn,e,w	Dn,e,w (C)	Dn,e,w (Ctr)	Equivalent area mm²	Colour
2500EAW.AC1 *	Vent + 1 Acoustic External Module	Front	42dB(A)	41dB	40dB	2670	White
2500EAW.AC2 *	Vent + 2 Acoustic Modules	Front	45dB(A)	43dB	42dB	2670	White
5000EAW.AC1 *	Vent + 1 Acoustic External Module	Front	39dB(A)	38dB	37dB	5350	White
5000EAW.AC2 *	Vent + 2 Acoustic Modules	Front	42dB(A)	40dB	38dB	5350	White

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

MA3051

Acoustic wall ventilator



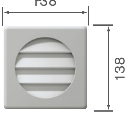
Physical specification

All measurements in millimetres unless otherwise indicated

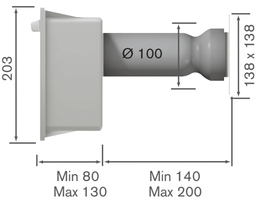
Weight: 2.65kg

Materials:

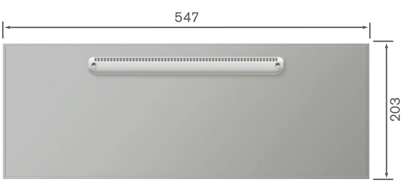
PVC: Casing for wall vent, duct, external grille and internal ventilator. Acoustic lining and material inside wall vent.



External grille



Side



Internal

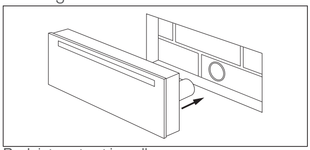
Features and benefits

- Highest performing acoustic background ventilator
- Provides acoustic attenuation to Dn,e,w 55dB(A)
- 2500mm^2 equivalent area performance
- Suitable for external wall thicknesses of 140mm and above
- Can be installed in internal wall constructions of between 100mm and 150mm
- Supplied with internal controllable vent and white/sand external grilles
- Conforms to acoustic requirements of Noise Insulation Regulations (NIR) 1975, one of only a small number of products available in the UK

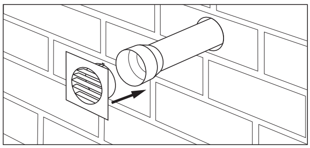
Installation

Instructions are provided with product including wall template for cut out. Bonding compound is required to complete installation.

Protective strip to protect internal unit until decoration is complete within dwelling.



Push into cut out in wall.



Push fit external grille.

Performance

Key

MA3051

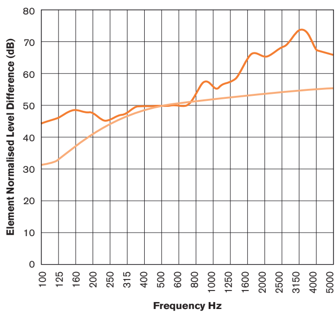
NIR 1975

Acoustic performance

Dn,e,w: Average weighted performance across frequency range

C: Pink noise

Ctr: Road noise



Models, control options and key data

Product code	Operation	Acoustic performance Dn,e,w	Dn,e,w (C)	Dn,e,w (Ctr)	Equivalent area mm^2
MA3051 *	Internal controllable trickle ventilator	55dB	54dB	52dB	2500

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

AWV39

Acoustic wall ventilator

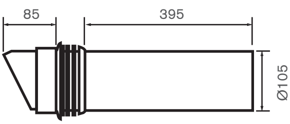
Physical specification

All measurements in millimetres unless otherwise indicated

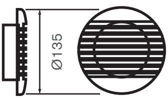
Weight: 0.74kg

Materials: PVC

External grille (supplied separately)



Internal

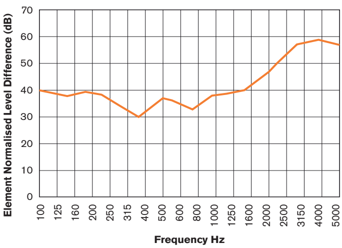


Side

Features and benefits

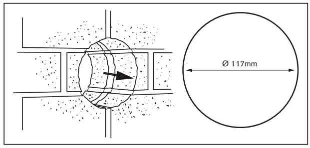
- Designed for use in refurbishment applications
- Provides acoustic attenuation to Dn,e,w 39dB
- 2500mm² equivalent area performance
- Suitable for wall thicknesses 255–370mm

Performance

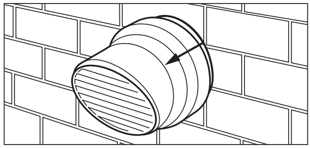


Acoustic performance
Dn,e,w: Average weighted performance across frequency range
C: Pink noise
Ctr: Road noise

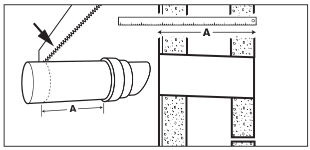
Installation



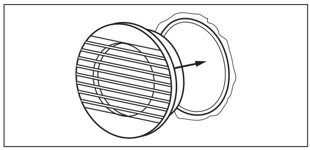
Using a 117mm core drill, cut a hole through wall.



