Aval Consulting Group.

Noise Impact Assessment

Client	Jacuna Kitchens
Site Location	178B Royal College Street and Arches 7475 Randolph Street NW1 0SP
Job Code	91496
Department	Environmental Noise

Revision History

Revision	Date	Author	Reviewed by	Approved by	Status
F	28 January 2022	Christopher Murphy DipHE CCENM	Nuvin Boyjonauth MSc IOA Dip. 2022	Ayan Chakravartty MSc MPhil IOA CCENM IOA Dip. 2022	Final

Signed

Date: 28 January 2022

Disclaimer

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1 Table of Contents

FAO CAMDEN COUNCIL

The following report supersedes the previous noise assessment submitted for Jacuna Kitchens. Prior discussions between Aval Consulting Group and Caice Design resulted in attenuation design changes to the extraction system to achieve the required operational noise level at this site. Repeat noise surveys have since been carried out and the updated assessment is to verify that these changes adequately satisfy the local noise guidelines.

1. Introduction

1.1 Overview

Aval Consulting Group has been commissioned by Jacuna Kitchens ('the client') to carry out a Noise Impact Assessment for the existing development at 178B Royal College Street and Arches 7475 Randolph Street, Camden ('the premises'). The development is a commercial kitchen and delivery centre consisting of 16 commercial kitchen units.

Camden Council requires a noise assessment carried out in accordance with the criteria of BS4142:2014 and local noise policy, as presented in the following report.

1.2 Objective

Camden Council requires evidence from a noise impact assessment that the kitchen extraction system at the premises will not have a detrimental impact on local receptors.

Noise monitoring must be carried out to establish the existing ambient background noise in order to determine that the extraction system will remain 10 dB below the background noise level measured at the nearest receptor. If deemed necessary, mitigation measures will be provided.

1.3 Site Location

The site is located under a railway line, with entrances on Royal College Street, and Randolph Street. The extraction system has two exhausts which are located on the north wall of the premises, with flues running up the railway arches. When all kitchens are occupied, the site is in operation between 09:00 – 23:00. As such, this assessment has been carried out considering the lowest hour of background noise in a 24 hour period. Detailed site drawings are attached in Appendix B at the end of this report.

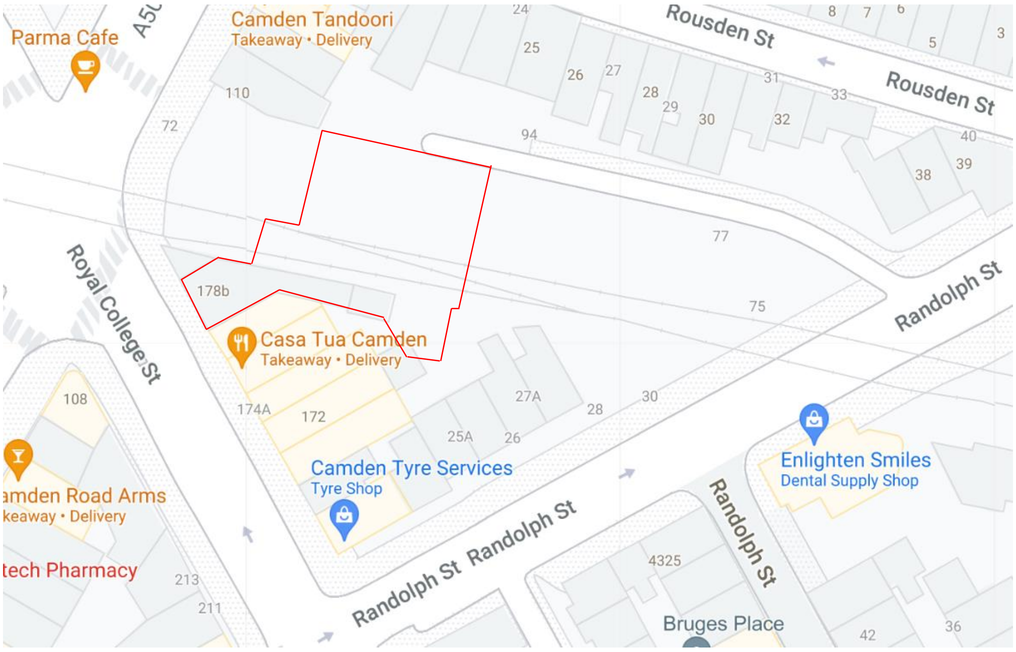

Figure 1.1 Site location (source: Google Maps)

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.

New commercial kitchen developments are typically assessed in accordance with BS4142, with consideration of the National Planning Policy Framework (NPPF) and World Health Organisation (WHO) Guidelines.

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 within 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:

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[1] The National Planning Policy Framework (2021) 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

"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.

The second aim of the NPSE:

Mitigate and minimise 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.

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 $L_{Aeq,t}$ 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

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

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

2.4 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 L_{Aeq}) to be compared with the background sound level (L_{A90}) in conjunction with the new noise source.

BS 4142 states that if the rated noise level exceeds the L_{A90} 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

3 daytime is typically between 07:00 h and 23:00 h.

4 night-time is between 23:00 h and 07:00 h.

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 Surveys

3.1 Overview

This section provides the details of the methodical approach taken to assess the noise emissions from the extraction system, as well as the prevailing acoustic environment around the property. The key noise indicators, namely $L_{Aeq,T}$, and L_{A90}, have been used in this assessment and are described in Appendix A.

To obtain the background level, a sound level meter was installed for a period of 24 hours. The lowest hour of background noise (L_{A90}) will be used to assess the operational noise level of the extraction system at the nearest receptor.

