



Unit 2, Neath Town Centre Retail Development
Neath, SA11 3ES

Noise Impact Assessment

1st October 2024
First Issue



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Revision History

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ParkerJones Acoustics Limited

Bristol	London	Glasgow	+44 (0)800 830 3338	Registered in England and Wales
11 Bankside Road	29 Lincoln's Inn Fields	126 West Regent Street	+44 (0)117 914 6558	Company No. 12235614
Brislington	Holborn	Glasgow	info@parkerjonesacoustics.com	
Bristol	London	G2 2RQ	www.parkerjonesacoustics.com	
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Executive Summary and Conclusions

This document, a Noise Impact Assessment (NIA) has been written to assess the risk of adverse impact from noise 'pollution' generated by plant to be installed as part of the development of Unit 2, Neath Town Centre Retail Development, Neath, SA11 3ES, which includes the fit out of the vacant retail unit for a delicatessen and organic grocery store.

The assessment has been made based on the manufacturer's noise data for the proposed plant (which includes 6 no. heat pumps and 3 no. refrigeration condensers on the rooftop, a kitchen extraction fan system flue at the rear of the building, a supply fan to the kitchen, and an extract fan to the shop), using 3D noise mapping software to predict the plant noise emissions outside of neighbouring residential windows. This has then been assessed against background noise levels determined in accordance with BS 4142:2014+A1:2019, with context provided by further assessment against BS 8232:2014 and WHO noise guidelines.

PJA believes that the Local Planning Authority will require the noise emissions to be at most, equal to the representative background sound level when assessed in accordance with BS 4142:2014+A1:2019. The required noise limits are provided in **Table 5.1 (Section 5.1)**, based on monitoring conducted over several days at the site as part of the baseline noise survey (**Section 4.0**).

In this case (in **Section 5.3**), PJA has predicted a worst-case rating level of 32 dB (with all plant operating simultaneously at maximum capacity), which is 5 dB below the minimum background sound level of 37 dB overnight and 11 dB below the minimum background level of 43 dB during daytime opening hours (the latter being the scenario where all plant operating simultaneously is most likely).

Therefore, the noise impact should be acceptably low, providing that the plant specification/design described in **Section 5.2** remains as stated, whilst incorporating PJA's recommendations for in-duct silencers on the atmospheric side of each supply and extract fan which should achieve the minimum insertion losses given in **Table 5.3**.

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1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment to accompany a planning application (ref: P2024/0562 with Neath Port Talbot Council) for the fit out of the vacant retail unit for a delicatessen and organic grocery store at Unit 2, Neath Town Centre Retail Development, Neath, SA11 3ES.

This document has been written to assess the risk of adverse impact from noise 'pollution' generated by the proposed plant on neighbouring residential properties once it is fully operational, which includes 6 no. heat pumps and 3 no. refrigeration condensers on the rooftop, a kitchen extraction fan system flue at the rear of the building, a supply fan to the kitchen, and an extract fan to the shop.

The objective is to ensure that the risk of noise impact will be controlled sufficiently. This is based upon ensuring that the noise emissions from the plant will not cause internal ambient noise levels inside nearby residential properties to exceed typical levels which are deemed to be acceptable for good living and sleeping conditions and that external noise levels in gardens won't affect the recreational use of these areas.

Therefore, the purpose of this report is to demonstrate whether the plant is able to achieve sufficiently low noise emissions that avoid an adverse impact, and if not, to provide recommendations on how to do so.

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in **Appendix A**.

The assessment has been undertaken in reference to:

- BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound';
- BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings'; and
- the WHO Environmental Noise Guidelines for the European Region.

2.0 Site and Development Description

The property in question is Unit 2 of the recently constructed Neath Town Centre Retail Development, Neath, SA11 3ES – located as shown in **Figure 2.1**, which includes retail and leisure units. It is surrounded by a variety of town centre uses.

An application has been made by Neath Deli under application ref: 2024/0562 with Neath Port Talbot Council for the *"fit out vacant retail unit for delicatessen and organic grocery store, including provision of a new mezzanine floor, covered external seating area to front and installation of extraction and ventilation equipment, heat pump and condenser units on the roof"*.

Proposed drawings are shown in **Figures 2.2** and **2.3**.

In terms of plant, the proposals include:

- 6 no. *Fujitsu AOYG24KATA* external heat pumps installed on the rear of the roof;
- 3 no. *Tecuseh* refrigeration condensers (installed next to the heat pumps);
- 1 no. kitchen extract duct/flue on the rear/north elevation, exhausting 1m above the roof parapet, ducting to an internally located *Systemair MUB 042 450E4 Sileo Multibox* fan;
- 1 no. extract duct from the shop floor terminating via a louvre low down on the north elevation, serviced by an internally located *Elta SCD315/4-1AC Case Mounted Axial Flow Fan*; and
- 1 no. supply duct to the kitchen and other 1st floor areas intaking via a louvre high up on the north elevation, serviced by an internally located *Elta SCD315/4-1AC Case Mounted Axial Flow Fan*.

In terms of noise-sensitive receptors, there appear to be potential residential properties in several directions. Whilst not immediately clear, it appears that the closest may be along Water Street to the south-west, with standalone residential buildings and properties behind with commercial ground floor use and (assumed as a worst-case) residential upper floor use. It is assumed as a worst case (unless obviously clear otherwise) that buildings have residential use on the upper floors. There are also arrays of terraced dwellings to the north-east.

The noise modelling software used in the assessment inherently predicts noise emissions to *all* neighbouring residential windows and gardens in the area and thus not assume that the worst-affected receptor is necessarily the closest.

Neath Deli will operate under the existing approved Class A1 use (shops, sandwich shops), with proposed opening hours of 08:00 to 18:00, Monday to Friday, and 09:00 to 16:00 on Saturdays and Sundays.

PJA assumes that the extract flue and heat pumps would likely operate around opening hours ± 1 hour, and that the refrigeration condensers would operate intermittently at any point during the day or night.

