Proposed Wendy's Restaurant Development

198 High Street, Camden, NW1 8QP

soundsolution CONSULTANTS

Noise Impact Assessment

TECHNICAL REPORT

36815-R2

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Noise Impact Assessment

Prepared for: The Wendy's Company, 198 High Street, Camden NW1 8QP

Site location: 198 High Street, Camden, NW1 8QP

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PROJECT NUMBER:	36815	DOCUMENT REFERENCE:	36815-R2
ORIGINATED		CHECKED	
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RELEASE	DATE	CHANGE DESCRIPTION	
1	05/08/2021	Original release.	
2	13/09/2021	Plant selection reviewed.	

1 INTRODUCTION

1.1 A Wendy's restaurant development has been proposed at 198 High Street, Camden, NW1 8QP (hereinafter, "The Site"). A plan highlighting the boundary of The Site has been provided in Appendix B with development proposal drawings in Appendix C.

1.2 This document has been prepared to support an application for a proposed change of use at The Site and has provided an assessment of mechanical plant noise impacts from the proposed development using BS 4142 methodology.

1.3 Proposed external mechanical plant has been noted to consist of 10 no. condenser units; 1 no. heat recovery unit; 1 no. wash-up extract fan; 1 no. kitchen supply fan; and 1 no. kitchen extract fan (to be ducted to the roof level).

1.4 The Site is situated in a mixed commercial/residential area, on the junction of the A4201 and A502 adjacent Camden commercial high street.

1.5 The nearest noise sensitive receptors have been indicated in Appendix D, identified as 1st – 3rd floor residential windows located adjacent the proposal, across from the A4201.

1.6 A Glossary of Acoustic Terms has been provided in Appendix A that may assist with the terminology used within this report.

2 NOISE CRITERIA

NATIONAL PLANNING POLICY FRAMEWORK (NPPF)

2.1 The Department for Communities and Local Government introduced the National Planning Policy Framework (NPPF) in March 2012. The latest revision of the NPPF is dated June 2019.

2.2 The Framework replaced most planning policy, circulars and guidance including Planning Policy Guidance 24: Planning and Noise (1994). The NPPF defines the Government's planning policies for England and sets out the framework, within which local authorities must prepare their local and neighbourhood plans, reflecting the needs and priorities of their communities. The Government's stated purpose in producing the NPPF was to streamline policy so the planning process is less restrictive, to give a more easily understood framework for delivering sustainable development.

2.3 Under the heading of "Conserving and Enhancing the Natural Environment", specific noise pollution aims are detailed in Section 170 of the NPPF. It is stated that planning policies and decisions should contribute to and enhance the natural and local environment by:

"preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of … noise pollution…"

2.4 Considering "Ground Conditions and Pollution" it is also stated in Section 180 of the NPPF that planning policies and decisions should also ensure that any new development is appropriate for its location considering the likely effects of pollution on health, living conditions, the natural environmental, sensitivity of the site and wider area and impacts that could arise from the development. The aims in doing so should:

- 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;
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

2.5 It is stressed that the above references to noise should not be considered in isolation and that the theme, referred to as the "golden thread" of sustainability that runs through the NPPF is integral to noise.

2.6 The NPPF acknowledges that there is a host of existing sources of national and international guidance which can be used, in conjunction with the Framework, to inform the production of Local Plans and decision making.

NOISE POLICY STATEMENT FOR ENGLAND (NPSE)

2.7 The Noise Policy Statement for England (NPSE) was published in March 2010. It sets out the long-term vision of government noise policy, which is fundamentally to: "Promote good health and good quality of life through the effective management and control of noise within the context of Government policy on sustainable development". The vision is supported by three key aims:

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and reduce to a minimum, other adverse impacts on health; and
- Where possible, contribute to the improvement of health and quality of life.

2.8 The NPSE should apply to all forms of noise including environmental noise, neighbour noise and neighbourhood noise but does not apply to noise in the workplace. The NPSE adopts the following concepts, to help consider whether noise is likely to have "significant adverse" or "adverse" effects on health and quality of life:

SOAEL – Significant Observed Adverse Effect Level.

This is the level above which significant adverse effects on health and quality of life occur.

LOAEL – Lowest Observed Adverse Effect Level.

This is the level above which adverse effects on health and quality of life can be detected.

NOEL – No Observed Effect Level.

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

2.9 The NPSE emphasises that:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available (Defra, 2010)."

NATIONAL PLANNING PRACTICE GUIDANCE (PPG)

2.10 Revised Planning Practice Guidance was released in March 2014 to support the NPPF and last updated in July 2019. The Guidance stipulates that Local Planning Authorities' plan making and decision making should take account of the acoustic environment and in doing so consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

2.11 The table below is in the Guidance to assist recognising "when noise could be a concern".

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

Table 1 – Planning Practice Guidance to Support National Planning Policy Framework.

BS 4142:2014+A1:2019 METHODS FOR RATING AND ASSESSING INDUSTRIAL AND COMMERCIAL SOUND

2.12 The British Standard BS 4142:2014 +A1:2019 "Methods for Rating and Assessing Industrial and Commercial Sound" describes methods for rating and assessing sound of an industrial or commercial nature. The scope of the standard includes relevant topics for commercial development, such as sound from fixed installations (mechanical and electrical plant and equipment). The standard is applicable to the determination of rating levels for sources of sound as well as ambient, background and residual levels. The Standard was amended in June 2019.

2.13 Certain acoustic features can increase the significance of impact that might be expected from a comparison of the specific sound level to the background sound level where these features are likely to affect perception and response. Where such features are present at the assessment location, a character correction (or penalty) to the specific sound level is made to obtain the rating level. This can be approached from subjective, objective and reference methods.

+ Tonality: A correction of 0dB to +6dB for sound ranging from not tonal to prominently tonal.

+ Impulsivity: A correction of up to +9dB can be applied for sound that is impulsive.

+ Intermittency: A penalty of +3dB can be applied if on/off conditions are readily distinctive within the reference time interval over the period of the greatest amount of on-time.

+ Other characteristics: A penalty of +3dB can be applied in the absence of all other defined characteristics, where the specific sound contains a distinctive feature in the residual acoustic environment.

2.14 Character corrections are normally added arithmetically where more than one feature is present, however, if any single feature is dominant to the exclusion of others, then it may be appropriate to reduce the correction or apply a zero correction for the minor characteristics. The rating sound level is equal to the specific sound level if there are no acoustic features present or expected to be present.

2.15 The significance of sound depends upon both the margin by which the rating level exceeds the background sound level and the context in which the sound occurs. An initial estimate of the impact of the specific sound is made by subtracting the measured background sound level from the rating level. The context of the development is important in assessing the impact.

- Typically, the greater this difference, the greater the magnitude of the impact.

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.

- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or significant adverse

impact. Where the rating level does exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

2.16 The scope of the Standard recognises that human response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The significance of its impact can depend on various factors such as the exceedance to the background level, its absolute level, time of day and change in environment, as well as local attitudes to the source of sound and character of the neighbourhood.

LOCAL POLICY

2.17 Camden London Borough Council's Local Plan[1] includes noise and vibration Policy A4, which states the following:

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

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

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

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

2.18 Within "Appendix 3: Noise thresholds" it is summarised that for noise sources of an industrial or commercial nature, it is expected that BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' would be applied and, for such cases a 'Rating Level' of 10 dB below background (15 dB if tonal components are present) should be considered as the design criterion.

2.19 Table C of Appendix 3 has been noted to provide a "Green, Amber, Red" criterion for plant noise during the day and night at a residential receptor, relating to LOAEL and SOAEL values (as described in the NPSE above). This table has been replicated below for ease of reference.

[1] Camden Local Plan, July 2017

Existing Noise sensitive receptor	Assessment Location	Design Period	LOAEL (Green)	LOAEL to SOAEL (Amber)	SOAEL (Red)
Dwellings**	Garden used for main amenity (free field) and outside living or dining or bedroom window (façade)	Day	'Rating level' 10 dB* below background	'Rating level' between 9 dB below and 5 dB above background	'Rating level' greater than 5 dB above background
Dwellings**	Outside bedroom window (façade)	Night	'Rating level' 10 dB* below background and no events exceeding 57 dB L_{Amax}	'Rating level' between 9dB below and 5dB above background or noise events between 57 dB and 88 dB L_{Amax}	'Rating level' greater than 5dB above background and/or events exceeding 88 dB L_{Amax}

Table 2 – Replication of Camden Local Plan Appendix 3: Table C

*10 dB should be increased to 15 dB if the noise contains audible tonal elements (day and night). However, if it can be demonstrated that there is no significant difference in the character of the residual background noise and the specific noise from the proposed development then this reduction may not be required. In addition, a frequency analysis (to include, the use of Noise Rating (NR) curves or other criteria curves) for the assessment of tonal or low frequency noise may be required.

**levels given are for dwellings, however, levels are use specific and different levels will apply dependent on the use of the premises.

2.20 Camden Planning Guidance (CPG) has provided further information on how planning policies are applied by the council. Included within the supplementary Amenity CPG[2] is a section on "Plant and other noise generating equipment", in which it states:

"Plant, ventilation, air extraction or conditioning equipment and flues can cause disturbance to residential properties. The Council would therefore welcome the use of long-term maintenance agreements to ensure that equipment maintains acceptable noise levels over its lifetime and the use of timers to limit any unnecessary operation of the equipment."

[2] Amenity, January 2021 (Camden Planning Guidance Supplementary Document)

3 ENVIRONMENTAL SURVEY SUMMARY

3.1 An environmental survey has been undertaken between 19th – 21st to quantify sound levels at the development site in accordance with BS 4142. Details of the study have been provided in Appendix D with results summarised herein this section.

BACKGROUND AND RESIDUAL SOUND LEVELS

3.2 The 'typical' background sound levels have been reported in this section in accordance with BS 4142 as established from histograms of the recorded dB $L_{A90,\ 15min}$ data at Position 1, shown in Appendix D. The measurement location has been used to describe the underlying climate at the southern façade of the development site, representative of the nearest noise sensitive location on the opposite side of the A4201 during proposed operating periods.

3.3 In line with Section 8.1.4 of BS 4142, the monitoring duration should reflect the range of background noise levels for the period assessed. In practice, there is no single level for background sound as this is a fluctuating parameter, although a representative value of the period should be used. Note this is not either the lowest or mean average value of dB $L_{A90,\ 15min}$.

Measurement Data		Free Field Sound Pressure Level, dB $L_{A90,\ T}$ re. 20µPa		
Date Range	Time HH:MM	Range	Representative	Period Description
19 – 21/07/2021	07:00 – 23:00	57 - 66	64	Day
	23:00 – 07:00	47 - 65	51	Night

Table 3 – Background sound level summary, dB $L_{A90,\ T}$.

3.4 The residual sound level data in this section have been summarised from raw data in Appendix D, generally in accordance with the requirements of BS 4142. The snapshots of environmental sound are taken to be representative of the underlying noise climate without the development in operation and are used to evaluate the environmental noise impact for the development.

Measurement Data		Free Field Sound Pressure Level, dB $L_{Aeq,\ T}$ re. 20µPa		
Date Range	Time HH:MM	Range	Representative*	Period Description
19 – 21/07/2021	07:00 – 23:00	65 - 75	68	Day
	23:00 – 07:00	59 – 77	62	Night

** Representative values of residual have been noted at times of representative background sound.*

Table 4 – Residual sound level summary, dB $L_{Aeq,\ T}$.

4 NOISE IMPACT ASSESSMENT

4.1 The recognised methodology for assessment has been taken from BS 4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* which includes consideration of sound from fixed plant installations.

4.2 It has been necessary to consider the noise generation from externally located plant items associated with the proposed development and the potential impact on nearby sensitive uses. All plant with noise generating elements located on the exterior of the building have been listed below, with the key items illustrated below in Figure 1. Further details provided in Appendix C.

