Azymuth Acoustics UK

Professional Acoustic Services

Condenser Noise Verification Report to Support Discharge of Planning Condition 24b

Ref: Z57053.5 RevB

13no. External Condenser units

Cross Lane & Varey Street,
Manchester,
M18 8WY

On behalf of

R&M Property Group

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Manchester,
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1.0 Introduction

Azymuth Acoustics UK (henceforth Azymuth) has been appointed by R&M Property Group to produce a condenser noise verification report regarding the installation of 13 Air Source Heat Pumps (ASHPs) at a new build development site consisting of 8no. apartments and 5no. houses located at the Cross Lane / Varey Street, Manchester.

The Condenser Noise Verification Report has been produced to assist with the discharge of Planning Condition 24b in relation to condenser noise as per Planning Application 136203/FO/2023 (Cross Lane) and 136204/FO/2023 as varied by 139774/JO/2024 (Varey Street).



Figure 1 – SoundPLAN model of Cross Lane

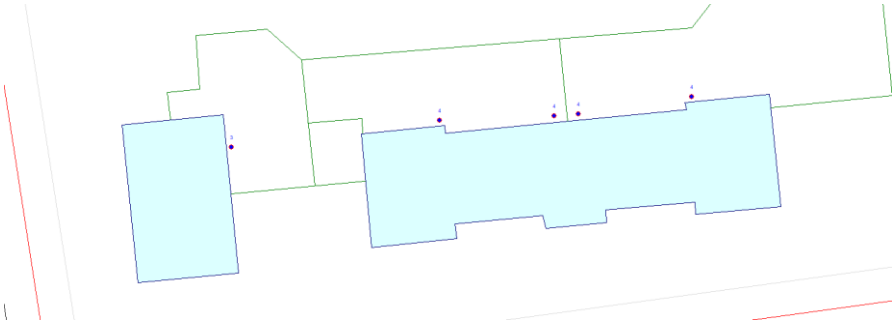


Figure 2 – SoundPLAN model of Varey Street

This condenser noise verification report is intended to provide verification relating to the noise impact of the 13no. external units on the surrounding environment to support the discharge of Planning Condition 24b within planning application 136203/FO/2023 and 139774/JO/2024. In particular, the report sets out the following details:

- The results of a baseline noise survey undertaken in the vicinity of Cross Lane and Varey Street in March 2024
- List of criteria set out by Azymuth within the Condenser Noise Impact Assessment
- Measurements of the plant on-site
- Results of the noise at the nearest noise sensitive receptors with all mitigation recommended in the Condenser Noise Impact Assessment implemented
- List of any potential extra mitigation required if plant noise exceeds the criteria

- Condition 24b below:

"Prior to the operation of the scheme a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of nonconformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria."

2.0 Azymuth 2024 Baseline Noise Survey

2.1 Measurement Procedures

The instrumentation used for the NIA consisted of a SvanTek 971/SvanTek 977 type 1 precision sound level meter. The equipment was calibrated before and after measurements. The sound level meter measured A-weighted (fast response) noise levels as well as octave bands noise levels for all measurement record.

Daytime noise level measurements were undertaken between 15:37hrs and 17:53hrs on Wednesday 6th March 2024 and between 10:32hrs and 11:53hrs on Wednesday 13th March 2024. The night-time measurements were undertaken between 23:00hrs and 00:11hrs on Tuesday 19th / Wednesday 20th March 2024.

The noise measurements were undertaken using the sound level meter at the position(s) shown in Figure 3 below:

- Position 1: Cross Lane (~6.5m from Cross Lane roadside)
- Position 2: Cross Lane / Varey Street (~5m from Cross Lane roadside)
- Position 3: Cross Lane / Chapman Street (~4.5m from Cross Lane roadside)



Figure 3 – Noise measurement position(s)

2.2 Summary of Azymuth Noise Measurements

2.2.1 General Environmental Noise Survey

The following table summarises the results of the noise measurements undertaken at the proposed site in terms of the average daytime and night-time noise levels.