Measure wall thickness and cut down plastic sleeve as required.



Push the sleeve through the wall. The seal will automatically sit between the sleeve and the external grille, providing a watertight fit.



Push fit internal grille.

Models, control options and key data

Product code	External grille colour	Acoustic performance Dn,e,w	Dn,e,w (C)	Dn,e,w (Ctr)	Equivalent area mm²
AWV39B *	Brown	39dB	39dB	37dB	2500
AWV39W *	White	39dB	39dB	37dB	2500

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

EAR42W

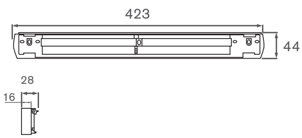
Acoustic window ventilator

Physical specification

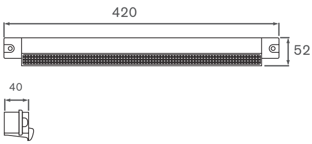
All measurements in millimetres unless otherwise indicated

Materials: ABS

Internal



Acoustic spacer



Features and benefits

- One of the best performing acoustic window ventilators available in the UK
- Provides an outstanding Dn,e,w; 42dB(A) for areas with high external noise transmission
- Humidity control to regulate supply of fresh air effectively throughout the day in response to changing indoor humidity levels
- Manual override control option for occupants to ensure a comfortable environment at all times
- Upward air deflection to eliminate replacement air causing draughts
- Manufactured from ABS – available in white as standard
- May require add on section in some window installations

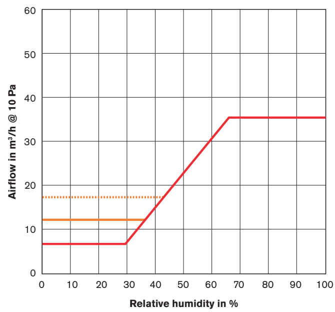
Slot size

Height: 12mm

Length	Central gap	Length
172mm	10mm	172mm

Route slot in window frame as required and screw ventilator over holes.

Performance



Key

EAR² 5-35m³/h

EAR² 17-35m³/h

EAR² 11-35m³/h

Acoustic performance
Dn,e,w: Average weighted performance across frequency range
C: Pink noise
Ctr: Road noise

Models, control options and key data

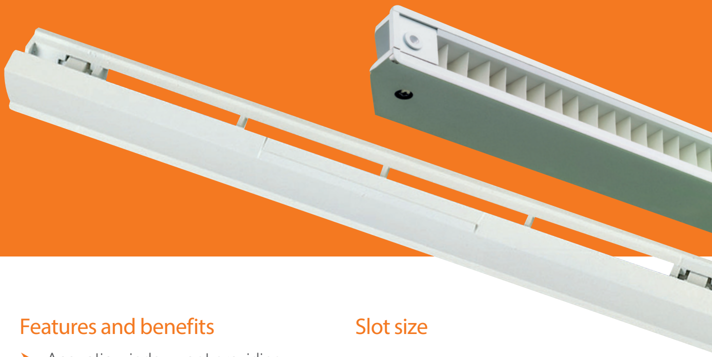
Product code	Controls	Acoustic performance Dn,e,w	Dn,e,w (C)	Dn,e,w (Ctr)	Equivalent area mm²	Colour
EAR42W *	Bottom	42dB(A)	42dB	42dB	3912	White

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

DN Vent

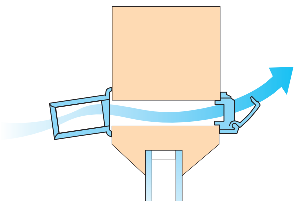
Acoustic window ventilator

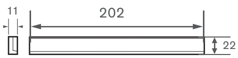


Physical specification

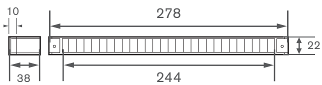
All measurements in millimetres unless otherwise indicated