- 10 no. Chiller/condenser units (CU 1 - 8 and CON 3 - 4)
- 1 no. Flaktwoods Kitchen supply fan (SF1)
- 1 no. Flaktwoods Kitchen Extract Fan with rooftop discharge (EF1)
- 1 no. Wash-up Extract Fan (EF2)
- 1 no. Heat recovery unit with supply and extract ducting at 2F level (HRU)

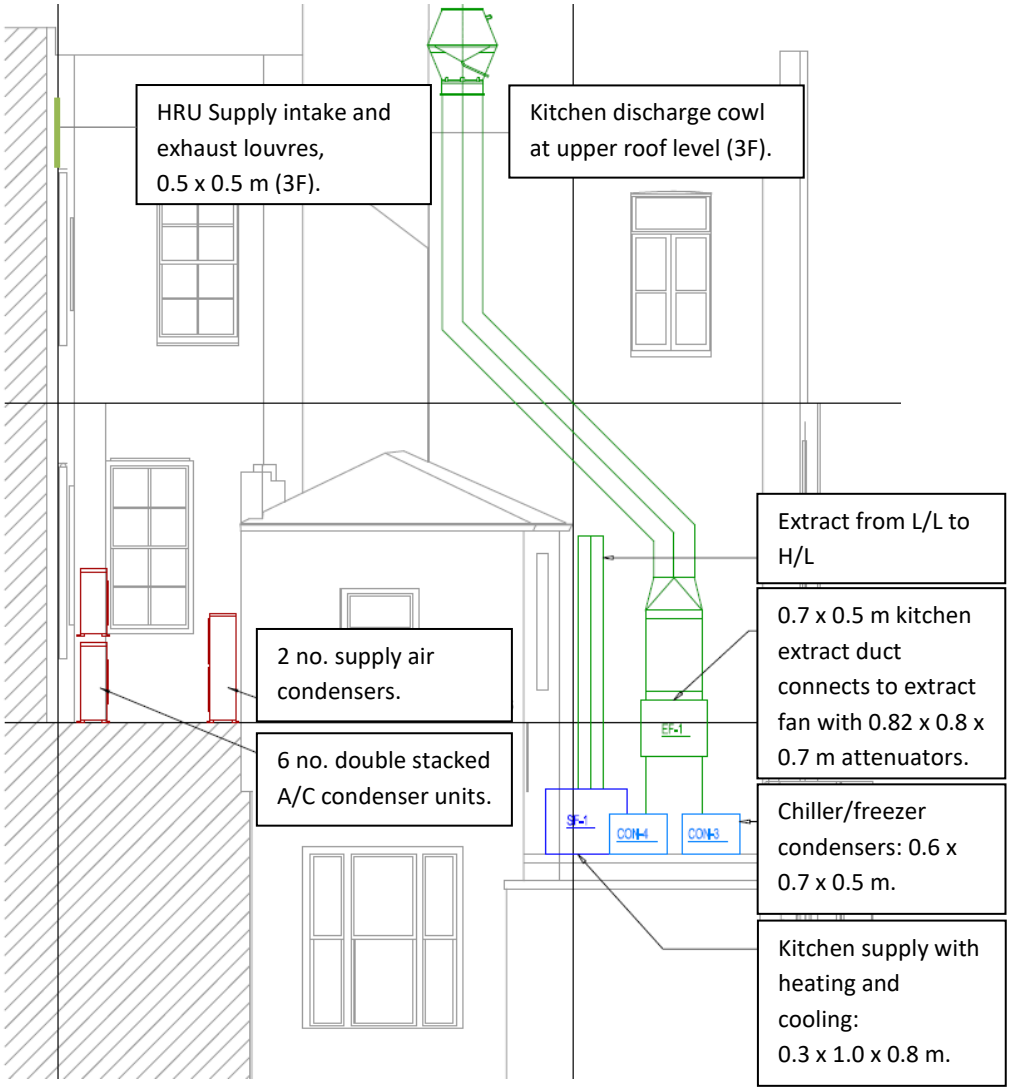


Figure 1 – Proposed North Rear elevation illustrating proposed locations of external plant.

4.3 As shown above, all external plant items have been proposed within dedicated plant decking areas to the rear of the development building, with kitchen extract ducting up to 3F roof level (shown in Figure 1) and HRU supply and exhaust located flush with the rear, south-west façade, ducted from an internal unit at 3F level, as illustrated in Figure C6 and C3 "West Alley Exterior Elevation", in Appendix C.

4.4 It has been noted that the above listed plant would replace the existing plant items located in these areas associated with the historic use of the building, identified as 13 - 15 no. decommissioned mixed-purpose condensers (as photographed in Figures D5 and D6 in Appendix D).

4.5 The nearest noise sensitive receptors (NNSRs) have been identified in Appendix B, Figure B1 as residential windows directly adjacent the development building, separated by the A4201, nominally 30 m from proposed plant items. The proposed plant location will be significantly screened by buildings where no line-of-sight occurs between receptor and source, illustrating a good acoustic design.

4.6 It has been noted that the policies within the Camden Local Plan consider the design criterion for commercial/industrial noise sources to be 10 dB below the measured background sound level and 15 dB if tonal components are present.

4.7 The recommended noise emission limits at 1 m from the nearest noise sensitive window have therefore been defined in the below table:

Time Period	Representative background sound level, dB $L_{A90,15min}$	Recommended noise emissions limit, BS 4142 Rating Level, dB $L_{Ar,\ Tr}$	Difference, dB
Daytime (07:00 – 23:00)	64	54	**-10**
Night-time (23:00 – 07:00)	51	41	**-10**

Table 5 – Recommended plant noise emissions limits expressed as BS 4142 Rating Level at 1 m from nearest noise sensitive receptor façade.

CALCULATION OF SPECIFIC SOUND LEVELS

4.8 Based on information presented in the manufacturer's datasheets (shown in Appendix F), and ducting specifications in Table C1 and Figures C3 – C5 in Appendix C, the sound levels of the proposed mechanical plant have been calculated, based upon the methods provided by CIBSE[3] .

4.9 The CIBSE calculation process comprises four components, the sound level from the extract outlet, the extract breakout, the supply inlet, and the supply breakout (where relevant). The full calculations can be found within Appendix E.

[3] Noise and vibration control for building services equipment. CIBSE Guide B4:2016. The Chartered Institution of Building Services Engineers CIBSE, 2016.

4.10 The contribution from the proposed mechanical plant sources have been provided in Table 6 below, and logarithmically summed to provide a prediction of the resultant sound pressure level at the nearest sensitive receptor. It should be noted that the calculation has illustrated a worst-case, in which all proposed plant units operate at 100 % fan speed, running coherently, at the same time, and at maximum duty continuously.

Source	Sound Pressure level dB $L_{Aeq,T}$ re. 20 µPa 1 m from nearest residential façade								
	Per octave band level, Hz								Total dB(A)
	63	125	250	500	1k	2k	4k	8k	
Condensers CU1 – CU8	-	-	-	-	-	-	-	-	33
Condensers CON 3 & CON 4	-	-	-	-	-	-	-	-	30
Kitchen Extract EF1 (combined elements: outlet and breakout)	0	36	29	21	18	14	8	3	26
Kitchen Supply SF1 (combined elements: outlet and breakout)	-	17	27	20	10	9	5	4	22
Wash-up Extract EF2	0	21	22	9	-2	-1	-4	-8	15
HRU supply and discharge	12	10	23	12	20	20	12	9	25
Sum at receptor	12	36	32	24	22	21	14	11	**36**

Table 6 – Proposed plant sound pressure levels at the nearest sensitive receptor (resultant level).

BS 4142 ASSESSMENT

4.11 The following numerical assessment has been presented in accordance with BS 4142:2014 A1:2019, as to provide a comparison between the rating sound level of the proposal against the background sound level existing prior to development.

4.12 The assessment has been based on both day and night-time operations, where it has been assumed that all plant could operate continuously and coherently for any given hour of the day and a worst-case 15-minutes in the night. It has been established that restaurant operations would start after 06:00 and conclude before 24:00 daily; however, the assessment below takes account of the underlying sound levels over the full night-time period (23:00 – 07:00) to ensure a robust evaluation and allow for some flexibility, if required.

Indicative BS 4142 assessment of proposed commercial plant to NNSR			
Result	**Day 07:00 – 23:00**	**Night 23:00 – 07:00**	**Commentary**
Background sound level, dB $L_{A90,T}$	64	51	Estimated as representative from histogram of background sound levels, from Table 3 and Appendix D.

Indicative BS 4142 assessment of proposed commercial plant to NNSR			
Result	**Day 07:00 – 23:00**	**Night 23:00 – 07:00**	**Commentary**
Residual sound level, dB $L_{Aeq, T}$	68	62	Representative based on the underlying range of measured levels in Table 4, as occurring during times of background sound.
Reference time interval	1-hour	15-minute	Relevant time interval for assessment period from BS 4142.
Specific sound level, dB $L_{Aeq, T}$	36	36	Recommended noise emission limits with a 3 dB reduction to account for character, as defined in Table 5 and **Error! Reference source not found.**.
Acoustic feature correction, dB	3	3	Precautionary correction for any intermittency (assuming source could be audible at receptor).
Rating level, dB $L_{Ar, Tr}$	39	39	The rating level is equal to the specific sound level plus acoustic feature corrections. These values have been derived in Table 5 as the recommended noise emission limits.
Excess of rating level over background sound level	**-28**	**-12**	
Assessment indicates likely indication of: *depending on the context	Low Impact	Low Impact	Where the rating level does not exceed the background sound level during any period of operation, this is an indication of the specific sound source having a low impact, depending on the context.
Uncertainty of the assessment	Low		See Statement of Uncertainty.

Table 7 – Numerical assessment in accordance with BS 4142 at nearest noise sensitive location

4.13 The numerical assessment in Table 7 has highlighted a low impact at the nearest noise sensitive location during periods of proposed operation, where the rating sound level has been predicted to lie significantly below the representative background sound level.

4.14 It has been acknowledged that these results must be considered in context, following the requirements of BS 4142. The concept of "context" has been notably emphasised in Section 11 of BS 4142 when considering numerical impacts established from applying the standard.

4.14.1 Where predictions have provided large differences between the residual sound level over the specific sound level, of > 10 dB(A), then it has been realised in context that the ambient sound level should not change by any perceptible degree due to the instatement of the development, regardless of daytime or night-time usage times.

4.14.2 Due to the large level difference between the residual and proposed activities, it has been further reviewed in context that these development activities will be largely indistinguishable at the receptor. It has been considered that masking will be afforded by the residual sound level given that relative differences would be significant for any daytime or night-time period.

4.14.3 Given the considerable masking noise presented by the residual environment, it has been determined that any noise character related to the plant emissions (including any tonality) would not be perceptible at the nearest sensitive receptor.

4.15 Where the cumulative rating level of building services plant at the nearest noise sensitive receptor is more than 10 dB below the representative background sound level in the day and night, this positively supports the notion of low impact in accordance with BS 4142. Furthermore, the impact may be considered negligible, when considering context following the requirements of BS 4142.

4.16 These findings also support the "Noise Thresholds" of Camden London Borough Council's Policy A4, on noise and vibration, providing plant emissions do not contain audible tonal characteristics, which has been determined as very unlikely given the prevailing residual sound level at the receptor, as described above.

STATEMENT OF UNCERTAINTY

4.17 Uncertainty inevitably limits the accuracy associated with all steps of any noise assessment, including measurement, calculation, or prediction. Factors include, but are not limited to:

- The inherent accuracy limitation of methodology in Standards and guidance.
- Variability in meteorological conditions.
- The accuracy of sound source input data of a calculation.