Location	Period	L_{AFmax}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
1) Cross Lane	Day	74.7	62.3	65.0	59.4	53.8
	Night	71.8	59.8	64.4	52.0	44.8
2) Cross Lane / Varey Street	Day	73.7	60.4	64.7	54.3	48.0
	Night	73.3	56.9	58.7	46.5	41.9
3) Cross Lane / Chapman Street	Day	78.3	66.2	69.1	64.5	58.9
	Night	72.9	58.6	61.9	51.1	40.9

Table 1 – Summary of Azymuth Acoustics noise measurements (general day/night ambient noise)

Azymuth assumes that all noise levels measured on-site during the baseline noise survey are typical of the site. Full results are in Appendix B.

2.2.2 Assessment of Night-time L_{Amax} Data

Azymuth has carried out an assessment of the available night-time L_{Amax} noise level data for measurement position 1 (referenced to ~6.5m from the roadside). The highest measured L_{Amax} value was 72.4dB and the duration of the night-time survey was exactly 20 minutes in this position hence it is estimated that the 10th highest L_{Amax} value over the entire 8hr night-time period is likely to be around 74-77dB.

2.2.3 Description of Noise Climate

The main source of noise affecting the site originates from traffic along Cross Lane and Chapman Street which see a moderate flow throughout the day.

The weather during the measurement procedure on Wednesday 6th March 2024 was dry with wind speeds less then 5mph whereas the weather on Wednesday 13th March was rainy with similar wind speeds. The weather during the night-time survey consisted of light rain showers with wind speeds also less than 5mph.

3.0 Assessment Criteria

In order to assess the extent of any measures required in order to comply with suitable conditions relating to potential noise sources, Azymuth Acoustics UK has reviewed various guidance documents and standards, these include:

- National Planning Policy Framework (NPPF 2026)
- British Standard 8233:2014
- World Health Organisation Guidelines on Community Noise
- British Standard 4142:2014+A1:2019 & BS 4142:1977
- Microgeneration Certification Scheme (MCS 020)
- Air Source Heat Pumps: Professional Advice Note (2026)
- Manchester City Council: Planning and Noise Technical Guidance
- Manchester City Council Planning Application 136203/FO/2023 (Cross Lane) and 139774/JO/2024 (Varey Street) Condition 24a and 24b.

3.1 National Planning Policy Framework (NPPF) 2026

The National Planning Policy Framework (NPPF), updated in August 2026, sets out national planning policy requirements relating to noise under Chapter 17, Policy P3 – Living conditions and pollution, and Policy P4 – Impact of development on existing activities.

Policy P3(1) requires development proposals to be appropriate for their location, taking into account the likely effects, including cumulative effects, of pollution on health, living conditions and the natural environment, whether these effects are on or off-site and whether they arise from the development itself or from pre-existing conditions in its vicinity. The policy also requires consideration of the sensitivity of the site, its intended occupiers and users, and the surrounding environment and population.

Of particular relevance to noise, Policy P3(2)(a) states that development proposals should:

“Provide healthy living conditions for occupiers and users in terms of adequate access to light and avoiding exposure to levels of air, noise, artificial light or other sources of pollution which could have an unacceptable adverse effect on health and quality of life. Where necessary suitable mitigation measures should be incorporated to secure acceptable living conditions.”

In addition, Policy P3(2)(b) states that development proposals should not give rise to, or contribute to, unacceptable levels of noise on or beyond the site, with adverse impacts to be avoided where possible or otherwise mitigated to an acceptable degree.

Policy P3(2)(d) specifically requires development proposals to:

“Mitigate and reduce to a minimum potential adverse impacts resulting from noise, not result in levels of noise exposure which would have a significant observed adverse effect, and maintain the character of tranquil areas…”

The NPPF also contains specific requirements concerning the relationship between new development and existing activities. Policy P4 – Impact of development on existing activities states that existing businesses, community facilities, public services and defence and security activities should not have unreasonable restrictions placed on their current or permitted operation as a result of development being approved after they were established. Development proposals should therefore be capable of being effectively integrated with existing activities and infrastructure in their vicinity.

Where an existing activity could have a significant adverse effect on a proposed new development, Policy P4(2) requires the proposal to identify the nature of the potential impacts and, where necessary, be informed by early discussions between the applicant, as the 'agent of change', and the existing uses that could be affected. The proposal must also demonstrate that suitable mitigation can be provided before first occupation where this is necessary for the development to be acceptable. Both lawful current and permitted levels of operation of existing activities should be taken into account.