Materials: ABS





1600DN (external)



2000D (internal)

Features and benefits

- Acoustic window vent providing attenuation up to Dn,e,w 37dB(A)
- 1400mm^2 equivalent area
- Internal unit (D Vent) provides upward deflection
- Suitable for installation up to two floors only

Slot size

External 1600DN

Height: 15.5mm

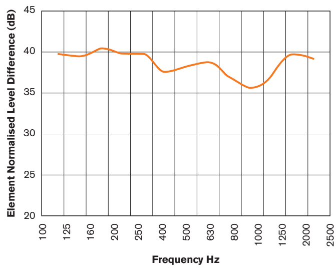
Length
240mm

Internal 2000D

Height: 15.5mm

Length
165mm

Performance



Acoustic performance
Dn,e,w: Average weighted performance across frequency range
C: Pink noise
Ctr: Road noise

Models, control options and key data

Product code	Description	Controls	Acoustic performance Dn,e,w	Acoustic performance Dn,e,w (C)	Acoustic performance Dn,e,w (Ctr)	Equivalent area mm²	Colour
1600DNFW *	Complete unit with D Vent internal	Front	37dB(A)	36dB	34dB	1400	White

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

AAB

Acoustic airbrick

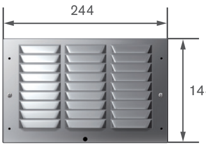
Physical specification

All measurements in millimetres unless otherwise indicated

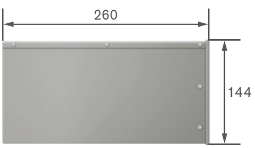
Weight: 6.5kg

Materials:

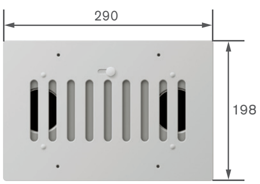
Casing – pre-galvanised grey steel. Two steel plate baffles support the perforated aluminium airways encased in sound absorbent mineral wool. An outer baffle assembly and acoustic linings are set behind louvred external grille.



External fascia



Side

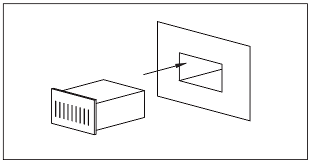


Internal fascia

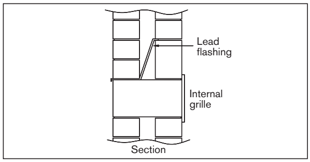
Features and benefits

- Provides acoustic attenuation to Dn,e,w 46dB
- Acoustic background ventilator
- 2500mm^2 equivalent area
- Supplied with internal hit & miss and external louvred grilles

Installation

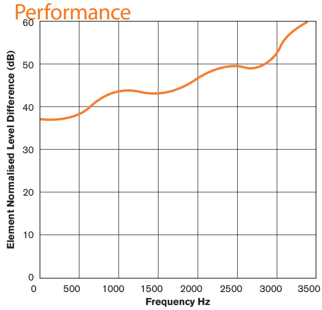


Existing dwellings: Cut an opening 240mm x 165mm through the wall.



New buildings: Build into inner leaf of cavity of wall at least one course above ventilator. Lead flashing to extend 100mm beyond the ventilator on each side.

Performance



Acoustic performance
Dn,e,w: Average weighted performance across frequency range
C: Pink noise
Ctr: Road noise

Models, control options and key data

Product code	Acoustic performance Dn,e,w	Dn,e,w (C)	Dn,e,w (Ctr)	Equivalent area mm^2
AAB *	46dB	46dB	44dB	2500

* Pricing is variable depending on quantity ordered - please call for details

UKAS ACCREDITATION INDEPENDENTLY ACCREDITED TEST INFORMATION

Product ordering information

Product Selector

Ventilation Options		Page No.	Mounting Options	Control Options	Extract or replacement air ventilation	Airflow Performance	Acoustic performance (Dn,e,w)
AAB		133	Wall	–	Replacement	2500mm²	46dB
MA3015		134	Wall	–	Replacement	2500mm²	55dB
AWV39		135	Wall	–	Replacement	2500mm²	39dB
EAR42W		136	Window	B	Replacement	3925mm²	42dB(A)
DN Vent		137	Window	F	Replacement	1400mm²	37dB(A)
2500EA		138	Window	F	Replacement	2670mm²	45dB(A)
5000EA		138	Window	F	Replacement	5350mm²	42dB(A)