3.2 Noise Monitoring Locations

Background noise monitoring (measurement location 1) was carried out at the location shown below in Figure 3.1. This position was chosen for monitoring as it was nearby the closest noise sensitive receptor and as such provided a representative background noise profile. Due to the tight space, it was not possible to capture these measurements free-field. The monitor was positioned approximately 1 meter from the 3 meter wall opposite the noise source. A façade correction was applied to account for this.

Figure 3.1 Background noise monitoring (image source : Aval Consulting Group)

Short term monitoring (measurement location 2) of the system fan was carried out between 14:20 and 14:50. From the minimum measurement distance of 1 meter, the extraction fans were inaudible in the prevailing ambient noise and it was impossible to isolate the system noise. Readings were heavily influenced by nearby noise from the railway line, road traffic, and pedestrians.

As the extraction system was inaudible at the background monitoring location, another closer location was chosen (see Figure 3.2) 1 meter from the extraction fan outlet. The quiestest values measured at this location have been taken as the representative level of the system, however is likely that the system is quieter than measured as, even from 1 meter, it was still indecipherable in the prevailing noise environment, however this measurement can be considered a conservative worse-case assessment.

Figure 3.2 Specific system noise monitoring (image source : Aval Consulting Group)

Noise Survey Periods

The background noise survey was carried out for a period of 24 hours, with short term attended measurements of the system fan for 30 minutes.

Measurement Location	Start Date	Start Time	End Date	End Time
1	19/01/22	14:00	20/01/22	14:00
2	19/01/22	14:20	19/01/22	14:50

Table 3.2 Noise Survey Periods

3.3 Details of Noise Monitoring Equipment

The details of the equipment used for the noise monitoring have been tabulated below. Both sound level meters were calibrated before and after survey with a UKAS calibrated field calibrator. Equipment calibration certficates are attached in Appendix D.

Equipment	Serial Number	Calibration Certificate Issued	Calibration Certificate Expiry
BSWA Class 1 308 Sound level meter	580273	02/01/2021	02/01/2023
NTi XL2-TA Class 1 Sound level meter	A2A-18661-E0	19/08/2021	19/08/2023
BSWA Class 1 CA111 Calibrator	550282	23/07/2021	23/07/2022

Table 3.3 Noise Equipment Details

3.4 Weather Conditions

The weather conditions throughout this survey period were suitable for the measurement of environmental noise in accordance with BS7445: Description and Measurement of Environmental Noise.

Variable	Condition
Wind	4.2 m/s Maximum
Cloud cover	0%
Precipitation	0.0 mm
Temperature	4 degrees

Table 3.4 Meteorological conditions during assessed period 00:00 – 01:00 20th Jan 2021 (source: Worldweatheronline Camden Town)

4. Noise Survey Results

4.1 Background level and specific level results

Noise monitoring was carried out over a period of 24 hours. As the site is in operation until 23:00, the assessment has been based on the lowest hour of measured background noise, which occurred between 00:00 – 01:00.

A summary of the representative assessed results can be seen in the table and noise profile graph below.

Indicator	Quietest hour (00:00-01:00) All values in (A)dB
L_{Aeq}	58.5
L_{A90}	49.0
L_{A10}	54.5