The proposed development has therefore been assessed in accordance with NPPF Policies P3 and P4, with consideration given to existing noise conditions, the potential noise effects associated with the development, the effects on existing and proposed noise-sensitive receptors, the potential cumulative effects, and the need for appropriate mitigation measures. Where relevant, consideration has also been given to the potential for the development to affect the continued operation of existing noise-generating activities.

3.2 British Standard 8233: 2014

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise. It provides recommendations for control of noise in and around buildings and suggests appropriate internal ambient noise level criteria / limits for a variety of different situations including residential properties.

The following table summarises the noise limits suggested by BS 8233 applying to residential properties:

Activity	Room	Good Design Range $L_{Aeq,T}$ dB	
		07:00-23:00hrs	23:00-07:00hrs
Resting	Living Room	35	-
Dining	Dining Room / Area	40	-
Sleeping (daytime resting)	Bedroom (at night)	35	30

Table 2 – Noise Limits for Residential Properties Suggested in BS 8233

BS 8233 also states that traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$, which would be acceptable in noisier environments.

3.3 World Health Organisation Environmental Noise Guidelines (ENG) 2018

The main purpose of the 2018 WHO guidelines is to provide recommendations for protecting human health from exposure to environmental noise originating from the following sources: transportation (road traffic, railway and aircraft), wind turbines and leisure activities.

The guidelines set out to define recommended exposure levels for environmental noise in order to protect population health. Exposure limits are average levels defined over a period of one year, measured outdoors in free field at the most exposed façade. It should be noted that the document does not provide guideline limit values for multiple noise sources in combination.

The 2018 guidelines supersede the Community Noise Guidelines from 1999. Nevertheless, the document recommends that all CNG indoor guideline values and any values not covered by the current guidelines should remain valid. As such, the following guidance would remain appropriate:

For protection against sleep disturbance inside dwellings, night-time noise levels should not exceed 30dB L_{Aeq} for continuous noise and 45dB L_{Amax} for typical single sound events (which are exceeded 15 times or more per night – see ProPG Appendix A.12 for more details).

To protect the majority of people from being seriously annoyed during the daytime, the outdoor sound level from steady, continuous noise (interpreted as noise from all sources combined) should not exceed 55dB L_{Aeq} on balconies, terraces and in outdoor living areas.

It should be noted that exposure levels defined in ENG and CNG are for guidance purposes as relates potential adverse health impacts and should not be interpreted as absolute limits or regulations.

3.4 British Standard 4142:2014+A1:2019 & BS 4142:1997

"Methods for assessing and rating industrial sound" describes methods for rating and assessing sound of an industrial and/or commercial nature. The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

- Typically, the greater the difference between background sound and industrial/commercial noise, the greater the magnitude of the impact.
- 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.
- A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

BS 4142 notes that: "Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact."

In BS 4142: 1997, it states that 'background noise level below 30dB and rating level below about 35dB are considered to be very low'. The assessment should consider the character of the existing sound environment alongside the measured and predicted noise levels when evaluating the potential impact.

3.5 Air Source Heat Pump: Professional Advice Note (2026)

The Air Source Heat Pumps Professional Advice Note (2026), published jointly by the Institute of Acoustics (IOA) and the Chartered Institute of Environmental Health (CIEH), provides guidance on proportionate acoustic assessments for air source heat pump (ASHP) installations, aiming to support planning applications for sustainable heating and cooling systems while reducing unnecessary administrative burdens for installers and local authorities. Where Permitted Development Rights (PDR) do not apply, the guidance outlines a range of assessment methods between standard installer-led MCS 020a calculations and more detailed assessments using BS 4142:2014+A1:2019, Methods for rating and assessing industrial and commercial sound.

The appropriate assessment level is determined by a Suitably Qualified Acoustician (SQA), considering the specific circumstances of the installation. The methodology primarily uses a noise threshold of 37 dB(A), defined as the incident sound pressure level calculated 1 metre in front of the centre of a window or door serving a habitable room in a neighbouring property.