Figure 2.1 – Aerial view of the site and surrounding area

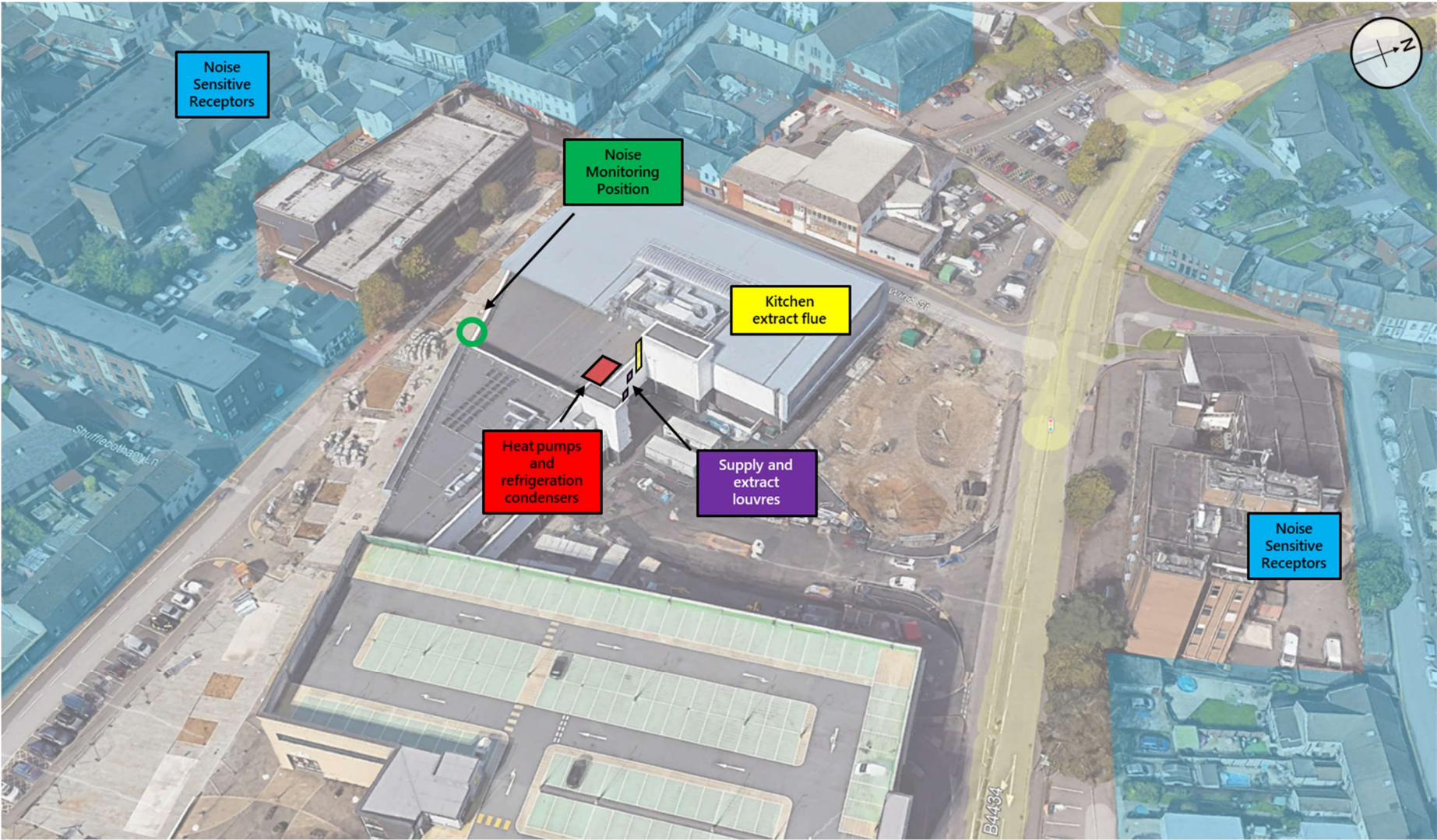


Figure 2.2 – Proposed floor plans

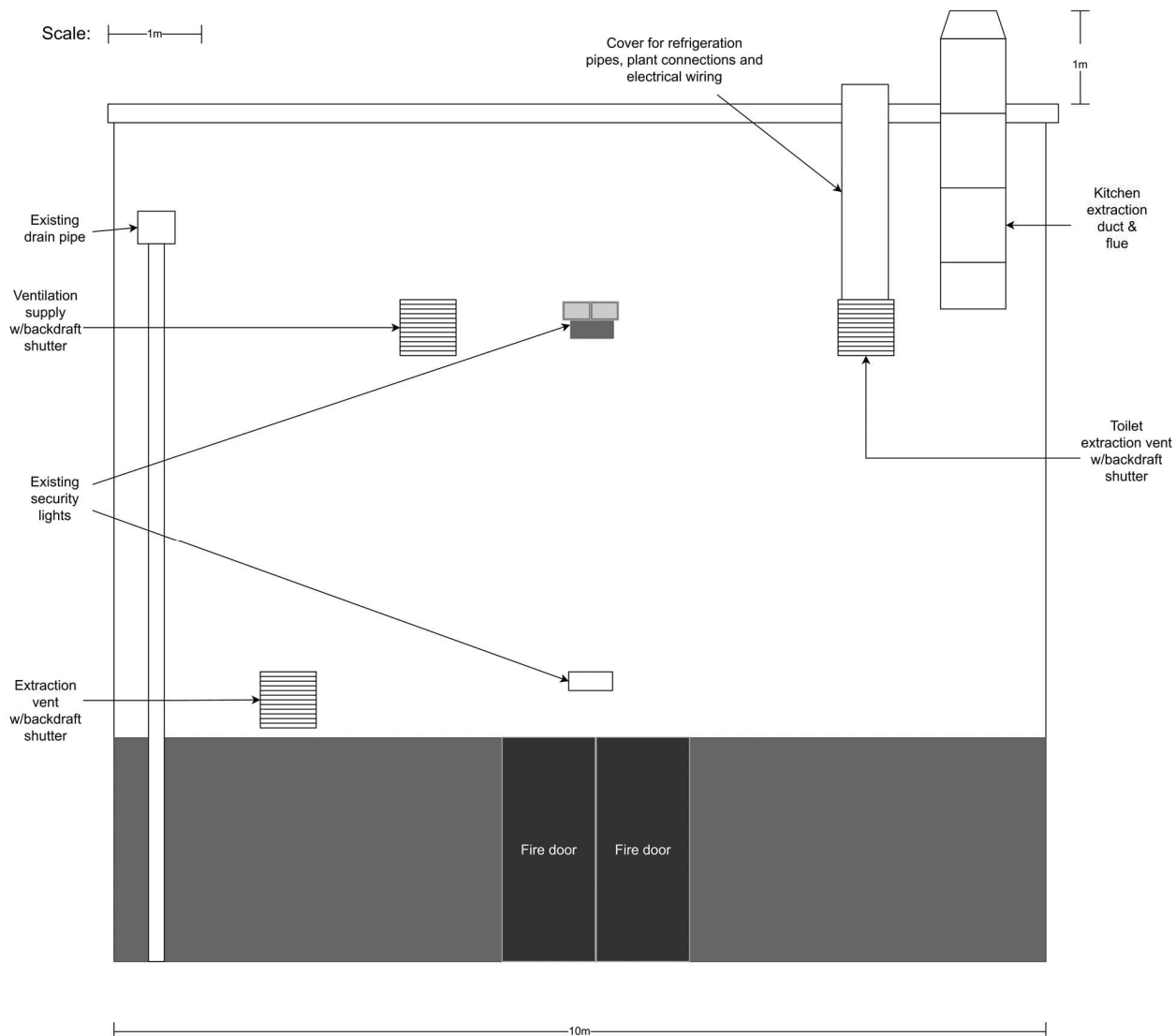
Neath Deli

Unit 2, Fairfield Way, Neath, SA11 3ES



Figure 2.3 – Proposed rear elevation

Elevation - Rear - Proposed



Note: Ductwork and vents for extraction and ventilation will be colour coded white to match existing exterior cladding

3.0 Relevant Guidelines

3.1 Local Authority Criteria

Based on a review of local planning policy and historic planning applications within Neath Port Talbot County Borough Council, it is seen that the following typical planning condition will be applicable to the proposed development;

"The applicant is to submit a noise impact assessment for the proposed development. The noise rating level emitted from external plant serving the approved use shall not be greater than the existing background noise level. The noise levels shall be determined at the nearest noise-sensitive premises or at another location that is deemed suitable by the Local Planning Authority. Measurements and assessments shall be made in accordance with 'BS 4142:2014 Method for rating and assessing industrial and commercial sound.'"

The typical planning condition requires that the rating level of the mechanical plant installation does not exceed the existing background noise levels. PJA assumes that similar requirements would be set for the proposals assessed herein.

3.2 BS 4142:2014

BS 4142:2014 'Methods for rating and assessing industrial and commercial sound' is intended to be used to assess the potential adverse impact of sound of an industrial and/or commercial nature, at nearby noise-sensitive receptor (NSR) locations (i.e., residential windows) within the context of the existing sound environment.

The method is based upon assessing the predicted noise emissions from plant/equipment against the existing background sound levels at NSRs, the latter of which is determined by a noise survey conducted at the site.

The predicted noise emissions are termed as a 'rating level', which is the 'specific sound level' from plant (the actual measurable noise level), plus 'penalties' which account for whether the noise has distinguishing characteristics such as tonality, intermittency, impulsivity, or is generally distinguishable from the ambient noise environment. Such features may attract attention and be considered annoying, hence sounds with these qualities should be penalised over sounds at the same specific noise level which is less intrusive.

The general aim is for the 'rating level' (plant noise emissions) to not exceed the existing background sound levels outside of residential windows. BS 4142:2014 states that *"the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

3.3 BS 8233:2014

BS 8233:2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' suggests appropriate criteria and limits for different situations. This includes internal noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's 'Guidelines for Community Noise and Night Noise Guidelines for Europe' document.

Table 4 of BS 8233:2014 provides internal ambient noise level (IANL) limits for dwellings from "steady external noise sources". These are summarised in **Table 3.1** below.

Table 3.1 – BS 8233:2014 internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$	-
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

Annex G.1 of BS 8233:2014 suggests that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB". Therefore, a noise limit directly outside of the nearest residential windows could be set based on the values above plus 15 dB. Therefore, to meet internal noise targets in nearby residential dwellings, noise from the proposed plant should not exceed 50 dB L_{Aeq} during the daytime and 45 dB L_{Aeq} during the night-time when measured/calculated directly outside of a bedroom or living room window.