Table 4.1 Summary of assessed noise levels

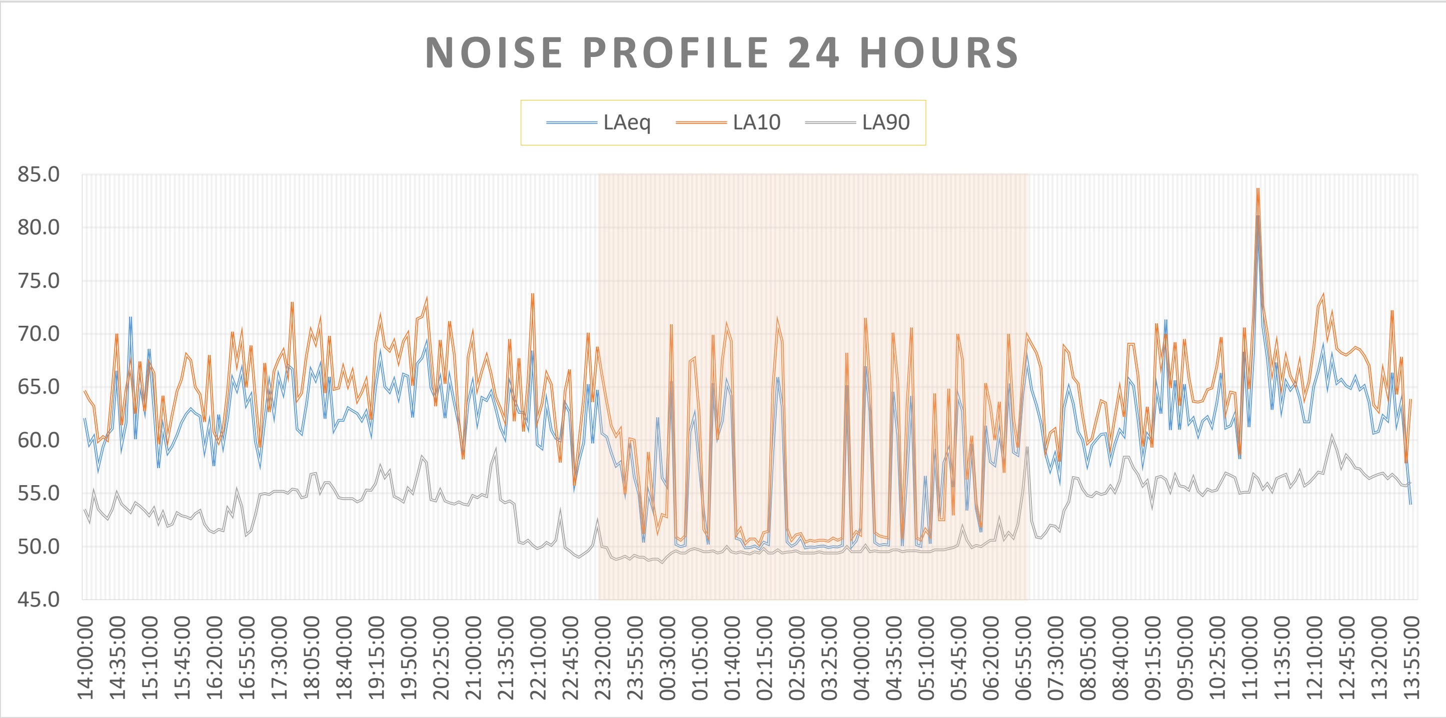


Figure 4.2 Noise profile 24 hours (shaded area = night time)

5. Noise Impact Assessment

As the background survey was conducted in a tight alley, it was not possible to achieve a free-field position. As per BS4142, a façade correction of -3 dB has been applied to the measured background level in the assessment to account for this.

As explained in section 4, it was not possible to isolate the system noise. Even from a measurement distance of 1 meter from the extract fan, the prevailing noise environment heavily influenced results. The values measured in section 4 will be used as the closest representative assessment figure, however this is a very conservative assessment as the system is likely operating several dB below this figure, but will provide a robust worst-case outcome.

System fan operational noise level = **48.9 dB(A) @ 1 meter**.

If short-term measurements of the system fan were to be taken in the middle of the night during the quietest period, it would still be impossible to obtain the specific level as per BS4142. As the noise graph in Figure 4.2 shows, the LAeq (5-minute average) didn't drop below 50 dB(A) throughout the 24 hour period even with the system shut down between the hours of 23:00 and 09:00.

An acoustic penalty has not been added as the system noise was indecipherable in the surrounding noise environment even from a close distance of 1 meter.

All figures presented in dB(A).

Equipment	Specific level	LA90 Background (00:00-01:00)
Extraction system	48.9 dB(A)	46.0 dB(A)

Table 5.1 Specific system level and LA90 background level adjusted for façade correction

The nearest and most noise-sensitive receptor was identified as the first-floor residential dwelling approximately 6 meters west of the extraction exhaust by the stairs. BS 4142 requires noise to be assessed 1 meter from the nearest façade, therefore the nearest receptor will be considered 5 meters away in the distance correction.

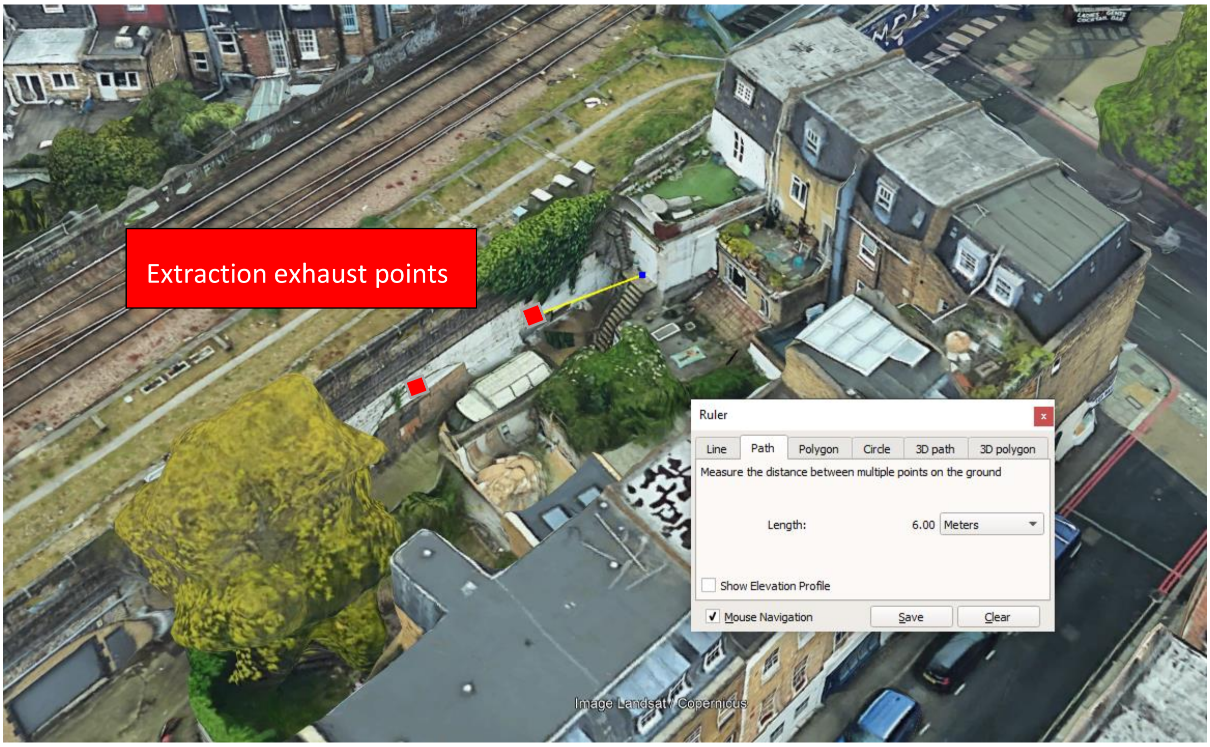


Figure 5.1 Nearest receptor to extraction system (image source: Google Maps)