4.18 It is imperative to minimise the uncertainty to a level commensurate with the intention of the assessment objective. Measures taken in this assessment to minimise uncertainty are:

- Baseline sound levels have been measured over a reasonably long period and therefore provide a good indication of representative background and residual sound levels.
- Sound level measurements were undertaken in accordance with recognised Standards, using a tall environmental windshield and were undertaken during reasonable weather conditions e.g. acceptably low wind speeds and precipitation.
- A direct measurement location was used and is considered to provide a representative basis for background noise levels at the nearest receiver locations to the development.
- Field calibration checks were undertaken before and after measurements to record very low levels of equipment drift.
- The sound source data has been provided from site measurements.
- The calculations have been conservative as not to under-predict the resulting impacts.

4.19 The aforementioned measures have been considered to reduce uncertainty to a level considered not to have any significance to the outcome of this assessment.

5 PREDICTED NOISE IMPACTS AND PLANNING

5.1 The evaluated noise impacts in this report should be considered by Camden London Borough Council mindful of the National Planning Policy Framework and Noise Policy Statement for England, which currently define the policy and decision-making requirements for planning and noise.

5.2 In deciding a suitable planning outcome, it must be recognised that noise management is a complex issue and at times requires complex solutions. There is no European or national noise limit which must be met. To assist in defining what level of noise impacts should be acceptable in sustainable development, the NPSE refers to established concepts from toxicology that are currently being applied to noise impacts.

5.3 The NPSE suggests that noise levels above the SOAEL should be avoided and that if noise levels fall between the LOAEL and SOAEL all reasonable steps should be taken to minimise and mitigate adverse effects while also considering the guiding principles of sustainable development. This does not mean that adverse effects cannot occur from a noise-generating development.

5.4 The range of noise impacts reviewed for the proposed development have been deemed acceptable with respect to overarching requirements for planning and noise, where resulting impacts have been anticipated around the LOAEL threshold of the NPSE.

5.5 It is expected that the noise emissions resulting from the proposed development plant will be largely unnoticeable during the most noise sensitive periods of assessment, based on the recommended emissions limits given in Table 5. The sound contribution is not expected to cause any change in behaviour or attitude.

5.6 In accordance with overarching planning requirements, measures have been satisfactorily considered to "*mitigate and minimise adverse impacts on health and quality of life*" which can be secured on the development by conditional approval, if necessary, to include:

- **The plant emissions rating level at the nearest noise sensitive receptor shall not exceed the recommended limits at 1 m from the nearest habitable residential window:**
  - **54 dB $L_{Ar,Tr}$ during the day (07:00 – 23:00)**
  - **41 dB $L_{Ar,Tr}$ during the night (23:00 – 07:00)**

The recommended emissions limits are not considered onerous and can be readily achieved with the building services plant equipment proposed.

6 CONCLUSIONS

6.1 An assessment of environmental sound levels has been carried out for the proposed development at 198 High Street, Camden, NW1 8QP. Environmental sound levels have been taken from a site survey at the boundary of the development site.

6.2 The development has been recognised to accord to a good acoustic design process, with the worst-case noise generating plant located on a rooftop within a well screened area on the northern side of the proposed building (away from existing nearest residential receptors).

6.3 Plant noise emissions limits have been recommended based on Camden local policy requirements, in terms of BS 4142 rating level. Plant emissions predictions, based on tested manufacturer sound data has shown that the design requirement is not onerous, where the recommended limits can be readily achieved with the proposed building services plant.

6.4 Based on the recommended noise emission limits (defined in Section 4), the proposal is expected to achieve a low or negligible impact at the nearest noise sensitive receptors. It is recommended that permission be granted and where noise emissions may be controlled, if necessary, by a suitable worded planning condition.

Appendix A: Glossary of Acoustic Terms

'A' weighting dB(A): Correction applied to the frequency range of a noise in order to approximate the response of the human ear. Noise measurements are often A-weighted using an electronic filter in the sound level meter.

Attenuation: Sound reduction, measured in decibels (dB).

Ambient Sound: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far. Note: The ambient sound comprises the residual sound and the specific sound when present.

Background sound level: A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

Calibration: A check of the function of a sound level meter by comparing the meter reading with a known sound pressure level.

Decibel (dB): The unit of sound level and noise exposure measurement. The range of audible sound pressures is approximately 0 dB to 140 dB.

Frequency (Hz): The pitch of the sound, measured in Hertz.

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

Octave-bands: A division of the frequency range into recognised bands.

Rating level, LAr,Tr: The specific sound level plus any adjustment for the character of the sound.

Residual sound: Ambient sound remaining in the absence of the specific sound or that it is supressed as not to contribute to the ambient sound level.

Residual sound level, Lr or Leq,T: The equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given reference time interval, T.

Sound pressure level (SPL): The basic measure of sound, expressed in decibels, usually measured with an appropriate frequency weighting (e.g. the A-weighted SPL in dB(A)).

Sound power level (Lw): The sound energy radiated per unit time by a sound source measured in watts (W). Sound power can be weighted (e.g. A-weighted) and is not influenced by environmental or physical factors such as weather or distance.

Specific sound: Sound source being assessed.

Specific sound level, Ls or Leq,T: The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval, T.

Appendix B: Annotated Location Plan

Figure B1 – Location Plan, with measurement position, proposed external plant location and nearest noise sensitive receptors annotated.

Appendix C: Scheme Design and Plant Specifications

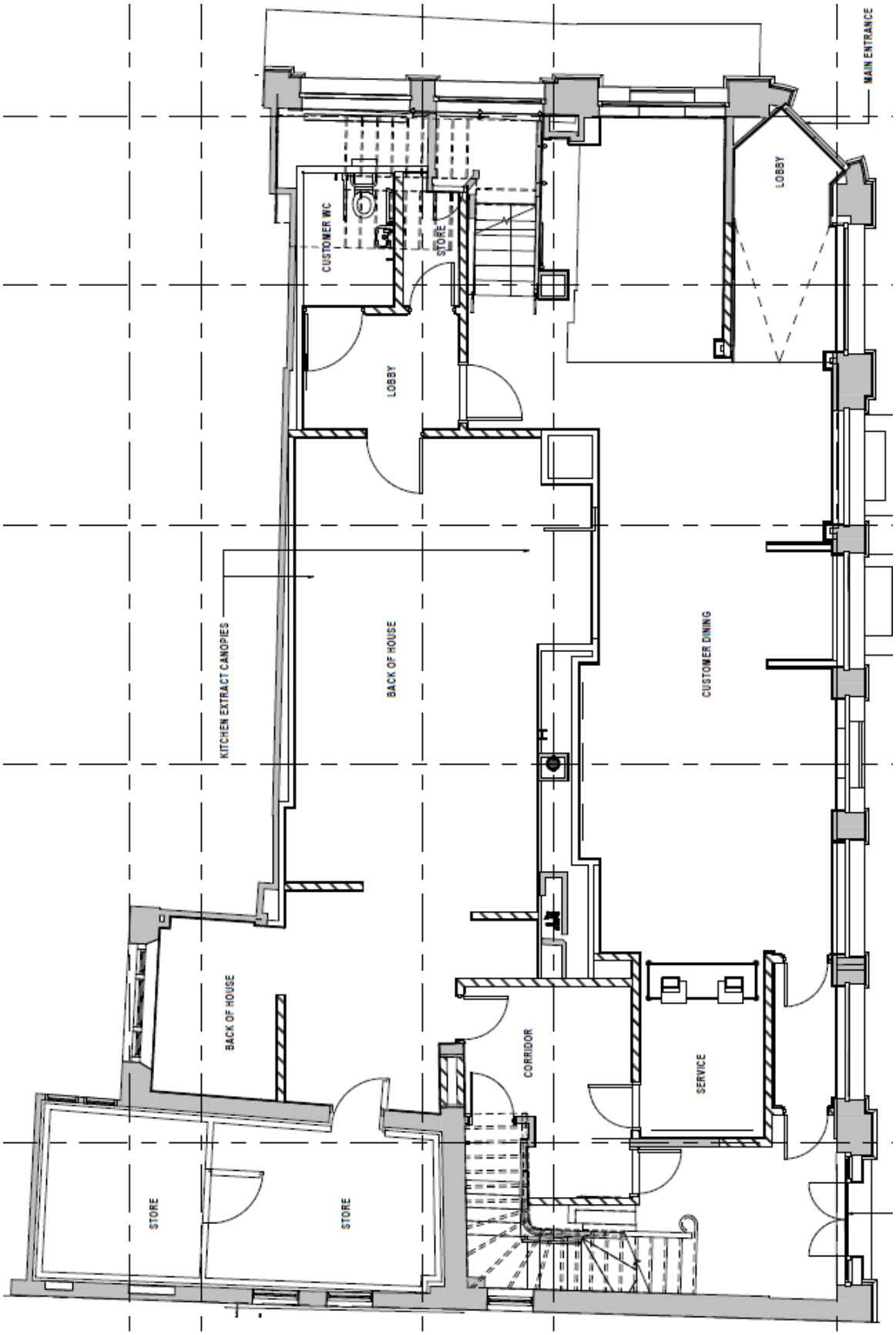


Figure C1 – Proposed ground floor development site plan.

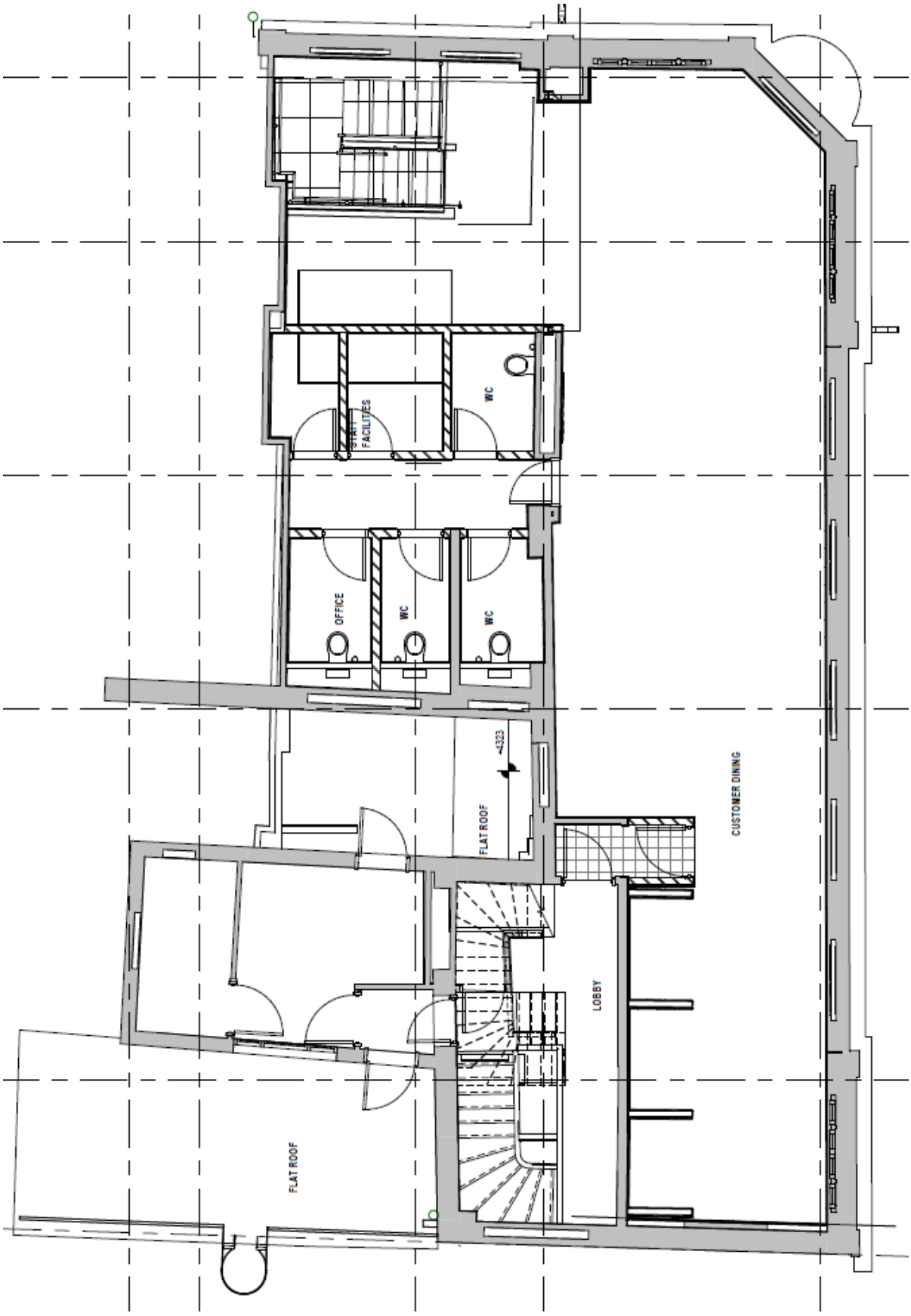


Figure C2 – Proposed first floor development site plan.