3.6 Microgeneration Certification Scheme (MCS 020)

The Microgeneration Certification Scheme allows for ASHPs to be installed on residential properties under permitted development.

Permission is granted if noise from the ASHP is equal to or lower than the noise limit of 37dB $L_{Aeq,5min}$ at 1 metre from a window or door opening to a habitable room ("a room other than a bathroom, shower room, water closet or kitchen") on the façade of a neighbouring residential property (including flats within the same block of flats). Compliance is determined via a series of steps set out in MCS 020. The 37dBA noise limit approximately equates to an internal noise level ≤25dBA in rooms with half-opened windows. This is in line with target night-time limits for bedrooms described in BS 8233 and ENG.

3.7 Manchester City Council: Planning and Noise Technical Guidance

3.7.1 Guidance Relating to Residential Developments

The Council has adopted the following noise limits for residential properties:

- Bedrooms (night time - 23.00 - 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 10 times)
- Living Rooms (daytime - 07.00 - 23.00) 35 dB L_{Aeq}
- Gardens and terraces (daytime) 55 dB L_{Aeq}

3.7.2 Guidance Relating to Industrial and Commercial Noise Sources

The Technical Guidance states that:

BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises (section 3.5). One of the indications of the impact of a BS 4142 assessment is 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.

3.8 Manchester City Council Planning Application 136203/FO/2023 and 139774/JO/2024

3.8.1 Condition 24a

"Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location. Prior to commencement of the use hereby approved the scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site. The scheme shall be implemented in full before the use commences or as otherwise agreed in writing by the City Council as local planning authority."

3.8.2 Condition 24b

"Prior to the operation of the scheme a verification report shall be submitted to and approved in writing by the City Council as local planning authority to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic report. The report shall also undertake post completion testing to confirm that the noise criteria have been met. Any instances of nonconformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria."

3.9 Recommended Noise Assessment Criteria

Azymuth has recommended the following criteria within the Condenser Noise Impact Assessment in order to reduce the impact of any ASHP noise on the surrounding environment:

- Noise level from plant to be 5dB L_{Aeq} below background noise level (L_{90}) at any of the nearest worst-case residential receptors (off-site and on-site) as set out in BS4142 and referenced in the planning policy 24a.
- Noise level not to exceed 37dB $L_{Aeq\ 5min}$ at the nearest noise-sensitive receptor's habitable area window (on-site) as set out in The Air Source Heat Pumps Professional Advice Note (2026) and MCS 020a.

4.0 Noise Assessment

4.1 Layout and Receptor Locations

The 13no. condenser units are to be located on the ground floor level at the rear façade of all the houses and flats with the exception being 69 Cross Lane with the condenser being placed on the ground floor level of the East Façade.

The nearest noise sensitive receptors **off site** consist of:

- No.13 Sheerness Street
- No.25 Sheerness Street
- No. 34 Highmead Street
- No. 38 Highmead Street

The nearest noise sensitive receptors **on site** consist of neighbouring flats and houses on the development.

The proposed outdoor unit(s) are understood to be as follows:

- 12no. Vaillant aroTHERM Plus 3.5kW
- 1no. Vaillant aroTHERM Plus 5kW

All flats use the same ASHP aside from 69 Cross Lane which uses the Vaillant aroTHERM Plus 5kW ASHP.

4.2 Implemented Mitigation Methods

4.2.1 Site Boundary Treatment

During the measurements, a 2.1 metre tall close boarded fences was present along the site boundary with 1.5 metre tall close boarded fences installed between the plot's gardens.



Figure 4 – Boundary Treatment Plan for Cross Lane (Key in Figure 5)



Figure 5 – Boundary Treatment Plan for Varey Street

This boundary treatment was included in the SoundPLAN model to accurately assess the impact of plant noise at the worst-case noise-sensitive receptors.

4.2.2 Quiet Mode

The Vaillant aroTHERM technical specification states that the units feature a 'Whisper Mode' operating setting, which limits their output to approximately 60% and reduces the sound pressure level by up to 9 dB (refer to Appendix C). Azymuth therefore has recommended that the ASHPs serving Flats 20, 22, 73 and 75 operate in Whisper Mode at all times to reduce noise emissions and assist in achieving the specified acoustic criteria.