A distance correction has been applied to calculate the sound level 1 m from the nearest receptor. The following equation was used:

Equation 1: $SPL_2 = SPL_1 - 20\log(r_2/r_1)$,

Where, r_2 is the receiver distance,

r_1 is the measurement distance,

SPL_1 is the noise level at r_1 and

SPL_2 is the noise level at the new receiver location

$SPL_2 = 48.9 - 20\log(5 / 1) = 34.9$ dB (A)

The noise level at approximately 1 m from the nearest receptor has been evaluated as **34.9 dB.**

The lowest background level at this location from a 24 hour sample has been measured as 46.0 dB, and as such the level at the nearest receptor is a **minimum** of **11.1 dB below background level**.

6. Conclusions

An environmental noise impact assessment has been undertaken at Jacuna Kitchens on 178B Royal College Street and Arches 7475 Randolph Street NW1 0SP.

The extraction system was previously assessed to be operating equal to the ambient background levels at the nearest receptor. Additional attenuation measures have since been implemented, and as of this report can now be verified as achieving to >10 dB below the lowest measured background level at the nearest receptor, thereby satisfying the local guidance as outlined by Camden Council.

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

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.

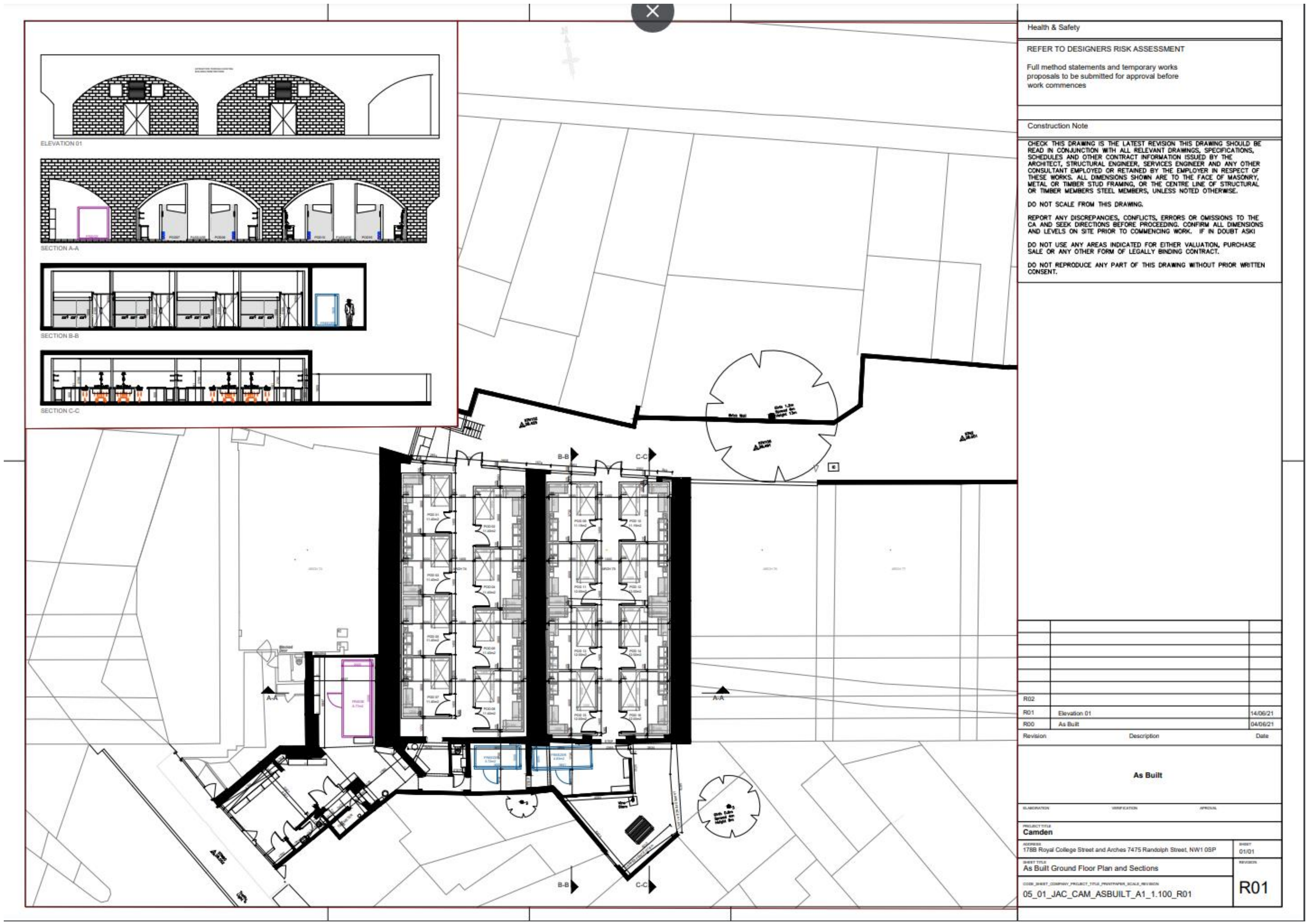
Ground-borne vibration

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.