Appendix D: Certificates

CERTIFICATE OF CALIBRATION

Class 1

TYPE: BSWA 308 **S/N:** 590144

京制01020122号

1. APPEARANCE Pass

2. CALIBRATION (sound)

Calibrator BK4231 Sound Level 93.8 dB Frequency 1000 Hz

Microphone Model / SN MP231 /580464

Filter	Nominal[dB]	Indication[dB]	Error[dB]
A	93.8	93.8	0.0
C	93.8	93.8	0.0
Z	93.8	93.8	0.0

3. FREQUENCY WEIGHTINGS (sound & electrical)

Z-weighting (sound & electrical); A/C-weighting (electrical, plus Z-weighting error)

Frequency [Hz]	Attenuation[dB] A	C	Z
10	-69.0	-14.3	0.0
20	-50.3	-6.2	0.0
31.5	-39.6	-3.1	0.0
63	-26.2	-0.8	0.0
125	-16.2	-0.2	0.0
250	-8.7	0.0	0.0
500	-3.3	0.0	0.0
1000	0.2	0.2	0.2
2000	1.5	0.1	0.3
4000	1.3	-0.5	0.4
8000	-1.0	-2.9	0.6
16000	-13.1	-15.0	-0.2
20000	-27.6	-29.5	-2.6

4. LEVEL LINEARITY (electrical)

Filter=A; Fsin=1kHz

Nominal[dB]	20	21	22	23	24	25	30	40	50	60	70	80	89
Indication[dB]	20.0	21.0	22.0	23.0	24.0	25.0	30.0	39.9	49.9	60.0	70.0	80.0	89.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
Nominal[dB]	90	91	92	93	94	95	96	97	98	99	100	110	120
Indication[dB]	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0	99.0	100.0	110.0	120.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nominal[dB]	129	130	131	132	133	134							
Indication[dB]	129.0	130.0	131.0	132.0	133.0	134.0							
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0							

5. SELF-GENERATED NOISE LEVEL (sound)

Measured in anechoic chamber with microphone; Backlight Off; Electrical noise please refer user manual

Filter	A	C	Z
Indication[dB]	~ 18	~ 23	~ 31

6. TIME WEIGHTINGS (electrical)

Filter=A; Fsin=4kHz; Steady Level=132dBA

Detector	F	S
Rate of Decay[dB/s]	34.8	4.3
Delta of F/S[dB]	0.0	

7. TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A= 132.0 dB

Tone Burst Duration [ms]	Response[dB] $L_{AFmax}-L_A$	$L_{ASmax}-L_A$	$L_{AE}-L_A$
500	-0.1	-4.1	-3.1
200	-1.0	-7.5	-7.0
50	-4.9	-13.2	-13.1
10	-11.2	-20.1	-20.1

Certificate of Calibration Class 1

BSWA-IV-C021-09-P0274

8. REPEATED TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A= 132.0 dB

Tone Burst Duration [ms]	Tone Burst Interval [ms]	Response[dB] $L_{AeqT}-L_A$
500	2000	-7.0
200	800	-7.0
50	200	-7.0
10	40	-7.0

9. OVERLOAD INDICATION (electrical)

Filter=A; Fsin=1000Hz

Nominal[dB]	Error[dB] Steady	Positive Half Cycle	Negative Half Cycle	Delta of Positive and Negative[dB]
134.1	0.0	0.1	0.1	0.0

10. C-WEIGHTED PEAK SOUND LEVEL (electrical)

Filter=C; Peak; Fsin=500Hz

Steady Signal Level	(L_{Cpeak}-L_C)[dB] Single Cycle	Positive Half Cycle	Negative Half Cycle
4dB Below Top	3.6	2.3	2.3
Middle	3.6	2.3	2.3
1dB Above Floor	3.6	2.6	2.5

CONDITIONS

Temperature	18	℃
Relative Humidity	36	%
Static Pressure	101.4	kPa

TEST EQUIPMENT

Item	Manufacturer	Model	S/N	Description
1	B&K	4231	3008422	Sound Calibrator
2	Agilent	33220A	MY44038043	Signal Generator
3	Agilent	34401A	SG47000236	Digital Multimeter
4	NJZY	ZY5142D	0425	Step Attenuator
5	B&K	4180	2412874	Standard Microphone

TEST PROCEDURES IN ACCORDANCE WITH IEC 61672-3:2013

Class 1 Performance Verified. Test Qualified.