Whisper Mode has been implemented in conjunction with the additional mitigation measures outlined below to achieve the specified acoustic criteria.

4.2.3 Adjusting the Positioning

The ASHPs serving Flats 20 and 22 has been repositioned to increase their separation from the neighbouring flat's windows. Azymuth has recommended relocating the units to positions similar to those adopted for Flats 73 and 75.

4.2.4 1.8 Metre Acoustic Close Boarded Fence

A 1.8 m high acoustic close-boarded fence was installed between the ASHP and the neighbouring windows. The fence extends beyond the depth of the ASHP to provide adequate screening and minimise direct noise transmission towards the affected windows.

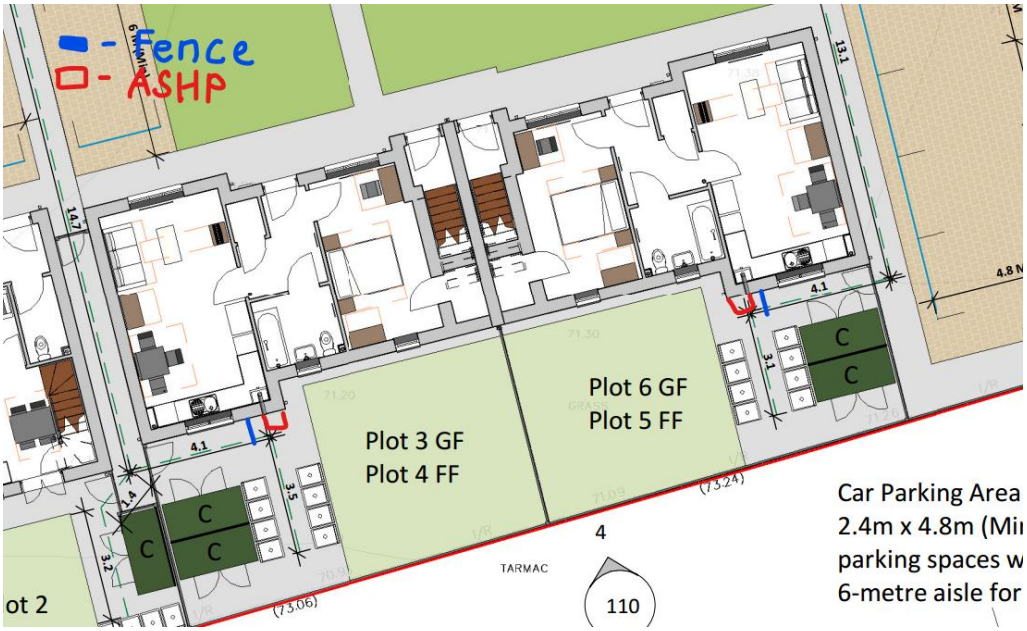


Figure 6 – Fence Location for Cross Lane

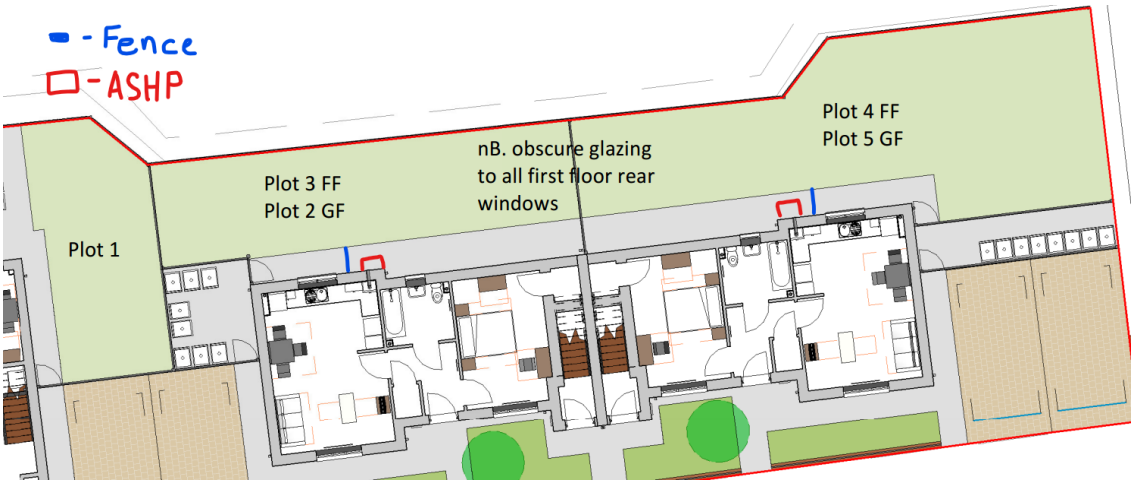


Figure 7 – Fence Location for Varey Street



Figure 8 – Example of Installation (22 Cross Lane)

5.0 Results of the Plant Measurement

5.1 100% Capacity

Azymuth measured the noise emissions from each condenser individually at 1 metre, with the equipment operating at 100% capacity for 5 minutes. Following each measurement, the plant was switched off to establish the existing ambient noise level at the measurement position and was measured for 5 minutes. The ambient noise contribution was then logarithmically subtracted from the overall measured level (with the plant operating) to determine the specific sound pressure level attributable to each condenser at 1 metre.

Plant Noise Source	Sound Pressure Level (dBA) @ 1 metre in Octave Band Centre Frequency, Hz								Total SPL @1 metre (dBA)
	63	125	250	500	1k	2k	4k	8k	
No. 14	55.5	49.4	46.6	43.8	42.1	36.9	27.6	27.2	46.5
No. 16	62.5	51.3	42.1	42.4	36.9	28.0	25.1	24.4	43.9
No. 18	14.8	50.9	40.8	43.6	38.1	29.9	14.8	20.5	43.7
No. 20	56.9	50.5	41.1	37.6	36.8	14.8	22.2	21.6	41.3
No. 22	52.3	54.3	45.6	42.0	42.3	34.5	17.8	22.4	46.1
No. 24	14.8	48.7	35.5	34.7	30.3	14.8	14.8	21.9	37.0