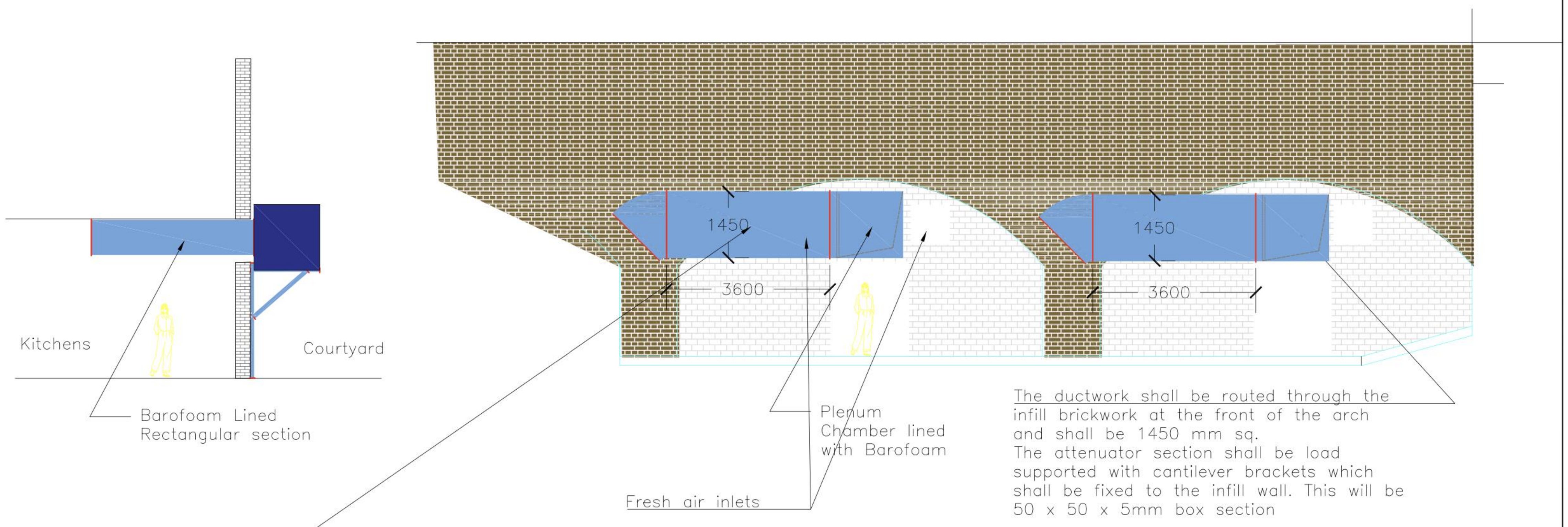
Sound insulation - Absorption within porous materials