3.4 World Health Organisation (WHO) Environmental Noise Guidelines

The WHO document *Guidelines for Community Noise 1999* has recently been superseded by the *Environmental Noise Guidelines for the European Region*. However, the updated guidance states that 'all WHO guidelines for community noise (CNG) indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid'.

The document sets out guidance as to noise levels at which there will be an unacceptable impact on the local community. WHO guidelines state:

- To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq} .

Therefore, noise from the proposed plant should not exceed 50 dB L_{Aeq} during the daytime when measured or calculated within a residential garden, patio, or balcony.

4.0 Baseline Noise Survey

4.1 Methodology

PJA has attended the site to conduct a baseline noise survey across several days between Friday the 27th and Monday the 30th of September 2024. The results have been used to determine a representative background sound level at a position representative of nearby residential receptors.

A fixed monitoring position was employed on the rooftop of the application site, on the southern side, facing towards the nearest dwellings. The microphone was angled downwards in front of the façade to remove any direct line of sight to neighbouring plant on the adjacent buildings. The location of the monitoring position is also shown in Figure 2.1 (Section 2.0).

The sound level meter was set to log noise levels over continuous 15-minute averaging periods with a 1-second time history rate. The monitoring equipment was left unattended for the majority of the survey with the exception of a short period around the installation and collection of the equipment.

The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise levels 'events' – i.e., emergency services sirens; and
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – or noise levels from continuous noise sources such as plant.

Appendix B contains further information on the methodology of the survey, including photographs taken from the site and the equipment used.

4.2 Results

A graph of the measured noise levels across the monitoring period is given in **Figure 4.1**.

Table 4.1 summarises the results across the proposed opening hours with a 1 hour buffer either side on the assumption that the plant may be operational to prepare for opening and to close down afterwards (07:00 – 19:00). The results for the closed hours are also shown (assuming that at least the refrigeration condensers would certainly continue operating)

The most relevant parameter in terms of the ‘representative background sound level’ is the $L_{A90,15min}$. **Figure 4.2** presents histograms of the $L_{A90,15min}$ values.

Table 4.1 – Summary of measured noise levels

Period	Parameter	Maximum	Minimum	Mean Average	Modal Average	Median Average
Proposed opening hours ± 1 hour (07:00 - 19:00)	$L_{Aeq,15min}$ (dB)	64	49	55	53	55
	$L_{AFMax,15min}$ (dB)	93	61	74	72	74
	$L_{A90,15min}$ (dB)	59	43	49	49	49
Closed hours (19:00 – 07:00)	$L_{Aeq,15min}$ (dB)	67	40	51	43	48
	$L_{AFMax,15min}$ (dB)	85	55	68	60	66
	$L_{A90,15min}$ (dB)	59	37	45	39	43

Figure 4.1 – Graph of measured noise levels

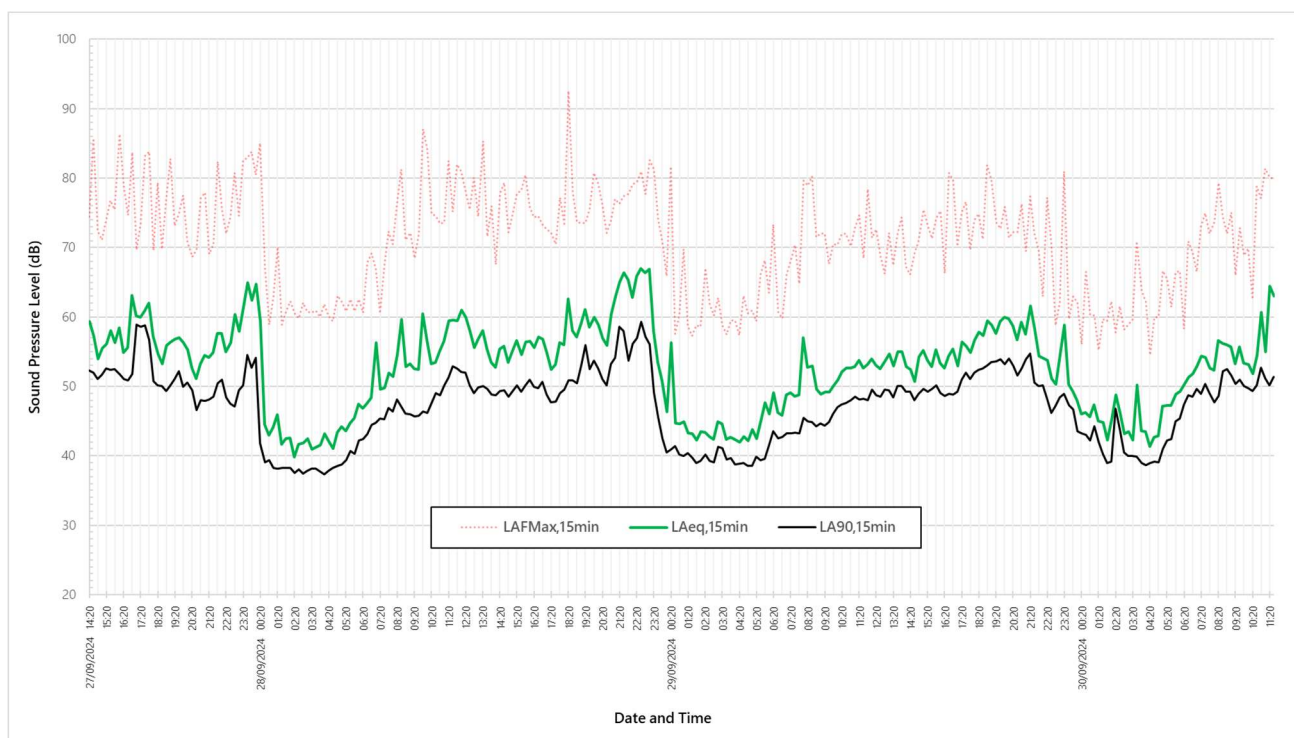
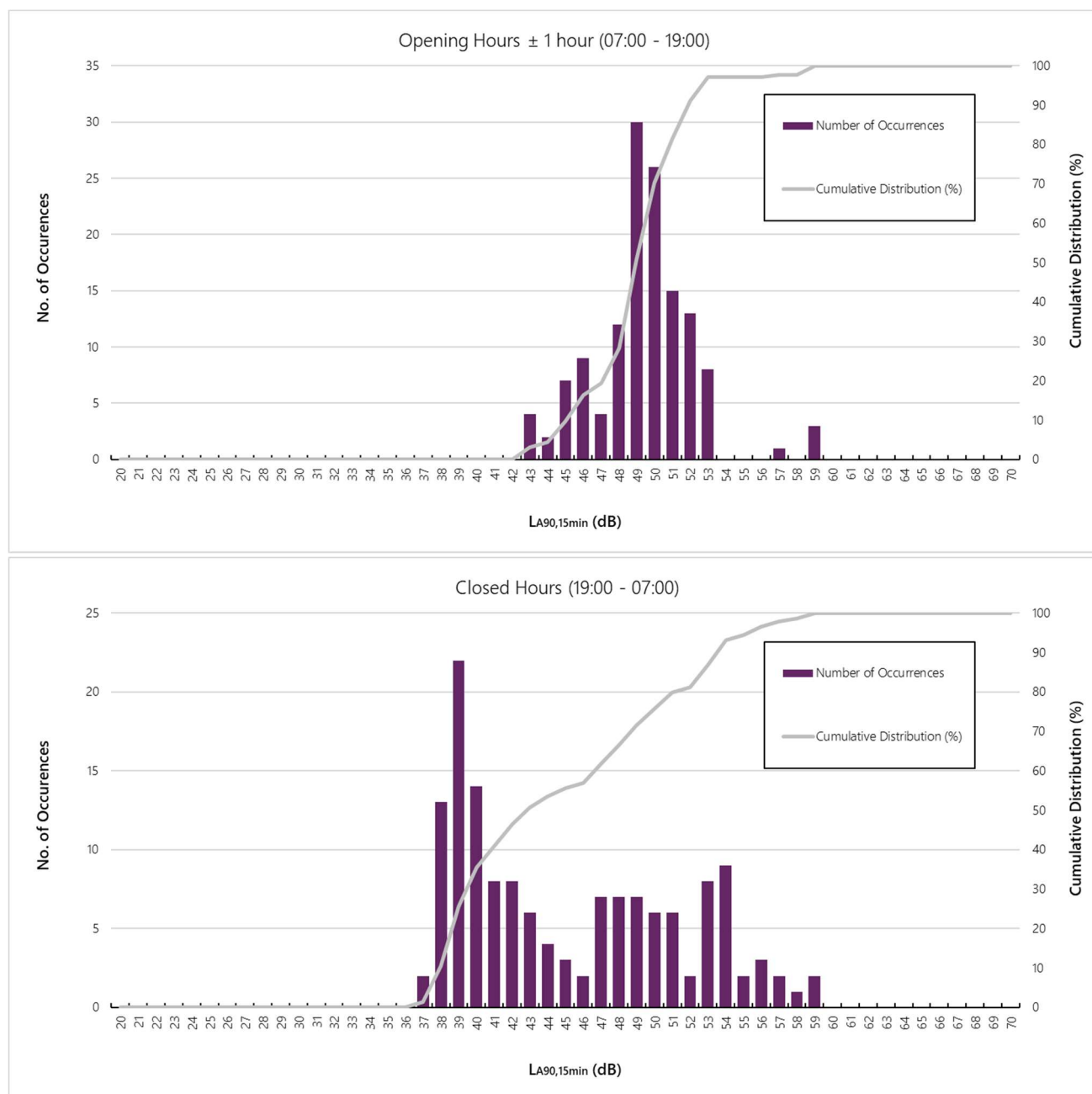