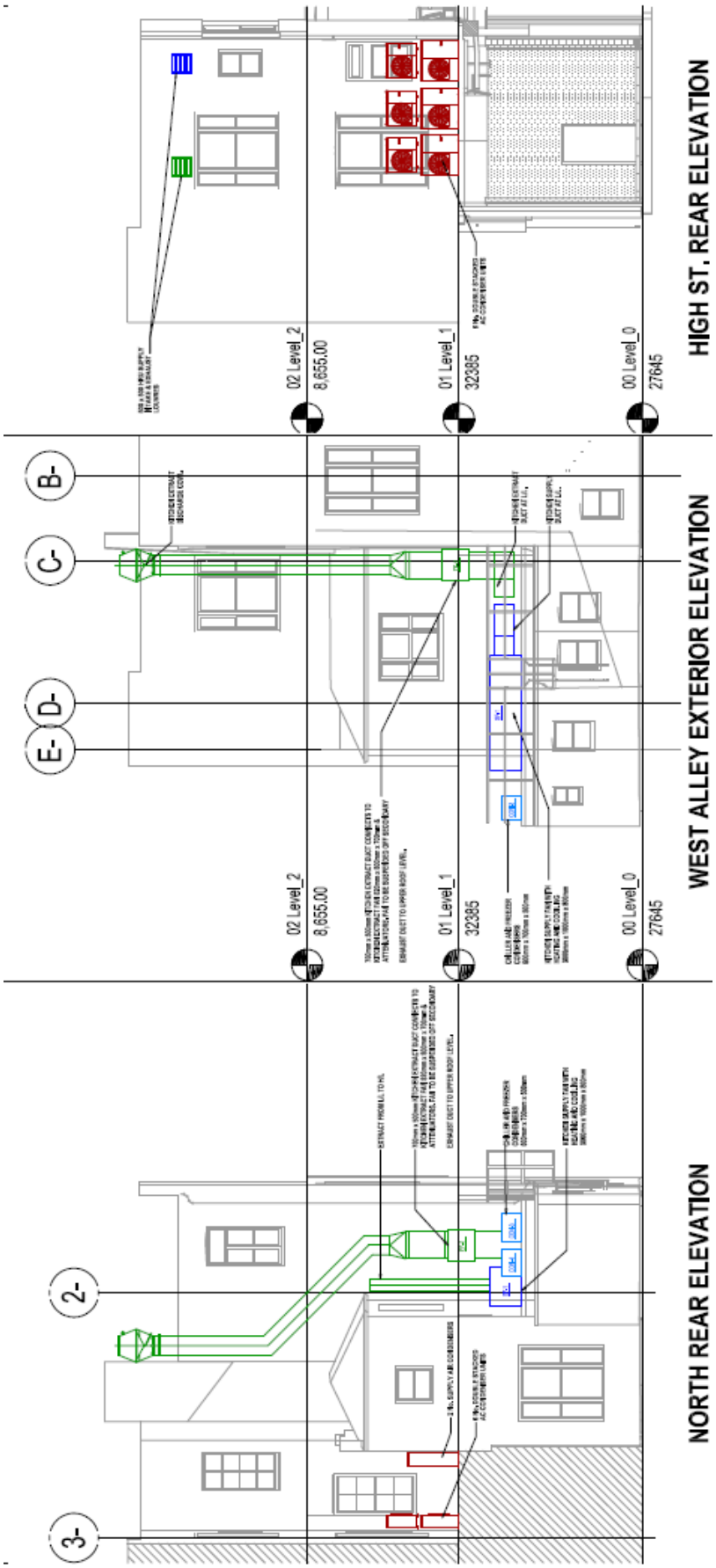


Figure C3 – Proposed Rear Elevations plan.

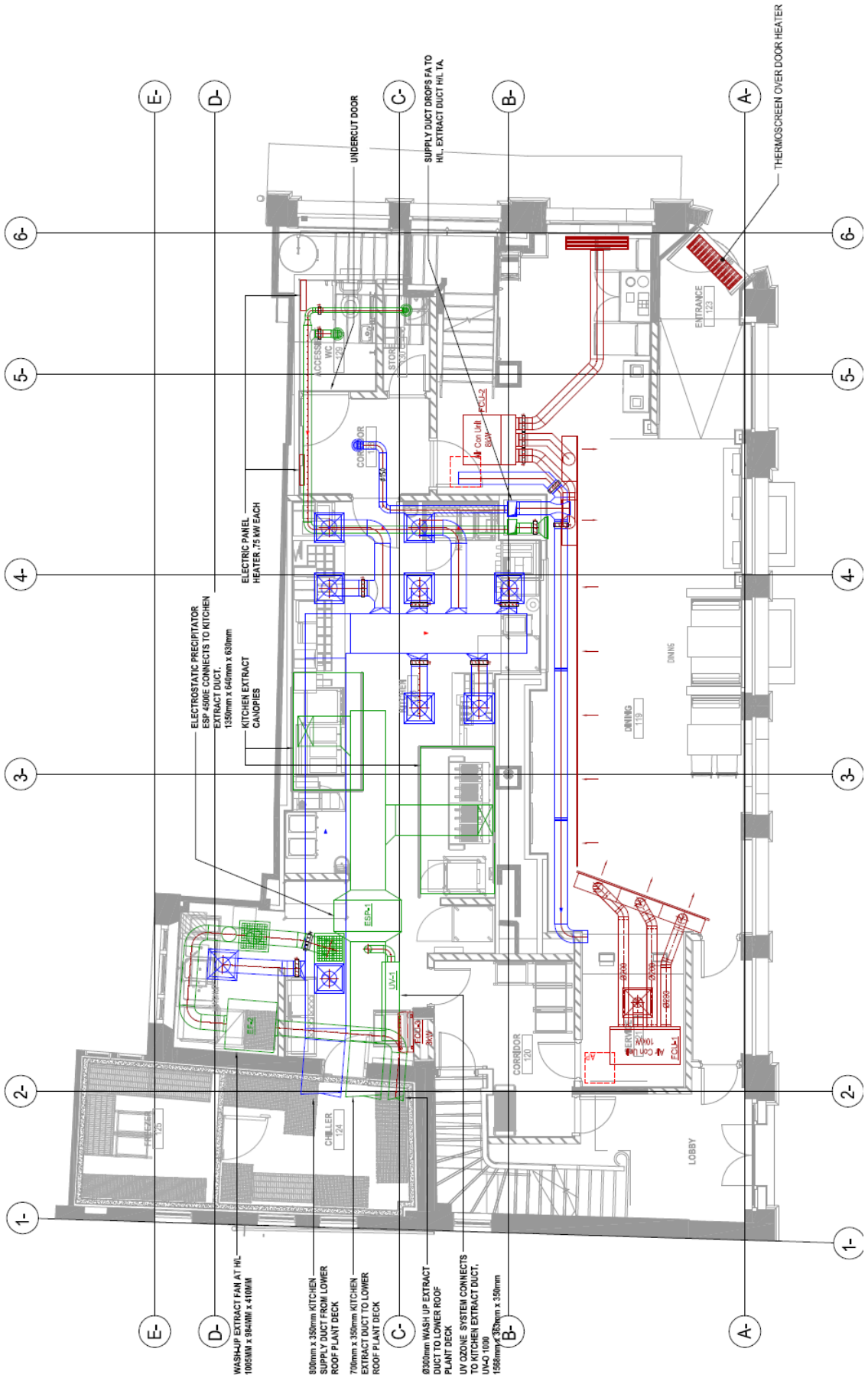


Figure C4 – Proposed Ground Floor M&E plan.

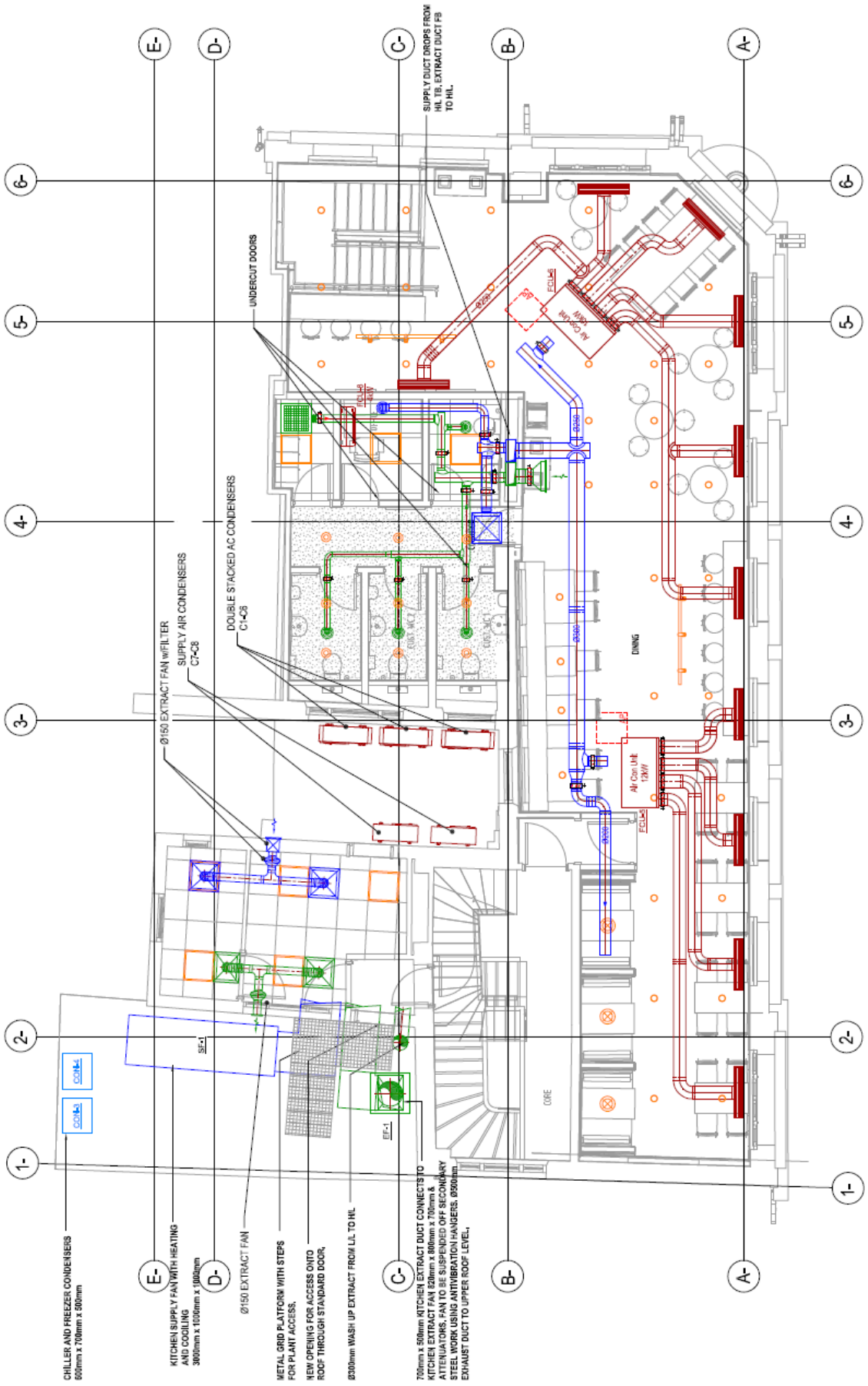


Figure C5 – Proposed First Floor M&E plan.