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 Drawing



Appendix C: Caice design implemented attenuation

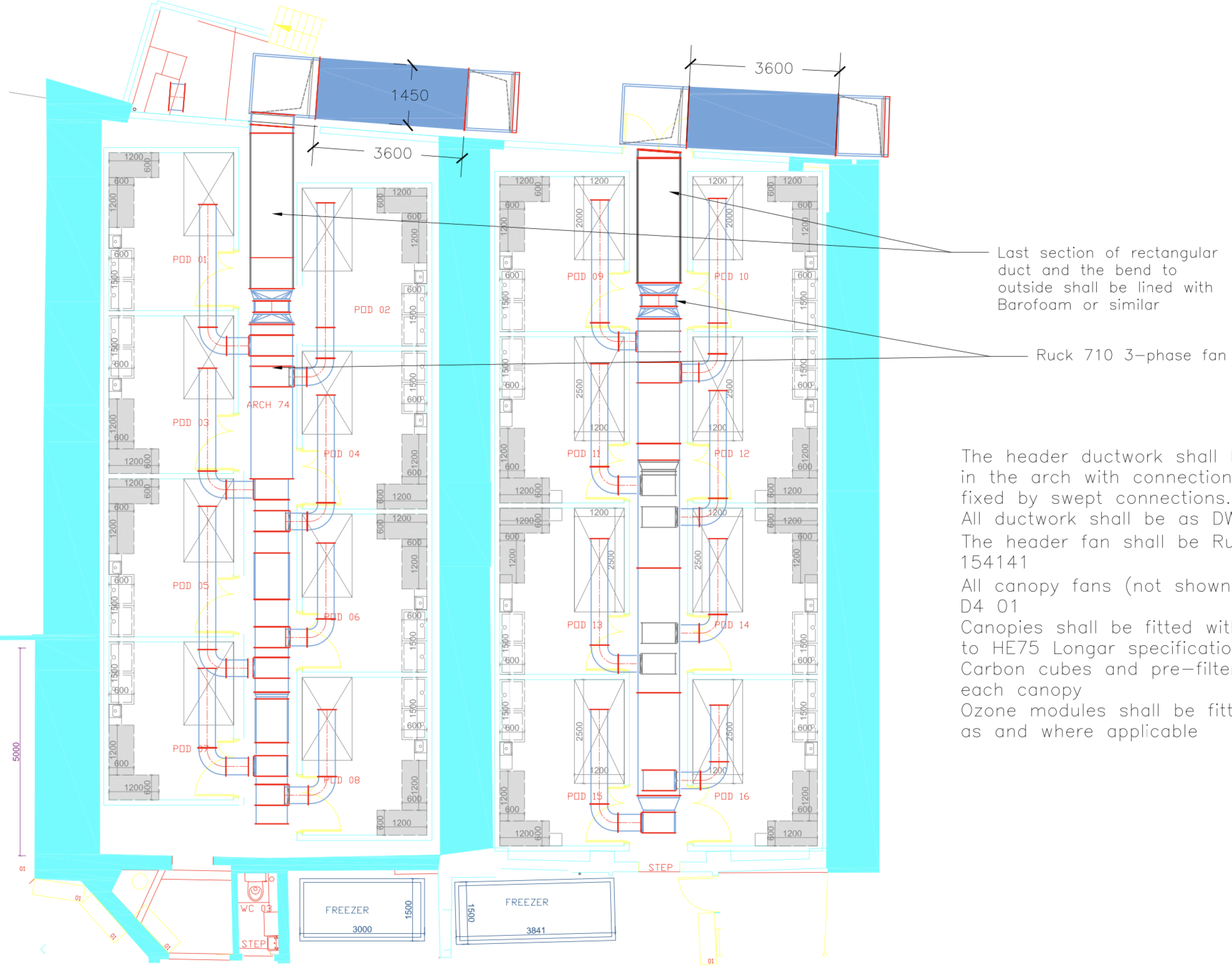


Project: Jacuna Kitchens Camden **Date:** 27/08/2021

Ref.	Description	Construction Code	Dimensions (mm) Width	Height	Length	Vol (m³/s)	PL (Pa)	Wt (Kg)	No. Off
ATT05	RUCK710 EXHAUST	SG03V/3C/L/SM	1450	1450	3600	6.94	48	607	2

Drawing Type:	Client:	Project:	Title:	Scale: nts	Date: 27 AUG 21	Drg No:	Rev:
FOR APPROVAL	JACUNA KITCHENS	CAMDEN CAICE EXTERNAL ATTENUATION	AS PROPOSED	Drawn:	Checked:	ABA JK CAM 0015	005

Sandbach · Cheshire · CW11 1HT
Tel: 01270 761433 ·
www.austinbroady.co.uk
Air Conditioning · Ventilation · Heating
AustinBroady AIR CONDITIONING



The header ductwork shall be routed at high level in the arch with connections from the canopies fixed by swept connections.
All ductwork shall be as DW144 and DW172
The header fan shall be Ruck AL 710 D4 01 | 154141
All canopy fans (not shown) are Ruck AL355 EC D4 01
Canopies shall be fitted with grease mesh baffles to HE75 Longar specification
Carbon cubes and pre–filters shall be fitted to each canopy
Ozone modules shall be fitted on an ad hoc basis as and where applicable

Drawing Type:	Client:	Project:	Title:	Scale: nts	Date: 27 AUG 21	Drg No:	Rev:	
FOR APPROVAL	JACUNA KITCHENS	CAMDEN	INTERNAL - AS PROPOSED	Drawn: 1:50 @A1	Checked:	ABA JK CAM 0011	003	Sandbach · Cheshire · CW11 1HT Tel: 01270 761433 www.austinbroady.co.uk Air Conditioning · Ventilation · Heating AustinBroady AIR CONDITIONING

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The complete acoustic design service

caice

Document Ref: 05/0312 27 August 2021

DESIGN APPRAISAL

Project: Jacuna Kitchens Camden

Enquiry Data

Our attenuator selections are based on the following information as provided by yourselves:

Schedule numbers	:	Not issued
Specification	:	Aval Consulting Noise Impact Assessment 91496 (Rev D, Dated 25-08-21)
Drawing numbers	:	Within the above mentioned Aval assessment
Noise data	:	As per the attached Equipment Noise Data Schedule

Please ensure that this is the correct data and advise of any subsequent revisions as this may affect the performance of our attenuators.

Project Design Criteria

The following noise criteria has been used as the basis of our design appraisal:

Internal:

We have not been asked to commit to achieving any particular internal noise levels.

External:

- to achieve 33dB(A) at a distance of 5 metres from the discharge openings.

Our attenuator regenerated noise level calculations are based on laminar air flow condition sound power levels from the fan manufacturer's data sheets

Attenuator Selection

The attenuators have been selected to achieve the design criteria as listed previously. The following noise paths have been taken into account:

- Fan noise transmission through the ductwork distribution system to external areas, via the intake and discharge openings (where attenuators are proposed).

Attenuator Location

To comply with BS EN ISO7235:2009, all our attenuator pressure losses are stated assuming laminar inlet and outlet airflow. Where unfavourable inlet and outlet conditions exist, allowance should be made in the system pressure for increased attenuator resistances. Please be aware that actual resistances measured across attenuators installed in poorly designed ductwork arrangements can be 3-4 times higher than that shown on our schedules.

Where attenuators are located outside the building, we would suggest that they are treated to the same specification as any associated external ductwork.

Acoustic Treatment to ductwork

Where attenuators are located in plantroom areas, it is good design practice to acoustically lag the ductwork from the attenuator to the point at which the duct penetrates and exits the plantroom structure. This is particularly appropriate in noisy plantrooms, to reduce the possibility of noise re-entry into the duct on the "quiet" side of the attenuator.

It is not recommended that main plant attenuators be installed in or above areas with specified noise design criteria. If this situation is unavoidable, then additional acoustic treatment (such as double skinning of attenuators) may be required in order to achieve a satisfactory noise climate.

Radiated Noise from Equipment Casings and Ductwork

Where mechanical equipment is located in or above areas with specified noise criteria, it is essential that the level of noise radiated from the equipment casings is controlled to an appropriate level.

As radiated noise levels from plant and equipment are not affected by in-duct attenuation, additional acoustic treatment (such as bulkheads or enclosures) may be required in order to achieve a satisfactory noise climate.

The responsibility for achievement of criteria due to noise radiation from equipment casings should be placed upon the relevant manufacturers. The manufacturers should be issued with sufficient design information to enable them to underwrite the acoustic performance of their products relative to this particular application.

Attenuators will only reduce duct borne fan noise via the distribution grilles, which is the extent of our responsibility and therefore acoustic lagging maybe required between the equipment casing and attenuators. Any such lagging should also include the casing of the attenuator.