Figure 4.2 – Histogram of measured $LA_{90,15min}$ values



5.0 Assessment

The assessment has been undertaken in accordance with BS 4142:2014+A1:2019. The following summarises the main steps of action in the assessment method:

- a representative background sound level $L_{A90,15min}$ is determined based upon the results of the environmental noise survey;
- the specific sound level L_s generated by the proposed plant is predicted outside of the windows of neighbouring noise-sensitive windows in the area;
- the rating level $L_{Ar,15min}$ is determined by the application of any 'penalties' which adjust for characteristic features of the sound which may be perceptible and potentially cause annoyance at each NSR;
- the predicted rating level $L_{Ar,15min}$ is compared to the $L_{A90,15min}$ and assessed following the guidance of BS 4142:2014+A1:2019; and
- if necessary, further mitigation measures are recommended to reduce the predicted noise emissions.

5.1 Background Sound Levels

In accordance with BS 4142:2014, the predicted rating level should be assessed against a 'representative' background sound level. This is commonly determined through the results of a baseline sound survey, as has been done in this case.

BS 4142:2014 states that *"in using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods."* BS 4142:2014 further states that *"a representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either minimum or modal value"*.

In this case, PJA has used the minimum values $L_{A90,15min}$ as the representative background sound level to represent a worst-case.

These levels appear consistent or lower than minimum background sound levels determined during a noise survey conducted over several days at street level monitoring positions in early 2020, submitted with planning application P2020/0486 as part of the Neath Town Centre Leisure and Retail Development (and thus before the application site and adjacent buildings were erected). Thus this would appear to be an appropriate worst-case representative level.

Table 5.1 – Derived representative background sound level $L_{A90,T}$ at nearby residential NSRs

Noise-Sensitive Receptor (NSR)	Period	Representative Background Sound Level $L_{A90,T}$ (dB)
1m outside of neighbouring residential windows	Proposed opening hours $\pm$ 1 hour (07:00 - 19:00)	43
	Closed hours (19:00 – 07:00)	37

5.2 Proposed Plant

5.2.1 Extract and Supply Fans

The proposals include:

- 1 no. kitchen extract duct/flue on the rear/north elevation, exhausting 1m above the roof parapet, ducting to an internally located *Systemair MUB 042 450E4 Sileo Multibox* fan;
- 1 no. extract duct from the shop floor terminating via a louvre low down on the north elevation, serviced by an internally located *Elta SCD315/4-1AC Case Mounted Axial Flow Fan*; and
- 1 no. supply duct to the kitchen and other 1st floor areas intaking via a louvre high up on the north elevation, serviced by an internally located *Elta SCD315/4-1AC Case Mounted Axial Flow Fan*.

Fans

The applicant has supplied PJA with information regarding the equipment which will be installed. The relevant data for in-duct sound power levels on the atmospheric side of the fans are provided in **Table 5.2** below. Extracts from the manufacturers' technical data documents are given in **Appendix C**.

Table 5.2 – In-duct sound power levels of the extract and supply fans

Fan	Model	Source Type	Sound Power Levels (SWL)							
			dB at Octave Band Centre Frequencies, Hz							dB(A)
			63	125	250	500	1 k	2 k	4 k	
Kitchen Extract Fan	Systemair MUB 042 450E4 Sileo Multibox ¹	In-duct outlet	90	82	79	75	71	67	62	77
Kitchen Supply Fan	Elta SCD315/4-1AC ²	In-duct inlet	89	84	82	67	59	52	47	75
Shop Extract Fan		In-duct outlet	88	87	82	67	61	54	48	76
Notes: – The octave band sound power levels are presented here as Z-weighted levels, rather than the A-weighted levels provided by the manufacturer. - The in-duct levels represent those that are relevant to the atmospheric side of the fans. - References are made at the bottom of the page to the source of the sound power level information.										

1 - https://www.lbfans.co.uk/wp-content/uploads/2018/07/MUB-042-450E4-sileo-Multibox.pdf?srsltid=AfmBOor-Zp6pKWSCmXZKH0dQJxrXcdVDXVd4tdLoeSGYZrKq6bU8M_wl

2 - https://webfiles-bucket.s3.eu-west-2.amazonaws.com/wp-content/uploads/2018/12/05195710/Compact_SCD.pdf

Silencers

PJA recommends that in duct silencers will be required on the atmospheric side of all fans.

The insertion losses in **Table 5.3** below have been used in the calculations. These have been selected based on the size of the ducting/fan that it serves and chosen as the accompanying silencer product that the fan manufacturer provides (to ensure compatibility), and are selected by PJA to provide an adequate level of noise reduction. The insertion losses should be treated as minimum values if sourcing an alternative supplier to the products referenced.

Table 5.3 – Recommended minimum insertion losses of atmospheric side in-duct silencers for all fans

Fan	Silencer	Insertion Loss (IL), dB						
		Octave Band Centre Frequencies, Hz						
		63	125	250	500	1 k	2 k	4 k
Kitchen Extract Fan	Systemair FSAF450B1DA Silencer 500/8 ³ (450mm length)	3	5	8	14	15	15	15
Kitchen Supply Fan	Elta Fans 068-0315-2DENP ^{4 5} (315mm diameter - 630mm length)	4	8	12	17	23	17	12
Shop Extract Fan								

Ducting

The extraction duct/flue will be a ≈450mm diameter circular flue. PJA has based the assessment on data from several research papers/M&E design guides ^{6 7 8} which suggest transmission losses for single skin circular ducts – the lowest of which are shown in **Table 5.4**. It is known that the best duct configuration to reduce fan noise breakout is a circular shape – as the hoop strength of a circular duct is very good (particularly a spiral round duct rather than a long seam duct); with much lesser stiffness than a rectangular duct. The low-frequency transmission loss in particular is substantial in a circular duct.

Table 5.4 – Estimated transmission losses of the noise break-out from the kitchen extract flue ducting

Ducting	Transmission Loss (dB)						
	Octave Band Centre Frequencies, Hz						
	63	125	250	500	1 k	2 k	4 k
450mm diameter single skin spiral round circular ducting	45	50	26	26	25	22	36

3 - <https://www.systemair.com/en-gb/products/fans/accessories/mechanical-accessories/silencers/duct-connected-silencers/sil-ax?sku=50106#tech-specs-ecom-acoustic-data>

4 - Available to purchase from <https://www.lbfans.co.uk/product/068-0315-2denp-315mm-flanged-silencer-elta/>

5 - Insertion losses from page 3 of <https://www.lbfans.co.uk/wp-content/uploads/2021/10/Flanged-Silencer.pdf>

6 - <http://www.vibrationdata.com/tutorials2/AG31-010lo.pdf>

7 - <https://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=1036&context=rtds>

8 - https://www.ahrinet.org/App_Content/ahri/files/STANDARDS/AHRI/AHRI_Standard_885_2008_with_Addendum_1.pdf

5.2.2 Heat Pumps and Condensers

The proposals include:

- 6 no. *Fujitsu AOYG24KATA* external heat pumps installed on the rear of the roof; and
- 3 no. *Tecumseh* refrigeration condensers (installed next to the heat pumps).