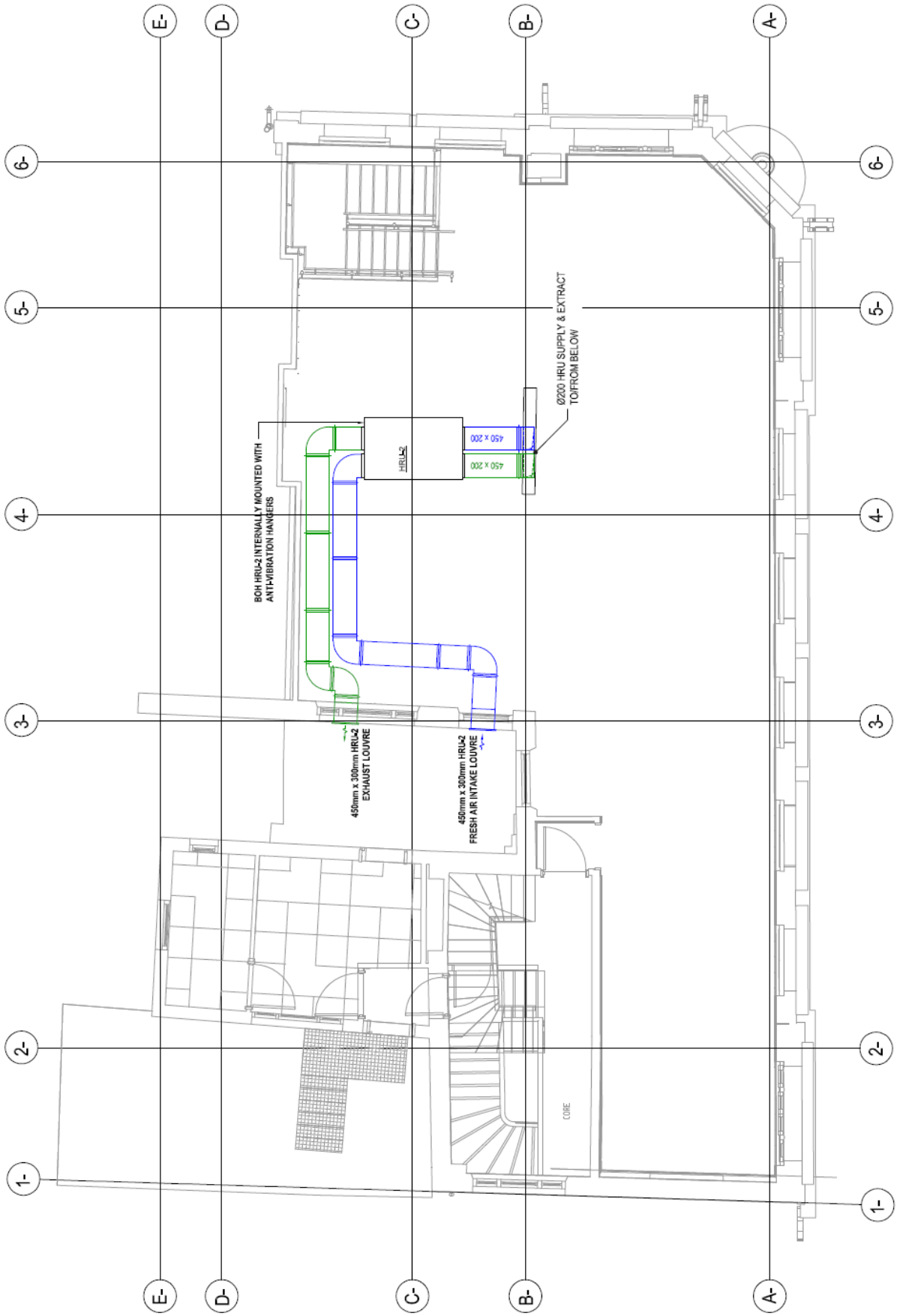


Figure C6 – Proposed First Floor M&E plan.

Item	Description	Model Number	Dimension WxHxD (mm)	Weight (KG)	Noise Level (dBA)	Duty	Electrical Data	Comments
EF1	Flaktwoods Kitchen Extract Fan	Estoc Targe 80-560-3-4	800 x 800 x 800	95	53>74	1.6m³/s @ 380Pa	400V/3ph/50Hz FLC: 24.7A	Set Inverter To 40Hz
SF1	Flaktwoods Supply Fan	ePowerBox 80-500-3-4	800 x 800 x 800	66	49>74	1.6m³/s @ 350Pa	400V/3ph/50Hz FLC: 14.9A	
EHB1	Electric Heater Battery	N/A	800 x 800 x 500	N/A	N/A	24.0kw	24kW, 3PHS, 3STG	Floor Stading Unit
HRU1	Evair Heat Exchanger Unit	REVEC-4200 H	1900 x 640 x 2300	296	85	9.0kW Heating 0.91m³/s @ 200Pa	400V/3ph/50Hz Current Absorbtion: 38.0A — Fresh Air Fan: 1155W, 0.91m³/s, 5.34A Exhaust Air Fan: 1155W, 1.27m³/s, 5.34A	
EF2	Flaktwoods Wash-up Extract Fan	ePowerBox 80-500-3-4	800 x 800 x 800	66	49>74	0.4m³/s @ 250Pa	240V/1ph/50Hz FLC: 4.04A	
AC1	Toshiba Wall Mounted Indoor Unit	RAV-RM301KRTP-E	798 x 293 x 230	10	55	2.5kW Nominal Cooling	N/A	
AC2	Toshiba Ducted Indoor Unit	RAV-RM1101BTP-E	1400 x 275 x 750	40	55	10.0kW Nominal Cooling	N/A	
AC3	Toshiba Ducted Indoor Unit	RAV-RM801BTP-E	1000 x 275 x 750	30	49	8.0kW Nominal Cooling	N/A	
AC4	Toshiba Ducted Indoor Unit	RAV-RM1401BTP-E	1400 x 275 x 750	40	55	12.1kW Nominal Cooling	N/A	
AC5	Toshiba Ducted Indoor Unit	RAV-RM1101BTP-E	1400 x 275 x 750	40	55	10.0kW Nominal Cooling	N/A	
AC6	Toshiba Wall Mounted Indoor Unit	RAV-RM401KRTP-E	798 x 293 x 230	10	55	3.6kW Nominal Cooling	N/A	
CU1	Toshiba Outdoor Unit	RAV-GM301ATP-E	780 x 550 x 290	33	62	2.5kW Nominal Cooling	220-240V/1ph/50Hz	
CU2	Toshiba Outdoor Unit	RAV-GM1101ATP-E	900 x 890 x 320	68	74	10.0kW Nominal Cooling	220-240V/1ph/50Hz	
CU3	Toshiba Outdoor Unit	RAV-GM801ATP-E	780 x 550 x 290	44	69	8.0kW Nominal Cooling	220-240V/1ph/50Hz	
CU4	Toshiba Outdoor Unit	RAV-GM1401ATP-E	900 x 890 x 320	68	68	12.1kW Nominal Cooling	220-240V/1ph/50Hz	
CU5	Toshiba Outdoor Unit	RAV-GM1101ATP-E	900 x 890 x 320	68	74	10.0kW Nominal Cooling	220-240V/1ph/50Hz	
CU6	Toshiba Outdoor Unit	RAV-GM401ATP-E	780 x 550 x 290	39	65	3.6kW Nominal Cooling	220-240V/1ph/50Hz	
CU7	Toshiba AHU Outdoor Condensing Unit	MCY-MAP601HT	900 x 1340 x 320	117	67	18.0kW Nominal Cooling	220-240V/1ph/50Hz, 18.3A 25A Fuse	
CU8	Toshiba AHU Outdoor Condensing Unit	MCY-MAP601HT	900 x 1340 x 320	117	67	18.0kW Nominal Cooling	220-240V/1ph/50Hz, 18.3A 25A Fuse	
DXI	Toshiba AHU DX Coil Interface	MM-DXC010	300 x 300 x 150	N/A	N/A	28.0kW Nominal Cooling	230V/1ph/50Hz	Controls For Supply DX Coil
DC1	Thermoscreen Air Curtain C Range Exposed	C1000E NT	1137 x 198 x 275	18	N/A	4.5/9kW Output	400V/3ph/50Hz Loading: 13.7A per phase	With Modbus Card
RAD1	ECOLEC	Panel Heater	600 x 500 x 40	-	N/A	0.75kW Output	230V/1ph/50Hz	
RAD2	ECOLEC	Panel Heater	600 x 500 x 40	-	N/A	0.75kW Output	230V/1ph/50Hz	
ESP	Purified Air ESP	ESP 4500E	640 x 630 x 1471	118	N/A	2.1m³/s	220-240V/3ph/50Hz 40W	
UV	Purified Air UV	UV-C 4500E	640 x 630 x 1471	89	N/A	2.1m³/s	220-240V/3ph/50Hz 1680W	

Table C1 – Proposed Plant Equipment Schedule.

EF1 - Targe Powerbox 80-560-3	63	125	250	500	1k	2k	4k	8k	Overall	LpA @ 3m, dBA
Inlet	26	82	84	75	71	69	66	60	**87**	*58*
Outlet	26	89	83	79	76	73	68	62	**91**	*61*
Breakout	26	76	70	62	59	58	54	50	**77**	*46*

Table C2 – Proposed Extract Fan EF1 tested sound data from manufacturer data sheet.

SF1 - ePowerBox EC 80-500-3-4 (G.6FF)	125	250	500	1k	2k	4k	8k	Overall	LpA @ 3m, dBA
Inlet	60	72	67	59	57	53	51	**74**	*48*
Outlet	75	76	71	67	62	57	53	**80**	*53*
Breakout	67	67	48	34	26	21	19	**70**	*39*

Table C2 – Proposed Supply Fan SF1 tested sound data from manufacturer data sheet.

EF2 - ePowerBox EC 80-500-3-4 (G.6FF)	63	125	250	500	1k	2k	4k	8k	Overall	LpA @ 3m, dBA
Inlet	-	60	72	67	59	57	53	51	**74**	*48*
Outlet	-	75	76	71	67	62	57	53	**80**	*53*
Breakout	-	67	67	48	34	26	21	*19*	**70**	*39*

Table C4 – Proposed Extract Fan EF2 tested sound data from manufacturer data sheet.

HRU - NRVU BVU	63	125	250	500	1k	2k	4k	8k	Overall
Inlet (Supply)	73	64	74	72	74	73	68	68	**80**
Outlet (Exhaust)	69	65	81	73	75	75	70	69	**84**
Breakout	71	58	63	52	50	44	40	32	**65**

Table C5 – Proposed Heat Recovery Unit (HRU) supply and exhaust tested sound data from manufacturer data sheet.

CU1 – CU8: Condenser Items	Item	Data	Total
RAV-GM301ATP-E	CU1	A-weighted Sound Power Level, L_{WA} dB(A)	62
RAV-GM1101ATP-E	CU2		74
RAV-GM801ATP-E	CU3		69
RAV-GM1401ATP-E	CU4		74
RAV-GM1101ATP-E	CU5		74
RAV-GM401ATP-E	CU6		65
MCY-MAP601HT	CU7		68
	CU8		68

Table C6 – Proposed Condenser (CU1 – CU8) tested sound data from manufacturer data sheet.

CON 3 and CON4: Condenser Items	Item	Data	Total
Duet + 3-1H	CON 3	A-weighted Sound Pressure level at 10 m, L_{pA} dB(A)	40
Duet + 2-1L	CON 4		45

Table C7 – Proposed Condenser (CU1 – CU8) tested sound data from manufacturer data sheet.