Please note that manufacturers' radiated noise data is often stated in free field conditions and can sometimes provide a misleading indication of the resulting noise level in the installed condition. In our experience, we have seen noise level differences as high as 20dB between manufacturers' stated sound pressure level and actual noise levels measured on site.

Ductwork Systems

To reduce the possibility of airflow generated noise exceeding the specified design criteria, good design practice (with reference to DW/144, HVAC and CIBSE recommendations) should be adopted when considering ductwork geometry and fittings.

Ductwork configurations that promote turbulent airflow must be avoided, particularly in close proximity to acoustically critical components such as attenuators, grilles, diffusers, dampers etc. In some cases, excessive resistances arising from poor ductwork design may prevent ventilation systems from achieving their full design duty.

Dampers should be installed as far away from air terminals as possible, and used only for fine trimming. Where major reductions in airflow or pressure are required, then fan speed reduction or system design should be considered.

Ductwork Velocities

With consideration to acoustics, the following guide duct velocities (m/s) should be adhered to where possible:

Description	NR40	NR35	NR30	NR25
Riser	9.0	7.5	6.0	5.0
Main Branch (above ceiling)	6.0	5.0	4.0	3.0
Grille	3.0	2.5	2.0	1.5
Diffuser	2.5	2.0	1.5	1.0
Stub duct (above ceiling)	4.0	3.0	2.0	1.5

Attenuator Quotation

Project: Jacuna Kitchens Camden **Date:** 27/08/2021

Ref.	Description	Construction Code	Dimensions (mm) Width	Height	Length	Vol (m^3/s)	PL (Pa)	Wt (Kg)	No. Off
ATT05	RUCK710 EXHAUST	SG03V/3C/L/SM	1450	1450	3600	6.94	48	607	2

General Information

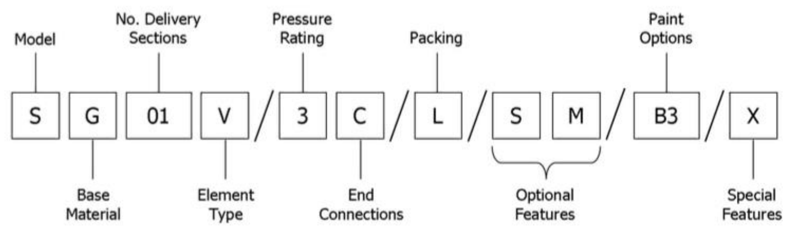
Delivery Period:	4-5 weeks from client approval of product details.
Delivery Price:	Included on 45' artic curtain sider lorry in normal working hours.
Payment Terms:	30 days from invoice date subject to account approval.
Acceptance:	This quotation is valid until 10/09/2021.
VAT:	All prices are exclusive of VAT.
Terms & Conditions:	Please see attached.

Direct Telephone 01249 449622
Direct E-Mail chris.clark@caice.co.uk

Attenuator Construction Code Definitions

Project: Jacuna Kitchens Camden Date: 27/08/2021

Sample Construction Code Format Diagram



Construction Code Definitions

Code Section	Code	Description
Model	S	Rectangular attenuator with SPLITTER elements
Base material	G	Standard gauge galvanised sheet steel
No. delivery sections	01 upwards	This number confirms how many sections will be delivered to site for each attenuator or splitter. For 02 or above assembly will be required by others
Element type	V	Elements installed in the vertical plane
Pressure rating	3	High pressure (+2000/-750Pa)
End connections	C	30mm profile flanges (profile flanges are compatible with Doby, Mez & Metu flanges)
Packing	L	Lightweight pallet wrapping on casing ends (EG/IG units are palletised and wrapped on the pallet)
Optional features	M	Infill protected by Melinex polyester film
	S	Side elements (for EG/IG units these are supplied with steel backing)

Attenuator Drawings

Project: Jacuna Kitchens Camden Date: 27/08/2021

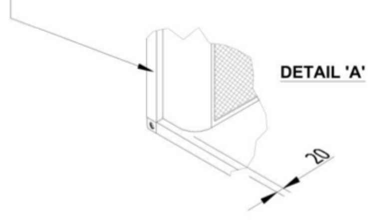
Construction Codes confirm the physical properties of each item. This drawing must therefore be read in conjunction with the Construction Code Definitions. Dimensions W1, H1, W2, H2, WD1, HD1 are always shown as "inside-duct". Dimensions L1, L2, LD1 are always shown as "over connections".

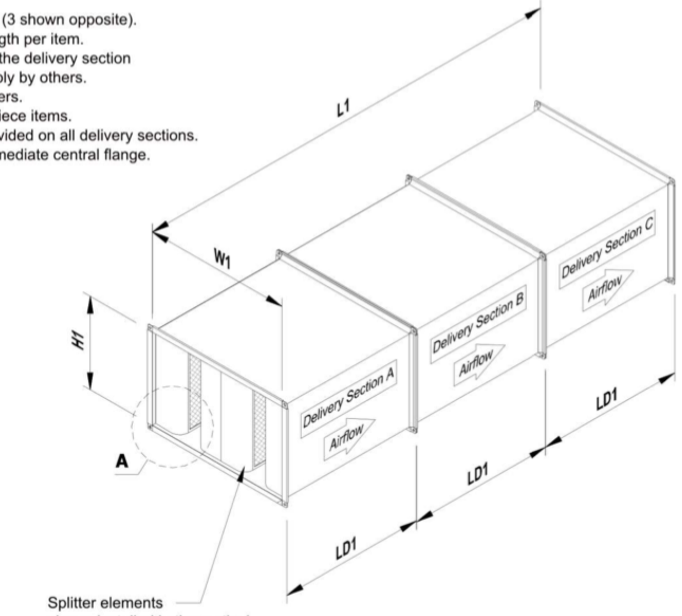
SG splitter attenuator - with profile flanges