The manufacturers provided noise data are provided in **Table 5.5** below. Extracts from the manufacturers' technical data documents (from which this data is taken from ⁹) are given in **Appendix C**.

Within the calculations, the units are modelled as point sources at a height matching the top of the unit (which are around 0.63m to 0.8m high), with the sound power level of the source set to the dB(A) sound power level. The octave band sound pressure levels have been scaled up to achieve the dB(A) sound power level.

Tecumseh does not provide octave band data, thus the same octave data for the Fujitsu unit has been assumed, scaled up to achieve the respective sound power level for each of the 3 no. Tecumseh units.

Table 5.5 – Source noise emission data for the proposed heat pumps and condensers

Make/Model	Quantity	Mode	Sound Pressure Levels @ 1m								Sound Power Level dB(A)
			dB at Octave Band Centre Frequencies, Hz							dB(A)	
			63	125	250	500	1 k	2 k	4 k		
Fujitsu AOYG24KATA ¹⁰	6	Heating	56	55	53	50	49	42	40	55 ¹¹	67
Tecumseh WINAJ9510Z ¹²	1	Cooling	Information not provided by the manufacturer								61
Tecumseh WINAJ4519Z ¹³	1										63
Tecumseh SII FH2511Z-XG ¹⁴	1										74

⁹ https://se.af.klimatherm.com/umbraco/surface/technicaldocumentationssurface/GetFile?relativePath=C%3A%5CWeb%5CFG-FTP-Files%5CFG%20Nordic%20Technical%20Documentation%5CFujitsu%5CCategories%5CR32%5CCategories%5CKassetter%5CCategories%5CRundbl%5C3%A5sande%201-fas%5CModels%5CAUXG18-54KRLB_AOYG18-54KATA%5CDesign%20%26%20Technical%20Manual%20AUXG2454KRLB_AOYG24-54KATA_Eng.pdf

¹⁰ <https://webstore.uk.fujitsu-general.com/6-8kw-economy-outdoor-unit-r32-single-phase-aoyg24kata>

¹¹ Measured at 1m behind the unit on axis with the centre of the fan, in anechoic conditions.

¹² Page 157 of https://www.fsw.uk.com/wp-content/uploads/2023/12/fsw_master_product_guide_-_section_j.pdf

¹³ Page 157 of https://www.fsw.uk.com/wp-content/uploads/2023/12/fsw_master_product_guide_-_section_j.pdf

¹⁴ Page 160 of https://www.fsw.uk.com/wp-content/uploads/2023/12/fsw_master_product_guide_-_section_j.pdf

5.3 Predicted Noise Emissions

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines, and calculation algorithms, including those set out in ISO 9613-2:1996. A full explanation of the noise modelling is provided in **Appendix D** along with images and noise maps/results from the model.

Figure D.2 in **Appendix D** shows the predicted specific noise levels ($L_{Aeq,15min}$) with all plant operating simultaneously at 100% capacity, at 1m outside of facades containing residential windows.

The predicted specific noise level outside of the worst affected residential window is **29 dB L_{Aeq}** in this worst-case scenario.

For simplicity and as a worst case, only this scenario with all plant operating simultaneously is assessed against both open and closed period (given that the predicted levels are well below the minimum background sound levels determined from the survey).

As per **Section 3.2**, a rating level penalty could be applied when assessing in accordance with BS 4142:2014+A1:2019:

- **Tonality** – the silencers are expected to muffle any notable tonal qualities with the fans, and condensers do not usually carry a notable tonal quality (at least to the extent that would incur a rating level penalty when assessed using the Joint Nordic method described in BS 4142);
- **Impulsivity** – no penalty as fans do not generally generate impulsive noises.
- **Intermittency** – whilst the noise sources are not operating continuously for 24 hours a day, it is not 'on' and 'off' in nature every few minutes, it would remain on for 100% of the reference assessment period and, therefore, no tonality penalty is applied.
- **Other sound characteristics** – as a worst-case, it is assumed that despite the presence of large arrays of other plant on the neighbouring roofs of the retail and leisure development, that the noise could be distinguishable and thus a 3 dB penalty is applied.

Therefore, a 3 dB rating level penalty has been applied as a worst case. **Table 5.6** summarises the BS 4142 assessment result.

Table 5.6 – Predicted rating noise levels – worst-case with all plant operating simultaneously

Location	Period	Specific Noise Level $L_{Aeq,15min}$ (dB)	Rating Level Penalties (dB)	Predicted Rating Level $L_{Ar,15min}$ (dB)	Representative Background Sound Level $L_{A90,15min}$ (dB)	Difference
1m outside of the worst-affected residential window	Proposed opening hours ± 1 hour (07:00 - 19:00)	29	+3	32	43	-11
	Closed hours (19:00 – 07:00)				37	-5

5.4 Analysis and Conclusions

BS 4142:2014+A1:2019 states 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.

PJA also believes as per **Section 3.1** that the typical criteria applied by the Local Planning Authority is for the rating noise level to not exceed the representative background sound level.

In this case, the worst-case rating level of 32 dB is below the minimum background sound level of 37 dB overnight and 43 dB during daytime opening hours.

Therefore, the noise impact should be acceptably low, providing that the plant specification/design described in **Section 5.2** remains as stated, whilst incorporating PJA's recommendations for in-duct silencers on the atmospheric side of each supply and extract fan which should achieve the minimum insertion losses given in **Table 5.3**.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2×10^{-5} Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e., 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Noise Survey Methodology

B.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter had been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrator had been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of a BS EN 60942:2003 Class 1 device.

Table B.1 – Equipment used for the noise survey

Name	Serial Number	Last Calibrated	Calibration Due
SVAN 957 Class 1 Sound Level Meter	28043	Jan-24	Jan-26
Casella CEL 120-1 Class 1 Calibrator	2651640	Feb-24	Feb-25

B.2 - Photos

Table B.2 – Photographs of the noise monitoring position



Appendix C - Manufacturer Noise Data

Extract and Supply Fans

Figure C.1 – Proposed kitchen extract fan



MUB 042 450E4 SILEO MULTIBOX

Item no. 37908

Version: 50 Hz; 90° airflow

Document type: Product card
Document date: 2019-11-25
Generated by: Systemair Online Catalogue



Description

- Speed-controllable
- Modular system
- Integral thermal contacts
- Low sound level
- Flexible airflow direction due to removable panels
- Installation in any mounting position
- Maintenance-free and reliable

The MUB fans size 450 have impellers with backward curved blades, manufactured from aluminium. The MUB 450 is equipped with external rotor motors, fully speed controllable. The three phase motors are D/Y connected for two speed operation. Motor protection is done by thermal contacts, which have to be connected to an external motor protection device. The casing consists of a corrosion-resistant aluminium frame with fibreglass reinforced plastic corners of PA6; highly shock-resistant. The double skin panels are manufactured from galvanised steel with 20 mm mineral wool insulation. To avoid condensation the profile is provided with a separate chamber to fix screws. The Multibox fans are delivered for straight through airflow but can easily be rebuilt due to removable panels. This allows flexible ventilation solutions. The MUB can also be used as extract- or supply air unit in air handling units. Installation in any mounting position is possible.