Appendix D: Environmental Survey Summary

The equipment used conforms to BS EN 61672-1:2003 (Class 1) for sound level meters and BS EN 60942 (Class 1) for sound calibrators; with at least traceable calibration history valid; no greater than two years for sound level meters and one year for sound calibrators, relevant to the times of the site assessment.

Manufacturer	Model No.	Description	Serial No.
Larson Davis	LxT (ST)	3rd octave band sound level meter	5851
	PRMLxT1L	Microphone preamplifier (low range)	55752
	337B02	½" electret microphone	313910
	CAL200	Sound level calibrator	11165

Table D1 – Sound monitoring equipment.

Validation checks at the end of the survey demonstrated acceptable drift across all parts of the study, across the sound level measurement equipment used, of ≤ 0.20 dB. Interval data was recorded at the measurement location at 1-minute and 15-minute periods, time synchronised to BST.

Weather conditions at the times of site attendance were deemed acceptable for surveying.

Weather conditions	Start	Finish	Additional comments
Wind velocity	3 m/s average	< 4 m/s average	None
Wind direction	North	East	
Cloud cover/rain	0 %, no rain	0 %, no rain	
Temperature	28 °C	26 °C	

Table D2 – Recorded weather conditions.

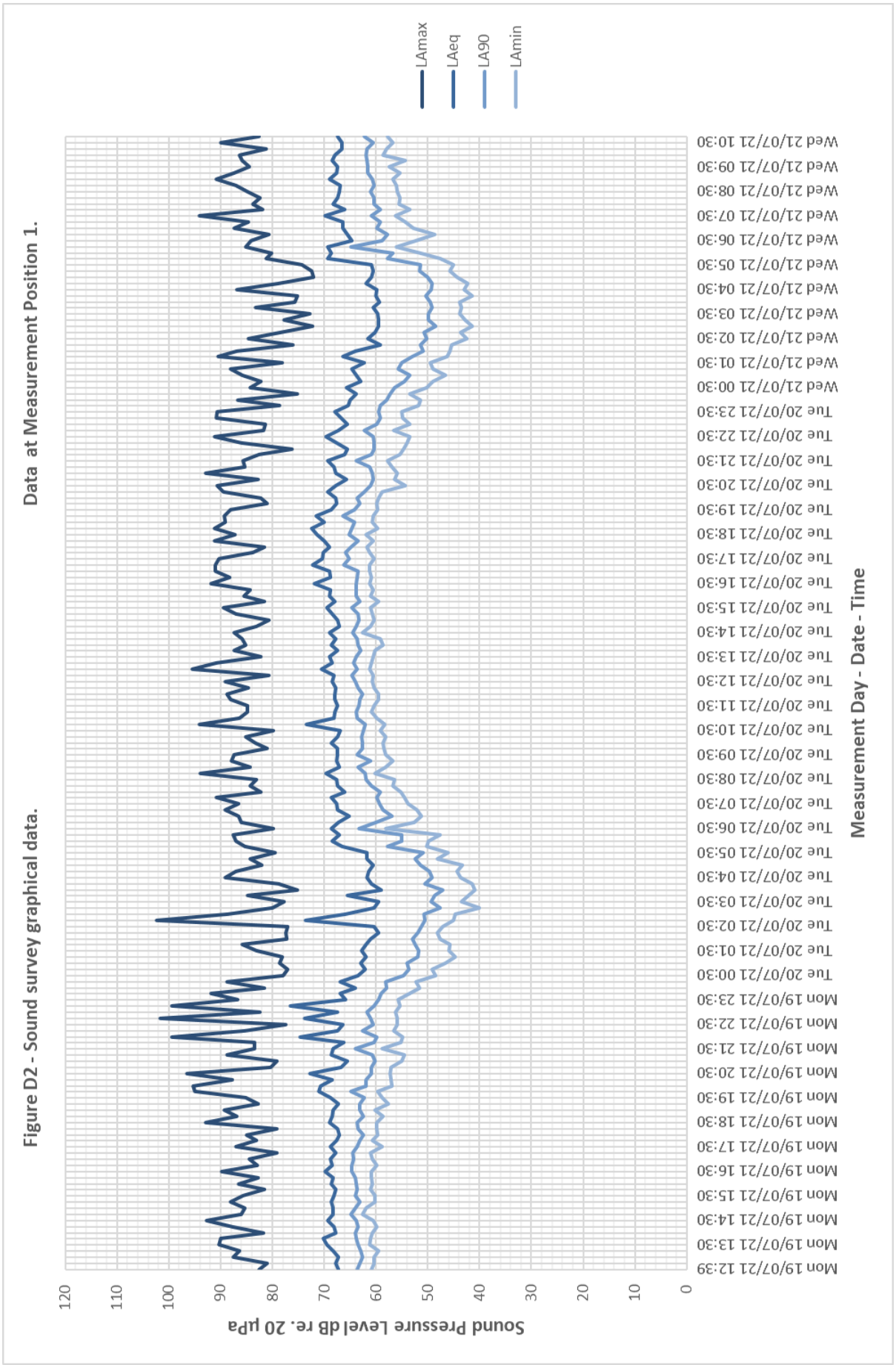
A brief description of the measurement position has been provided below:

Extended 0.5 m out of a southeast facing, 2F window, facing onto the A4201 and commercial high street, representative of the adjacent residential receptors at the same height.

Incident sound was observed predominantly from road traffic on the A4201 as well as A502 (Camden High Street). Other sounds included general sounds from pedestrian traffic below as well as music from a high street grocery seller directly below.

No other commercial activity was audible.

Figure D1 – Photos highlighting Measurement Position 1.


LAmax
LAeq
LA90
LAmin
Sound Pressure Level dB re. 20 µPa
0
10
20
30
40
50
60
70
80
90
100
110
120
Measurement Day - Date - Time
Mon 19/07/21 12:39
Mon 19/07/21 13:30
Mon 19/07/21 14:30
Mon 19/07/21 15:30
Mon 19/07/21 16:30
Mon 19/07/21 17:30
Mon 19/07/21 18:30
Mon 19/07/21 19:30
Mon 19/07/21 20:30
Mon 19/07/21 21:30
Mon 19/07/21 22:30
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Tue 20/07/21 23:30
Wed 21/07/21 00:30
Wed 21/07/21 01:30
Wed 21/07/21 02:30
Wed 21/07/21 03:30
Wed 21/07/21 04:30
Wed 21/07/21 05:30
Wed 21/07/21 06:30
Wed 21/07/21 07:30
Wed 21/07/21 08:30
Wed 21/07/21 09:30
Wed 21/07/21 10:30
Data at Measurement Position 1.
Figure D2 - Sound survey graphical data.

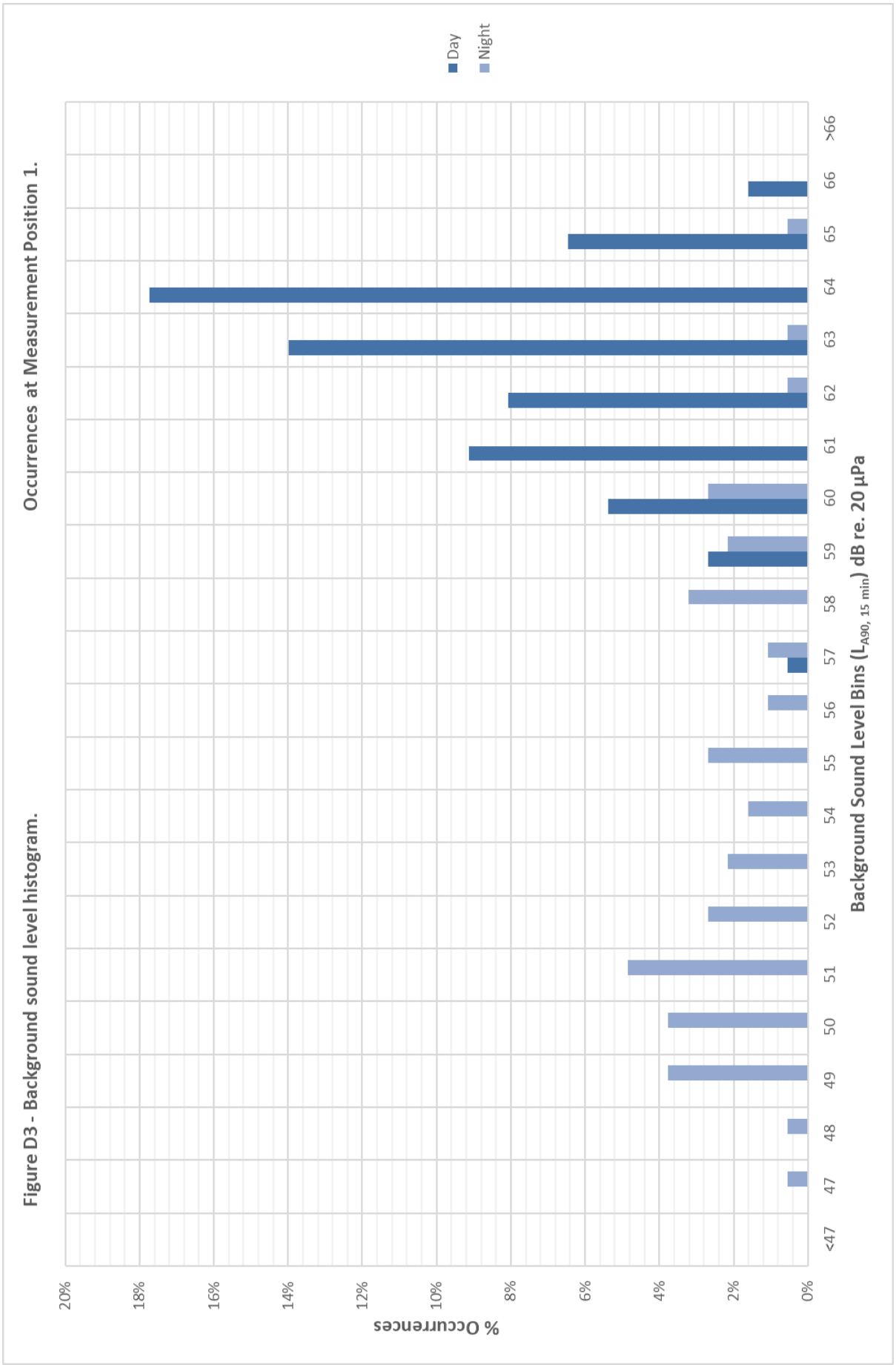


Figure D3 - Background sound level histogram.