Notes:

1. Attenuators may be delivered in 1, 2, 3 or 4 sections in length (3 shown opposite).
2. See **NDL** in table below for number of delivery sections in length per item.
3. Assembly of multiple piece items must be in accordance with the delivery section and airflow label layouts, typically as shown opposite. Assembly by others.
4. Nuts, bolts, flange clamps and gasket between flanges by others.
5. Delivery section and airflow labels only provided on multiple piece items.
6. Identification labels stating item reference and description provided on all delivery sections.
7. Where **LD1** exceeds 1250 each delivery section has an intermediate central flange.
8. All dimensions in mm.
9. Tolerances on **W1** & **H1** +/- 2mm.
10. Tolerances on **LD1** +/- 3mm

Profile flanges suitable for MEZ, DOBY or METU flanging systems. See table below for flange size.





Splitter elements set back in casing by 20mm and provided with aerodynamic bullnoses on inlet and outlet as shown. However if item has non-standard elements refer to Attenuator Model Code Definitions for details.

Splitter elements shown installed in the vertical plane. Refer to item Model Code for actual orientation.

		Primary Dimensions			Delivery Data					
Ref.	Construction Code	W1	H1	L1	LD1	NDL	Flange Size	Paint Colour	Wt (Kg)	No. Off
ATT05	SG03V/3C/L/SM	1450	1450	3600	1200	3	30mm		607	2
ATT06	SG01V/3C/L/SM	1000	1000	1050	1050	1	30mm		92	2

Appendix D: Sound level meter and calibrator laboratory calibration certificates

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

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	0.1	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

ANV MEASUREMENT SYSTEMS

CERTIFICATE OF CALIBRATION

ilac-MRA

UKAS CALIBRATION 0653

Date of Issue: 19 August 2021

Certificate Number: UCRT21/2011

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 5 Pages

Approved Signatory

K. Mistry

Customer	Castle Group Limited Salter Road Scarborough Business Park Scarborough North Yorkshire YO11 3UZ
Order No.	12408
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
NTi	Sound Level Meter	XL2-TA	A2A-18661-E0
NTi	Firmware		4.21
NTi	Pre Amplifier	MA220	09903
NTi	Microphone	MC230A	A20961
Brüel & Kjær	Calibrator	4231	C001
	Calibrator adaptor type if applicable		UC 0210

Performance Class 1

Test Procedure TP 10. SLM 61672-3:2013

Procedures from IEC 61672-3:2013 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2013 Yes

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2013

Date Received 18 August 2021 ANV Job No. UKAS21/08550

Date Calibrated 19 August 2021

The sound level meter submitted for testing has successfully completed the periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed. As evidence was publicly available, from an independent testing organisation responsible for approving the results of pattern-evaluation tests performed in accordance with IEC 61672-2:2013, to demonstrate that the model of sound level meter fully conformed to the class 1 specifications in IEC 61672-1:2013, the sound level meter submitted for testing conforms to the class 1 specifications of IEC 61672-1:2013.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	Initial Calibration		

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

MEASUREMENT SYSTEMS

CERTIFICATE OF CALIBRATION

ilac-MRA

UKAS CALIBRATION 0653

Date of Issue: 23 July 2021

Certificate Number: UCRT21/1913

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Page 1 of 2 Pages

Approved Signatory

K. Mistry

CUSTOMER Castle Group Limited
Salter Road
Scarborough Business Park
Scarborough
North Yorkshire
YO11 3UZ

ORDER No 12401 Job No UKAS21/07485

DATE OF RECEIPT 23 July 2021

PROCEDURE Procedure TP 1 Calibration of Sound Calibrators

IDENTIFICATION Sound Calibrator BSWA type CA111 serial number 550282 with half-inch housing

CALIBRATED ON 23 July 2021

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

Certificate No UCRT21/1913

Page 2 of 2 Pages

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output and its fundamental frequency and total distortion were:

Nominal Setting dB	Mean Level	Frequency	Distortion
94	93.83 ± 0.14 dB rel 20 μPa	1000.92 Hz ± 0.06 %	(0.97 ± 0.07) %
114	113.81 ± 0.14 dB rel 20 μPa	1000.99 Hz ± 0.06 %	(2.28 ± 0.17) %

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Setting dB	Temperature	Atmospheric pressure	Relative Humidity
94	24 to 26 °C	100.6 to 100.7 kPa	37 to 47 %
114	24 to 26 °C	100.6 to 100.7 kPa	37 to 47 %

The tests carried out were as specified in Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). The sound calibrator has been shown to conform to the class 1 requirements for periodic testing in Annex B of IEC 60942:2003 for the sound pressure level and frequency stated, for the environmental conditions under which the tests were performed. However, as public evidence was not available, from a testing organisation responsible for pattern approval, to demonstrate that the model of sound calibrator conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, no general statement or conclusion can be made about conformance of the sound calibrator to the requirements of IEC 60942:2003.

NOTE
The measured sound pressure level given is valid under the environmental conditions stated above. The output of many sound calibrators varies a little with ambient air pressure; however no information regarding any corrections which may be needed for this device have been published by its manufacturer, BSWA. Additional corrections may be necessary when calibrating a sound level meter fitted with a free-field response microphone; see manufacturers' information for details.

The results on this certificate only relate to the items calibrated as identified above.

Calibrator adjusted No END R 1