Acoustics

Mid-frequency band, Hz

	Hz	Tot	63	125	250	500	1k	2k	4k	8k
LwA Inlet	dB(A)	75	62	64	68	70	69	66	61	54
LwA Outlet	dB(A)	77	64	66	70	72	71	68	63	56
LwA Surrounding	dB(A)	59	46	48	52	54	53	50	45	38

Measuring point: $q_v = 1,06 \text{ m}^3/\text{s}$, $P_s = 250 \text{ Pa}$

Figure C.2 – Kitchen extract fan Recommended supply fan silencer insertion losses

Technical Data

Article name

FSAF450B1DA Silencer 500/8

Article number

#50107

Dimensions and weights

Weight

Acoustic

Frequency Hz

Insertion Loss dBW

63

3

125

5

250

8

500

14

1K

15

2K

15

4K

15

8K

14

Figure C.3 – Proposed kitchen supply and shop extract fans

COMPACT SCD

Product Overview

- 7 standard sizes from 315mm to 630mm
- Air volume flow rates up to 4.84 m³/s
- Static pressures up to 190 Pa
- Suitable for operating temperatures up to +70°C
- Available in **AC**



Single Phase 220V to 240V / 50Hz

Product Code	Speed r/min		Sound Power Level dBW @ Octave Band Hz								Total dB
			63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
SCD315/4-1AC	1395	Inlet	63	68	73	64	59	53	48	45	75
		Outlet	62	71	73	64	61	55	49	48	76

Figure C.4 – Recommended kitchen supply and shop extract fans silencer insertion losses

Dynamic Insertion Loss

Fan Size	Silencer Length	Silencer Type	Insertion Loss @ Octave Band (Hz)							
			63	125	250	500	1k	2k	4k	8k
0250	1D	ENP	-2	-5	-6	-9	-13	-11	-6	-6
		EP	-4	-6	-8	-11	-14	-16	-11	-10
	2D	ENP	-4	-7	-10	-15	-19	-16	-12	-9
		EP	-7	-10	-15	-16	-15	-17	-13	-13
0315-0560	1D	ENP	-2	-5	-6	-9	-13	-11	-6	-6
		EP	-4	-6	-8	-11	-14	-16	-11	-10
	2D	ENP	-4	-7	-10	-15	-19	-16	-12	-9
		EP	-7	-10	-15	-16	-15	-17	-13	-13

Heat Pumps and Refrigeration Condensers

Figure C.5 – Proposed heat pumps - manufacturer Noise Data

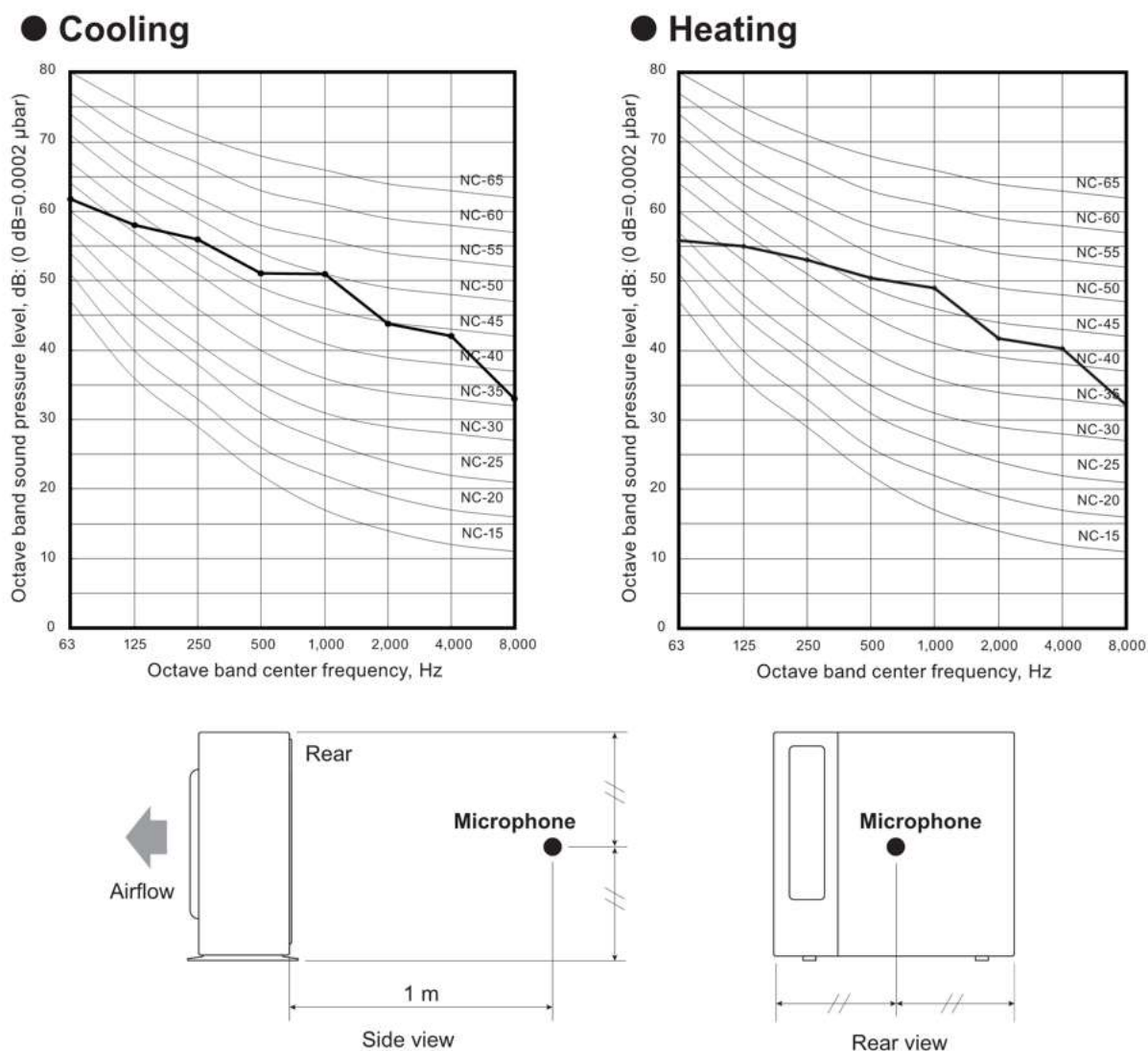


Figure C.6 – Proposed refrigeration condensers - manufacturer Noise Data

Tecumseh WINTSYS® Condensing Unit Data



MODEL	DIMENSIONS MM			CONNECTIONS		Sound Power	Net Weight, Kg	Horse Power
	LENGTH	WIDTH	HEIGHT	SUCTION	LIQUID			
WINAE4450Y-FZ	942.00	654.00	710.00	3/8"	1/4"	59	53.00	1/2
WINAE4460Y-FZ	942.00	654.00	710.00	3/8"	1/4"	59	53.00	1/2
WINAJ4476Y-FZ	942.00	654.00	710.00	1/2"	3/8"	59	62.00	3/4
WINAJ4492Y-FZ	942.00	654.00	710.00	1/2"	3/8"	58	62.00	3/4
WINAJ4511Y-FZ	942.00	654.00	710.00	5/8"	3/8"	60	63.00	1
WINAJ4513Y-FZ	942.00	654.00	710.00	5/8"	3/8"	59	63.00	1
WINFH4518Y-FZ	1174.00	654.00	710.00	5/8"	3/8"	67	75.00	1-1/2
WINFH4525Y-FZ	1174.00	654.00	710.00	5/8"	3/8"	72	77.00	2
WINAE4450Z-FZ	942.00	654.00	710.00	3/8"	1/4"	58	53.00	1/2
WINAE4460Z-FZ	942.00	654.00	710.00	3/8"	1/4"	59	53.00	1/2
WINAE4470Z-FZ	942.00	654.00	710.00	3/8"	1/4"	60	53.00	1/2
WINAJ4480Z-FZ	942.00	654.00	710.00	1/2"	3/8"	61	62.00	1
WINAJ9510Z-FZ	942.00	654.00	710.00	5/8"	3/8"	61	63.00	1-1/4
WINAJ9513Z-FZ	942.00	654.00	710.00	5/8"	3/8"	61	65.00	1-3/4
WINAJ4517Z-FZ	942.00	654.00	710.00	5/8"	3/8"	61	65.00	1-1/2
WINAJ4519Z-FZ	942.00	654.00	710.00	5/8"	3/8"	63	65.00	1-1/2
WINFH4524Z-FZ	1174.00	654.00	710.00	5/8"	1/2"	72	79.00	2
WINFH4531Z-FZ	1174.00	654.00	710.00	7/8"	1/2"	73	83.00	2-1/2
WINFH4538Z-XC	1174.00	654.00	710.00	7/8"	1/2"	73	80.00	3-1/2
WINAE2425Z-FZ	942.00	654.00	710.00	3/8"	1/4"	57	53.00	1/2
WINAJ2440Z-FZ	942.00	654.00	710.00	1/2"	1/4"	58	61.00	1
WINAJ2446Z-FZ	942.00	654.00	710.00	1/2"	3/8"	58	63.00	1-1/4
WINAJ2464Z-FZ	942.00	654.00	710.00	5/8"	3/8"	59	65.00	1-1/2
WINFH2480Z-FZ	1174.00	654.00	710.00	5/8"	1/2"	70	74.00	2
WINFH2511Z-FZ	1174.00	654.00	710.00	5/8"	1/2"	71	82.00	2-1/2