QC 05

DATE: 2024 Y 10 M 25 D **TEST (sig.):** JS **APVD (sig.):**

CERTIFICATE OF CALIBRATION

Class 1

TYPE: BSWA 308 S/N: 580273

京制01020122号

1. APPEARANCE Pass

2. CALIBRATION (sound)

Calibrator: BK4231 Sound Level: 93.8 dB Frequency: 1000 Hz

Microphone Model / SN: MP231 /580307

Filter	Nominal[dB]	Indication[dB]	Error[dB]
A	93.8	93.8	0.0
C	93.8	93.8	0.0
Z	93.8	93.8	0.0

3. FREQUENCY WEIGHTINGS (sound & electrical)

Z-weighting (sound & electrical); A/C-weighting (electrical, plus Z-weighting error)

Frequency [Hz]	Attenuation[dB] A	C	Z
10	-69.0	-14.3	0.0
20	-50.4	-6.2	0.0
31.5	-39.5	-3.1	0.0
63	-26.2	-0.8	0.0
125	-16.1	-0.2	0.0
250	-8.7	0.0	0.0
500	-3.3	0.0	0.0
1000	0.2	0.2	0.2
2000	1.6	0.2	0.4
4000	1.3	-0.5	0.4
8000	-0.7	-2.6	0.9
16000	-11.7	-13.8	0.9
20000	-25.5	-27.5	-0.8

4. LEVEL LINEARITY (electrical)

Filter=A; Fsin=1kHz

Nominal[dB]	20	21	22	23	24	25	30	40	50	60	70	80	89
Indication[dB]	20.0	21.0	22.0	23.0	24.0	25.0	30.0	40.0	50.0	60.0	70.0	80.0	89.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nominal[dB]	90	91	92	93	94	95	96	97	98	99	100	110	120
Indication[dB]	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0	99.0	100.0	110.0	120.0
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nominal[dB]	129	130	131	132	133	134							
Indication[dB]	129.0	130.0	131.0	132.0	133.0	134.0							
Error[dB]	0.0	0.0	0.0	0.0	0.0	0.0							

5. SELF-GENERATED NOISE LEVEL (sound)

Measured in anechoic chamber with microphone; Backlight Off; Electrical noise please refer user manual

Filter	A	C	Z
Indication[dB]	~ 18	~ 23	~ 31

6. TIME WEIGHTINGS (electrical)

Filter=A; Fsin=4kHz; Steady Level=132dBA

Detector	F	S
Rate of Decay[dB/s]	34.7	4.3
Delta of F/S[dB]	0.0	

7. TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A= 132.0 dB

Tone Burst Duration [ms]	Response[dB] $L_{AFmax}-L_A$	$L_{ASmax}-L_A$	$L_{AE}-L_A$
500	-0.1	-4.1	-3.1
200	-1.0	-7.5	-7.0
50	-4.9	-13.2	-13.1
10	-11.2	-20.1	-20.1

8. REPEATED TONEBURST RESPONSE (electrical)

Filter=A; Fsin=4kHz

Steady Level L_A= 132.0 dB

Tone Burst Duration [ms]	Tone Burst Interval [ms]	Response[dB] $L_{AeqT}-L_A$
500	2000	-7.0
200	800	-7.0
50	200	-7.0
10	40	-7.0

9. OVERLOAD INDICATION (electrical)

Filter=A; Fsin=1000Hz

Nominal[dB]	Error[dB] Steady	Positive Half Cycle	Negative Half Cycle	Delta of Positive and Negative[dB]
134.1	0.1	0.1	0.1	0.0

10. C-WEIGHTED PEAK SOUND LEVEL (electrical)

Filter=C; Peak; Fsin=500Hz

Steady Signal Level	($L_{Cpeak}-L_C$)[dB] Single Cycle	Positive Half Cycle	Negative Half Cycle
4dB Below Top	3.6	2.3	2.3
Middle	3.6	2.3	2.3
1dB Above Floor	3.7	2.6	2.3

CONDITIONS

Temperature	18	℃
Relative Humidity	36	%
Static Pressure	101.4	kPa

TEST EQUIPMENT

Item	Manufacturer	Model	S/N	Description
1	B&K	4231	3008422	Sound Calibrator
2	Agilent	33220A	MY44038043	Signal Generator
3	Agilent	34401A	SG47000236	Digital Multimeter
4	NJZY	ZY5142D	0425	Step Attenuator
5	B&K	4180	2412874	Standard Microphone

TEST PROCEDURES IN ACCORDANCE WITH IEC 61672-3:2013

Class 1 Performance Verified. Test Qualified.

DATE: 2021 Y 2 M 1 D TEST (sig.): JD APVD (sig.): QC 05