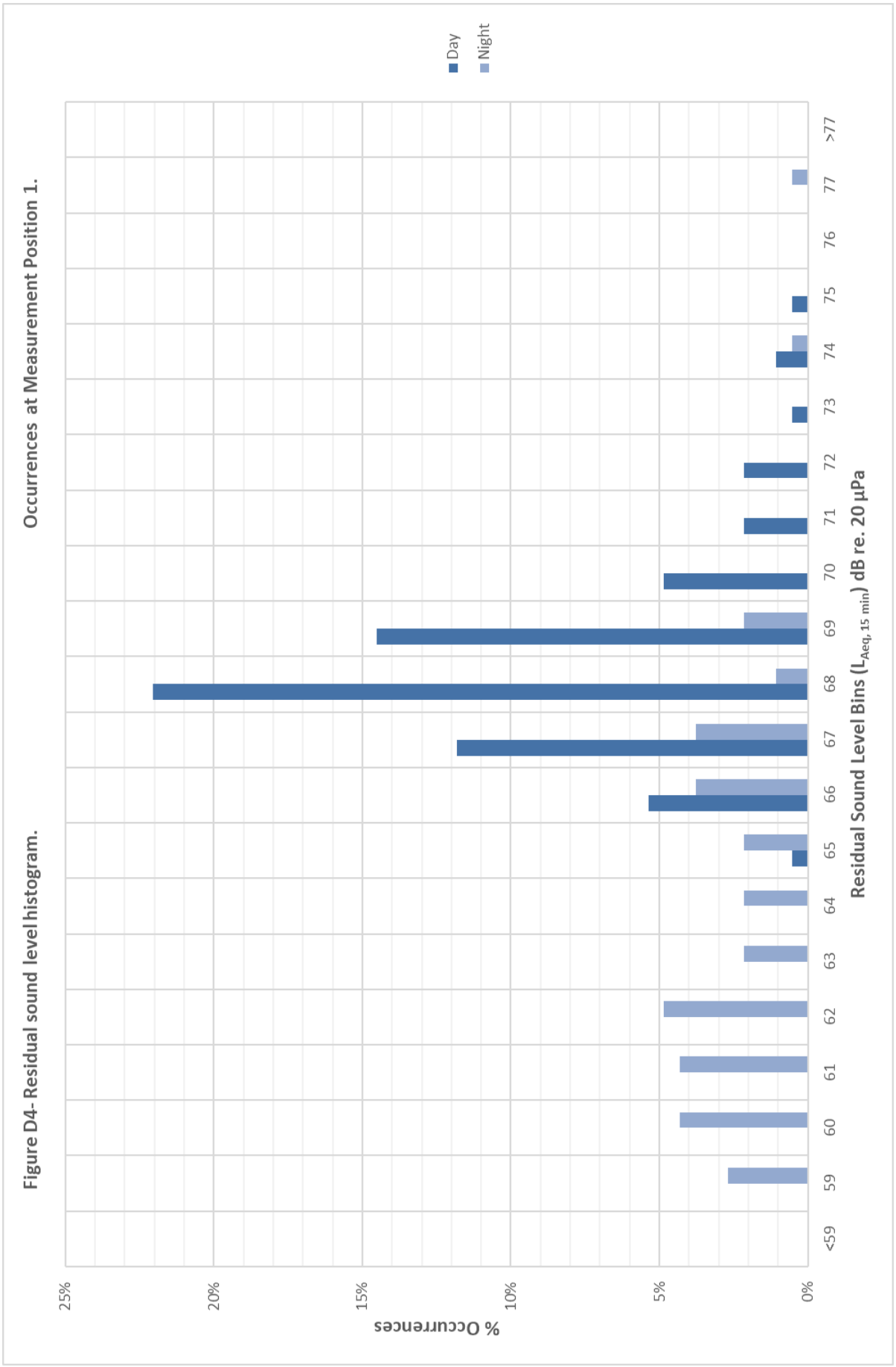


Figure D4- Residual sound level histogram.

Figures D5 and D6 – Photos highlighting existing mechanical plant in designated plant roofing areas at rear of proposed development building (northwest side).

Appendix E: Calculations

Condensers CU1 - CU8 calculation of noise to nearest receptor				
#	Procedure	Item	Data	Total
1	RAV-GM301ATP-E	CU1	Sound Power Level, L_{WA} dB(A)	62
	RAV-GM1101ATP-E	CU2		74
	RAV-GM801ATP-E	CU3		69
	RAV-GM1401ATP-E	CU4		74
	RAV-GM1101ATP-E	CU5		74
	RAV-GM401ATP-E	CU6		65
	MCY-MAP601HT	CU7		68
		CU8		68
2	Sum of A-weighted sound pressure levels at 1 m from source(s)		L_{pA} dB(A)	69
3	Reflections (Q = 4)		dB	6
4	Distance correction (30 m to receptor)		dB	-30
5	Screening Loss		dB	-12
6	A-weighted sound pressure level from source(s) at receptor		L_{pA} dB(A)	**33**

Table E1 – Proposed condenser sound levels (CU1 – CU8) calculated to nearest receptor.

CON3 Condenser Breakout Calculation to Nearest Receptor			
#	Procedure	Data	Total
1	Extract breakout – A-weighted sound pressure level at 1 m	L_{pA} dB(A)	60
2	Reflections (Q = 4)	dB	6
3	Distance correction (30 m to receptor)	dB	-30
4	Screening loss	dB	-12
5	A-weighted sound pressure level at receptor	L_{pA} dB(A)	**24**

Table E2 – Proposed freezer condenser sound levels (CON3) calculated to nearest receptor.

CON4 Condenser Breakout Calculation to Nearest Receptor			
#	Procedure	Data	Total
1	Extract breakout – A-weighted sound pressure level at 1 m	L_{pA} dB(A)	65
2	Reflections (Q = 4)	dB	6
3	Distance correction (30 m to receptor)	dB	-30
4	Screening loss	dB	-12
5	A-weighted sound pressure level at receptor	L_{pA} dB(A)	**29**

Table E3 – Proposed freezer condenser sound levels (CON4) calculated to nearest receptor.

EF1 - Estoc Targe (Powerbox) Fan Aperture (Extract) Calculation to Nearest Receptor										
#	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
1	In-duct sound power level	L_W dB	26	89	83	79	76	73	68	62	82
2	Duct losses	dB	-10.8	-7.2	-5.4	-1.8	-1.8	-1.8	-1.8	-1.8	-
3	Bend losses	dB	0.0	-1.0	-5.0	-8.0	-4.0	-3.0	-3.0	-3.0	-
4	End reflection	dB	-6.7	-3.1	-1.1	-0.3	-0.1	0.0	0.0	0.0	-
5	L_W at exit	L_W dB	9	78	72	69	70	68	63	57	75
6	Reflections	dB	3	3	3	3	3	3	3	3	-
7	Power to pressure	L_p	-37	-37	-37	-37	-37	-37	-37	-37	-
8	Screening correction	dB	-5	-6	-7	-8	-9	-12	-14	-17	-
9	Directivity correction factor	dB	-0.25	-0.25	-0.5	-4.5	-7.5	-7	-7	-7	
10	A-weighting	dB	-26	-16	-9	-3	0	1	1	-1	-
11	**Sound Pressure level at receptor**	**L_{pA} dB(A)**	**-57**	**22**	**22**	**20**	**20**	**17**	**10**	**-1**	**25**

Duct Breakout Calculation to Nearest Receptor										
	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
	L_W at end of element	L_W dB	15	82	78	77	74	71	66	60	79
	Duct transmission loss	dB	24	24	25	26	29	32	36	39	-
	Length effect	dB	0	67	61	60	54	48	39	30	-
	Distance loss	dB	-28	-28	-28	-28	-28	-28	-28	-28	-
	Reflections	dB	3	3	3	3	3	3	3	3	-
	Screening correction	dB	-12	-14	-17	-20	-20	-20	-20	-20	-
	Direct field Level	dB	-37	27	19	15	9	3	-6	-15	-
	Reverberant field level	dB	0	0	0	0	0	0	0	0	-
	Resultant SPL at receptor	**L_{pA} dB(A)**	0	27	19	15	9	5	1	0	17

#	Details of system and surrounding context			
2	Duct Length:		9	m
3	Number of bends		1	
4	End diameter	W	H	
		700	500	mm
6	Reflection Factor	Q =	2	
7	Distance		27	m
8	Path Difference:		0.05	
9	Exhaust area		0.35	m^2
	Angle		90	°

Table E4 – Proposed Extract Fan sound levels (EF1) calculated to nearest receptor (CIBSE).

EF2 - ePowerBox EC 80-500-3-4 (G.6FF) Fan Breakout Calculation to Nearest Receptor										
#	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
1	In-duct sound power level	L_W dB	0	75	76	71	67	62	57	53	73
2	Duct losses	dB	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-
3	Bend losses	dB	0.0	0.0	-2.0	-10.0	-16.0	-8.0	-6.0	-6.0	-
4	End reflection	dB	-11.5	-6.7	-3.0	-1.0	-0.3	-0.1	0.0	0.0	-
5	L_W at exit	L_W dB	-12	68	71	60	50	54	51	47	64
6	Reflections	dB	3	3	3	3	3	3	3	3	-
7	Power to pressure	L_p dB	-37	-37	-37	-37	-37	-37	-37	-37	-
8	Screening correction	dB	-10	-12	-15	-18	-21	-24	-24	-24	-
9	Directivity correction factor	dB	1	2	3	4	5	6	6	6	
10	A-weighting	dB	-26	-16	-9	-3	0	1	1	-1	-
11	**Sound Pressure level at receptor**	**L_{pA} dB(A)**	**-81**	**8**	**16**	**9**	**1**	**3**	**0**	**-6**	**15**

Duct Breakout Calculation to Nearest Receptor										
	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
	L_W at end of element	L_W dB	0	75	76	71	67	62	57	53	73
	Duct transmission loss	dB	23	18	24	25	28	31	35	38	-
	Length effect	dB	-20	60	55	49	42	34	25	18	-
	Distance loss	dB	-22	-22	-22	-22	-22	-22	-22	-22	-
	Reflections	dB	3	3	3	3	3	3	3	3	-
	Screening correction	dB	-12	-15	-17	-20	-23	-24	-24	-24	-
	Direct field Level	dB	-52	26	18	9	-1	-10	-19	-26	-
	Reverberant field level	dB	0	0	0	0	0	0	0	0	-
	Resultant SPL at receptor	**L_{pA} dB(A)**	0	26	18	10	3	0	0	0	14

#	Details of system and surrounding context			
2	Duct Length:		4	m
3	Number of bends		2	
4	End diameter	W	H	
		300	300	mm
6	Reflection Factor	Q =	2	
7	Distance		28	m
8	Path Difference:		0.99	
9	Exhaust area		0.09	m^2
	Angle		0	°

Table E5 – Proposed Extract Fan sound levels (EF2) calculated to nearest receptor (CIBSE).

SF1 - (ePowerBox EC 8) Fan Breakout Calculation to Nearest Receptor										
#	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
1	In-duct sound power level	L_W dB	0	68	80	75	67	65	61	59	76
2	Duct losses	dB	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-
3	Bend losses	dB	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
4	End reflection	dB	-4.3	-1.7	-0.5	-0.1	0.0	0.0	0.0	0.0	-
5	L_W at exit	L_W dB	-5	66	79	75	67	65	61	59	76
6	Reflections	dB	3	3	3	3	3	3	3	3	-
7	Power to pressure	L_p dB	-37	-37	-37	-37	-37	-37	-37	-37	-
8	Screening correction	dB	-13	-15	-18	-21	-24	-24	-24	-24	-
9	Directivity correction factor	dB	1	1	1.5	1.5	2	2	2	2	
10	A-weighting	dB	-26	-16	-9	-3	0	1	1	-1	-
11	**Sound Pressure level at receptor**	**L_{pA} dB(A)**	**-76**	**2**	**20**	**18**	**11**	**10**	**6**	**2**	**20**

	Duct Breakout Calculation to Nearest Receptor									
	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
	L_W at end of element	L_W dB	0	68	80	75	67	65	61	59	76
	Duct transmission loss	dB	22	27	28	29	32	35	39	42	-
	Length effect	dB	-17	46	57	51	40	35	27	22	-
	Distance loss	dB	-24	-24	-24	-24	-24	-24	-24	-24	-
	Reflections	dB	6	6	6	6	6	6	6	6	-
	Screening correction	dB	-13	-15	-18	-21	-24	-24	-24	-24	-
	Direct field Level	dB	-49	12	20	11	-3	-8	-16	-21	-
	Reverberant field	dB	0	0	0	0	0	0	0	0	-
	Resultant SPL at receptor	**L_{pA} dB(A)**	0	12	20	12	2	1	0	0	14

#	Details of system and surrounding context			
2	Duct Length:		0.2	m
3	Number of bends		0	
4	End diameter	W	H	
		1000	800	mm
6	Reflection Factor	Q =	2	
7	Distance		29	m
8	Path Difference:		2.11	
9	Exhaust area		0.80	m^2
	Angle		45	°

Table E6 – Proposed Supply Fan sound levels (SF1) calculated to nearest receptor (CIBSE).