1PH - LBP R404A/R452A*

CODE	MODEL	APPROX HP	dB(A)
J1108	SILAJ2432ZFZ	5/8	57
J1109	SILAJ2440ZFZ	5/8	57
J1110	SILAJ2446ZFZ	3/4	57
J1112	SILAJ2464ZFZ	1-1/2	58
J1114	SILFH2480ZXC	2	66
J1116	SILFH2511ZXC	3	74

Appendix D – Calculations

D.1 – In-Duct Noise

Table D.1 – Sound power leaving the kitchen extract flue termination

Kitchen Extract Fan		Octave Band Centre Frequencies, Hz							dB(A)	NR
Sound Power Levels at the Termination		63	125	250	500	1000	2000	4000		
Fan In-duct Sound Power Level (SWL)	Systemair MUB 042 450E4 Sileo Multibox	92.1	82.1	78.6	75.2	71.0	66.8	62.0	77.4	72
Duct/Bend	Width Length / Angle / Number of bends Type									
In-duct Silencer	Systemair FAS450B1DA 500/8 Silencer	-3.0	-5.0	-8.0	-14.0	-15.0	-15.0	-15.0		
Straight 1	450 mm 11.0 m	-6.6	-6.6	-3.3	-1.7	-1.7	-1.7	-1.7		
Bend 1	450 mm 1 Radiused	0.0	0.0	0.0	-1.0	-2.0	-3.0	-3.0		
Outlet End Reflection Loss	45 cm 45 cm	-9.0	-5.0	-2.0	0.0	0.0	0.0	0.0		
Total In-duct Attenuation		-18.6	-16.6	-13.3	-16.7	-18.7	-19.7	-19.7	dB(A)	NR
SWL at the Termination Point		73.5	65.5	65.3	58.6	52.4	47.2	42.4	60.8	57

Table D.2 – Sound power inside the external ductwork before the kitchen extract flue termination

Kitchen Extract Fan		Octave Band Centre Frequencies, Hz							dB(A)	NR
Sound Power Level breaking out of the External Duct skin		63	125	250	500	1000	2000	4000		
Fan In-duct Sound Power Level (SWL)	Systemair MUB 042 450E4 Sileo Multibox	92.1	82.1	78.6	75.2	71.0	66.8	62.0	77.4	72
Duct/Bend	Width Length / Angle / Number of bends Type									
In-duct Silencer	Systemair FAS450B1DA 500/8 Silencer	-3.0	-5.0	-8.0	-14.0	-15.0	-15.0	-15.0		
Straight 1	450 mm 11.0 m	-6.6	-6.6	-3.3	-1.7	-1.7	-1.7	-1.7		
Bend 1	450 mm 1 Radiused	0.0	0.0	0.0	-1.0	-2.0	-3.0	-3.0		
In-duct Silencer										
Total In-duct Attenuation		-9.6	-11.6	-11.3	-16.7	-18.7	-19.7	-19.7	dB(A)	NR
SWL inside of the Duct skin		82.5	70.5	67.3	58.6	52.4	47.2	42.4	63.1	59

Table D.3 – Sound power leaving the kitchen supply fan intake louvre

Kitchen Supply Fan		Octave Band Centre Frequencies, Hz							dB(A)	NR
Sound Power Levels at the Termination		63	125	250	500	1000	2000	4000		
Fan In-duct Sound Power Level (SWL)	Elta SCD315/4-3AC	89.2	84.1	81.6	67.2	59.0	51.8	47.0	75.0	75
Duct/Bend	Width Length / Angle / Number of bends Type									
In-duct Silencer	Elta Fans 068-0315-2DENP	-4.0	-8.0	-12.0	-17.0	-23.0	-17.0	-12.0		
Outlet End Reflection Loss	60 cm 60 cm	-8.0	-4.0	-1.0	0.0	0.0	0.0	0.0		
Total In-duct Attenuation		-12.0	-12.0	-13.0	-17.0	-23.0	-17.0	-12.0	dB(A)	NR
SWL at the Termination Point		77.2	72.1	68.6	50.2	36.0	34.8	35.0	62.0	61

Table D.4 – Sound power leaving the shop extract fan exhaust louvre

Shop Extract Fan		Octave Band Centre Frequencies, Hz							dB(A)	NR
Sound Power Levels at the Termination		63	125	250	500	1000	2000	4000		
Fan In-duct Sound Power Level (SWL)	Elta SCD315/4-3AC	88.2	87.1	81.6	67.2	61.0	53.8	48.0	75.8	75
Duct/Bend	Width Length / Angle / Number of bends Type									
In-duct Silencer	Elta Fans 068-0315-2DENP	-4.0	-8.0	-12.0	-17.0	-23.0	-17.0	-12.0		
Outlet End Reflection Loss	60 cm 60 cm	-8.0	-4.0	-1.0	0.0	0.0	0.0	0.0		
Total In-duct Attenuation		-12.0	-12.0	-13.0	-17.0	-23.0	-17.0	-12.0	dB(A)	NR
SWL at the Termination Point		76.2	75.1	68.6	50.2	38.0	36.8	36.0	62.9	61

D.2 – Noise to Atmosphere

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package that implements a wide range of national and international standards, guidelines, and calculation algorithms, including those set out in ISO 9613-2:1996.

The majority of the objects within the model (buildings, roads, barriers/fences, etc) have been imported from OpenStreetMap – or drawn manually where not possible. The scaled site plan, floor plan, and elevation for the proposed development have also been accounted for in the model.

The extract flue termination has been modelled as a point source with the sound power levels determined through the calculations in **Table D.1**. This accounts for the source sound power levels in **Table 5.2**, the losses where applicable provided by the silencers (**Table 5.3**), and the minimal losses where applicable from sound energy dissipation over straight lengths and bends within the ductwork. Noise breakout from the skin of the external ducting is represented as a vertical area source to match the dimensions of the external ducting, based on the sound power levels in **Table D.2** and accounting for the sound reduction indices of the duct skin in **Table 5.4**.

The two other supply and extract louvres are represented by vertical area sources of 600 x 600mm in size (as shown on the elevation drawings), with the sound power levels in **Tables D.3 and D.4**. No potential insertion losses for the louvre have been accounted for as a worst case.

The rooftop condensers and heat pumps have been modelled as point sources at a height matching the top of the unit (which are around 0.63m to 0.8m high), with the sound power level of the source set to the dB(A) sound power level in **Table 5.6**. The octave band sound pressure levels have been scaled up to achieve the dB(A) sound power level.

The noise model has been used to predict the resulting L_{Aeq} noise emissions from the proposed plant. The noise model has assumed:

- downwind propagation, i.e., a wind direction that assists the propagation of sound from source to receptor, as a worst-case;
- a maximum reflection factor of two where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- a ground absorption factor of 0 to represent hard, reflective ground as a worst-case.
- receptor heights on noise sensitive facades at heights of 1.5m, 4.5m, 7.5m, etc, placed at 1m outside of noise sensitive facades which contain windows, with the plot showing the highest/worst-affected floor level from each individual façade/elevation.
- noise contours plotted at a height of 7.5m (2nd floor window height).
- atmospheric sound absorption based upon a temperature of 10°C and a humidity level of 70%, as per Table 2 of ISO 9613-2:1996.

Figure D.1 – 3D views of the model setup

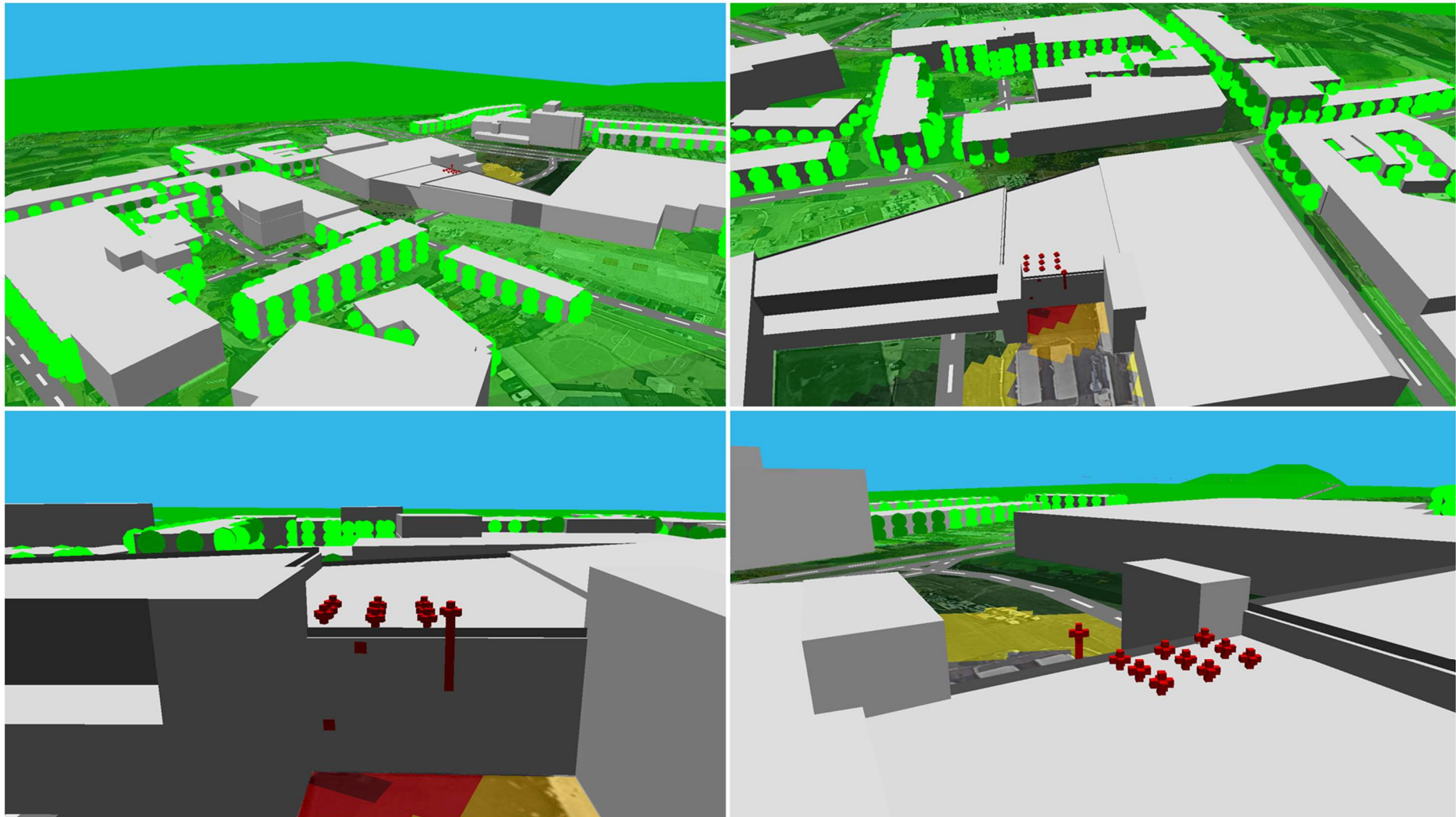
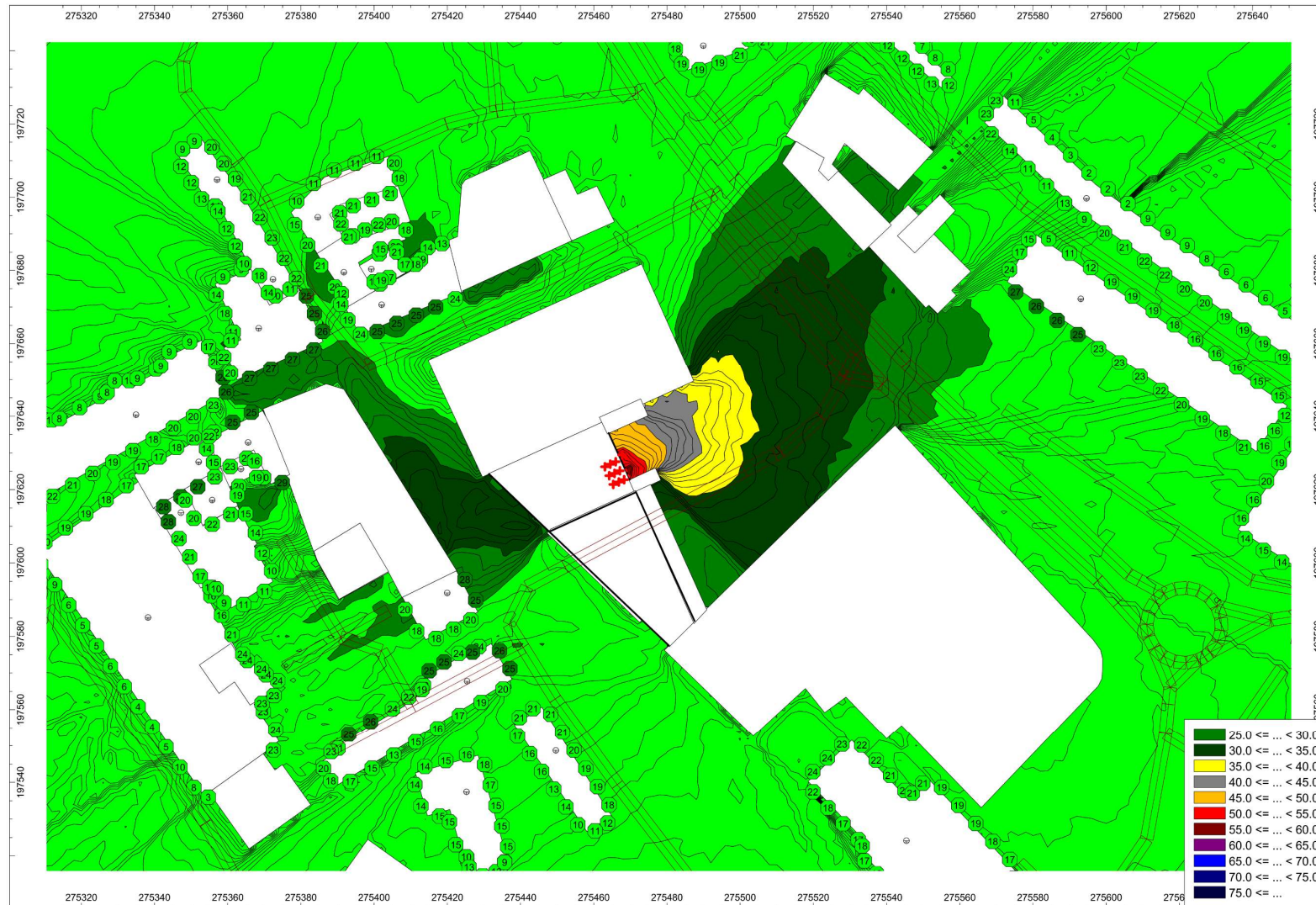


Figure D.2 – Predicted specific noise levels (dB L_{Aeq}) – all plant operating simultaneously





ParkerJones Acoustics Limited

Bristol

11 Bankside Road
Brislington
Bristol
BS4 4LB

London

29 Lincoln's Inn Fields
Holborn
London
WC2A 3EE

Glasgow

126 West Regent Street
Glasgow
G2 2RQ

+44 (0)800 830 3338

+44 (0)117 914 6558

info@parkerjonesacoustics.com

www.parkerjonesacoustics.com

Registered in England and Wales

Company No. 12235614