HRU - NRVU BVU (Supply) Calculation to Nearest Receptor										
#	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
1	In-duct sound power level	L_W dB	73	64	74	72	74	73	68	68	79
2	Duct losses	dB	-10.0	-7.0	-3.0	-2.5	-2.5	-2.5	-2.5	-2.5	-
3	Bend losses	dB	0.0	-2.0	-10.0	-16.0	-8.0	-6.0	-6.0	-6.0	-
4	End reflection	dB	-10.0	-5.4	-2.3	-0.7	-0.2	-0.1	0.0	0.0	-
5	L_W at exit	L_W dB	53	50	59	53	63	64	60	60	69
6	Reflections	dB	3	3	3	3	3	3	3	3	-
7	Power to pressure	L_p dB	-37	-37	-37	-37	-37	-37	-37	-37	-
8	Screening correction	dB	-6	-7	-8	-10	-12	-14	-17	-20	-
9	Directivity correction factor	dB	0.5	1.5	2	2.75	3.25	4	4	4	
10	A-weighting	dB	-26	-16	-9	-3	0	1	1	-1	-
11	**Sound Pressure level at receptor**	**L_{pA} dB(A)**	**-12**	**-5**	**10**	**9**	**21**	**21**	**13**	**9**	**22**

#	Details of system and surrounding context			
2	Duct Length:		5	m
3	Number of bends		2	
4	End diameter	W	H	
		450	300	mm
6	Reflection Factor	Q =	2	
7	Distance		28	m
8	Path Difference:		0.10	
9	Exhaust area		0.14	m^2
	Angle		45	°

Table E7 – Proposed Intake sound levels (HRU) calculated to nearest receptor (CIBSE).

HRU - NRVU BVU (Exhaust) Calculation to Nearest Receptor										
#	Procedure	Data	Octave Band Level dB							Total dB(A)
			63	125	250	500	1k	2k	4k	8k	
1	In-duct sound power level	L_W dB	69	65	81	73	75	75	70	69	81
2	Duct losses	dB	-11.0	-7.7	-3.3	-2.8	-2.8	-2.8	-2.8	-2.8	-
3	Bend losses	dB	0.0	-2.0	-10.0	-16.0	-8.0	-6.0	-6.0	-6.0	-
4	End reflection	dB	-10.0	-5.4	-2.3	-0.7	-0.2	-0.1	0.0	0.0	-
5	L_W at exit	L_W dB	48	50	65	54	64	66	61	60	70
6	Reflections	dB	3	3	3	3	3	3	3	3	-
7	Power to pressure	L_p dB	-37	-37	-37	-37	-37	-37	-37	-37	-
8	Screening correction	dB	-6	-7	-9	-11	-13	-16	-19	-22	-
9	Directivity correction factor	dB	0.5	1.5	2	2.75	3.25	4	4	4	
10	A-weighting	dB	-26	-16	-9	-3	0	1	1	-1	-
11	**Sound Pressure level at receptor**	**L_{pA} dB(A)**	**-18**	**-6**	**15**	**8**	**20**	**21**	**13**	**7**	**22**

#	Details of system and surrounding context			
2	Duct Length:		5.5	m
3	Number of bends		2	
4	End diameter	W	H	
		450	300	mm
6	Reflection Factor	Q =	2	
7	Distance		29	m
8	Path Difference:		0.16	
9	Exhaust area		0.14	m2
	Angle		45	°

Table E8 – Proposed Exhaust sound levels (HRU) calculated to nearest receptor (CIBSE).

Appendix F: Manufacturer Data Sheets

Fläkt Woods Limited
Technical Data Sheet
Estoc Targe - Powerbox GF

Quotation Number	:	Project Code	: BA-17777-1
Project Name	: Wendy's Camden	Customer	:
Item Reference:	: EF1	Date:	: Thursday, August 19, 2021

Fan Code	Estoc Targe (PowerBox) 80-560-3
Fan Diameter / Size	560
Velocity	7.2 m/s
Form of Running	B (Horizontal)
Requested Duty (40 Hz)	1.6m³/s @ 600 Pa (static)
Actual Duty	1.76m³/s @ 729 Pa (static) speed contro
Control Adjustment	40 Hz
Full speed (50 Hz)	2.19m³/s @ 1124 Pa (static) no controlle
Outlet Dynamic Pressure	29 Pa
Duty Shaft Power	2.38 kW
Max Shaft Power	2.34 kW
Motor Frame	Integral [Class F]
Motor Rating	2.50 kW
Full Load Current	7 A
Starting Current	24.5 A
Electrical Supply	380-420 Volts 50 Hz 3 Phase
Start Type	Enquire
Motor Winding	Standard
ErP [FMEG] Rating	Not in Scope
SFP value	1.35 W/(l/s) @ Actual Duty
Power from mains	2.38 kW
Energy Consumption	7138 kWh (3000 h/year)
Running Cost / Year	£857
Air Density	1.123 kg/m³ / 40 °C / 0 m / 40% RH
Smoke Venting	Non Smoke Venting
Product Number	GF805607

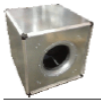
Acoustic figures for adjusted running speeds have been interpolated and are for reference only.

This Offer is made subject to the latest version of our A100-19 Terms and Conditions, a copy of which can be made available on request.

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m*
Inlet*	26	82	84	75	71	69	66	60	86	58
Outlet*	26	89	83	79	76	73	68	62	90	61
Breakout*	26	76	70	62	59	58	54	50	77	46

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa
Sound data at actual duty.

Figure F1 – Proposed Extract Fan (EF1) manufacturer data sheet.



Fläkt Woods Limited
Technical Data Sheet
Estoc EC - Powerbox

Quotation Number	:	Project Code	: BA-17777-3
Project Name	: Wendy's Camden	Customer	:
Item Reference:	: SF1	Date:	: Thursday, August 19, 2021

Fan Code	ePowerBoxEC 80-500-3-4 (G.6FF)
Fan Diameter / Size	500
Velocity	8.2 m/s
Form of Running	B (Horizontal)
Requested Duty (8.1V)	1.6m³/s @ 600 Pa (static)
Actual Duty	1.6m³/s @ 602 Pa (static) speed control
Control Adjustment	8.1V
Full speed (10V)	1.91m³/s @ 853 Pa (static) no controller
Outlet Dynamic Pressure	37 Pa
Input Power	1.62 kW
Full Load Current	4.3 A
Motor Frame	Integral [Class F]
Motor Rating	2.75 kW (Maximum Power)
Electrical Supply	380-420 Volts ±10% 50 Hz 3 Phase
Regulation 1253/2014	
UVU Efficiency	61.8%
UVU Target Efficiency	48.3%
Nominal Flow Rate	2.05 m³/s @ 819 Pa
Effective Input Power	2.75 kW
Nominal RPM	1800 rpm
SFP value	1.01 W/(l/s) @ Requested Duty
Power from mains	1.62 kW
Energy Consumption	4852 kWh (3000 h/year)
Running Cost / Year	£582
Air Density	1.123 kg/m³ / 40 °C / 0 m / 40% RH
Product Number	BE500018

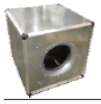
Acoustic figures for adjusted running speeds have been interpolated and are for reference only.

This Offer is made subject to the latest version of our A100-19 Terms and Conditions, a copy of which can be made available on request.

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m**
Inlet*	-	68	80	75	67	65	61	59	81	55
Outlet*	-	83	84	79	75	70	65	61	87	60
Breakout*	-	75	75	56	42	34	29	24	78	46

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa
Sound data at requested duty.

Figure F2 – Proposed Supply Fan (SF1) manufacturer data sheet.



Fläkt Woods Limited
Technical Data Sheet
Estoc EC - Powerbox

Quotation Number	:	Project Code	: BA-17777-2
Project Name	: Wendy's Camden	Customer	:
Item Reference:	: EF2	Date:	: Thursday, August 19, 2021

Fan Code	ePowerBoxEC 80-500-3-4 (G.6FF)
Fan Diameter / Size	500
Velocity	2.1 m/s
Form of Running	B (Horizontal)
Requested Duty (5V)	0.4m³/s @ 250 Pa (static)
Actual Duty	0.41m³/s @ 261 Pa (static) speed contro
Control Adjustment	5V
Full speed (10V)	0.81m³/s @ 1023 Pa (static) no controlle
Outlet Dynamic Pressure	2 Pa
Input Power	0.31 kW
Full Load Current	4.3 A
Motor Frame	Integral [Class F]
Motor Rating	2.75 kW (Maximum Power)
Electrical Supply	380-420 Volts ±10% 50 Hz 3 Phase
Regulation 1253/2014	
UVU Efficiency	61.8%
UVU Target Efficiency	48.3%
Nominal Flow Rate	2.05 m³/s @ 819 Pa
Effective Input Power	2.75 kW
Nominal RPM	1800 rpm
SFP value	0.77 W/(l/s) @ Actual Duty
Power from mains	0.31 kW
Energy Consumption	941 kWh (3000 h/year)
Running Cost / Year	£113
Air Density	1.123 kg/m³ / 40 °C / 0 m / 40% RH
Product Number	BE500018

Acoustic figures for adjusted running speeds have been interpolated and are for reference only.

This Offer is made subject to the latest version of our A100-19 Terms and Conditions, a copy of which can be made available on request.

	Sound Spectrum (Hz)								Overall	
	63	125	250	500	1k	2k	4k	8k	Lw*	LpA @ 3 m*
Inlet*	-	60	72	67	59	57	53	51	74	48
Outlet*	-	75	76	71	67	62	57	53	80	53
Breakout*	-	67	67	48	34	26	21	<20	70	39

* Lw dB re 10^{-12} W ** dBA re $2x10^{-5}$ Pa
Sound data at actual duty.

Figure F3 – Proposed Supply Fan (SF1) manufacturer data sheet.

AIR HANDLING UNIT eCO Top

Project	1883 () / Wendy's Camden	*Acon 3.01.53591*
AOC	ACON-02844875	
Unit	4 () / HRU1 Revised	2021-08-20
Size	06	Page 4/14
Customer		
Customers ref.		
Our ref.	Callum Cole	

Approved according to requirements 2018

Unit type: NRVU BVU		
SFPint (2016: 1366 W/(m³/s), 2018: 1086 W/(m³/s))	731	W/(m³/s)
Dry temperature efficiency (balanced) (EN308) (2016: 67 %, 2018: 73 %)	76.0	%
External leakage rate	0.4	%
Internal leakage rate	0.0	%

	Supply air	Extract air	Unit
Heat exchanger pressure drop	139	139	Pa
Filter energy classification	A	A	
Filter pressure drop, start	71	42	Pa
Filter area	0.3	0.3	m²
Filter cross section air velocity	2.5	2.6	m/s
Air flow	0.70	0.73	m³/sec
Total pressure rise	509	460	Pa
Fan fan system effect	0	0	Pa
Fan total efficiency	57.3	55.4	%
Fan system input power (absorbed electrical power) according to SFP	0.739	0.719	kW

SOUND POWER LEVELS
(standard: EN13053 ISO/CD 13347-2)

	Lw per octave band (dB)								LwA
Octave band (Hz)	63	125	250	500	1k	2k	4k	8k	dB(A)
Fresh air connection	67	58	70	55	49	44	37	34	62
Supply air connection	73	64	74	72	74	73	68	68	79
Extract connection	69	67	70	55	55	52	41	38	63
Exhaust connection	69	65	81	73	75	75	70	69	81
To surroundings	71	58	63	52	50	44	40	42	57

Figure F4 – Proposed Heat Recovery Supply and Exhaust (HRU) manufacturer data sheet.

Appendix G: Acousticians Qualifications and Status

Dominic Attwell BEng. (Hons) MIOA

Position Held: Acoustic Consultant.

Qualifications: BEng. (Hons) Audio Acoustics.

Affiliations: Member of the Institute of Acoustics.

Acoustics Experience: 5 years.

James Blakeley BSc. (Hons) MIOA

Position Held: Senior Acoustic Consultant.

Qualifications: BSc. (Hons) Audio Technology.

Affiliations: Member of the Institute of Acoustics.

Acoustics Experience: 9 years.