No. 26	50.4	48.3	43.0	41.2	39.0	33.0	26.7	27.9	43.6
No. 28	53.2	50.1	48.4	42.6	39.0	36.9	34.5	32.3	46.1
No. 69	44.2	46.2	43.4	14.8	14.8	14.8	14.8	21.8	36.3
No. 71	59.1	53.7	45.5	45.4	42.8	38.0	32.8	27.8	47.7
No. 73	52.4	48.7	42.8	40.1	37.7	34.2	30.0	28.3	43.2
No. 75	50.6	51.3	43.9	40.8	36.3	35.8	30.8	27.3	43.8
No. 77*	44.6*	38.1*	14.8*	14.8*	14.8*	14.8*	15.5*	20.4*	26.5*

Table 3 – Measured Sound Pressure Level of Condensers @1m at 100% Capacity

*Due to fluctuations in road traffic noise, the ambient noise level occasionally increased during measurements taken with the plant switched off, resulting in higher overall noise levels than those recorded with the plant operating. This makes it difficult to reliably isolate the specific noise contribution of the ASHPs through logarithmic subtraction, particularly where the difference between the plant-on and plant-off measurements is insufficient.

Consequently, these measurements are considered unreliable for determining the precise sound pressure level of the individual units. However, they indicate that the noise emissions from the ASHPs are significantly below the prevailing background noise levels, suggesting that their contribution is unlikely to be significant.

To avoid relying on potentially unreliable individual measurements, Azymuth has adopted an average sound pressure level based on the measurements obtained from all ASHPs as the input for the acoustic model in soundPLAN for Flat No. 77. This provides a consistent basis for the assessment, with the model used to predict the cumulative noise impact at the nearest noise-sensitive receptors.

5.2 Plant on Whipser Mode

Azymuth recommended the implementation of the manufacturer's Whisper Mode operating setting for the ASHPs serving Flats 20, 22, 73 and 75, which were identified as the primary noise sources affecting the rear façades of Flats 18, 24, 71 and 77, respectively.

According to the manufacturer's specification, activating Whisper Mode was expected to provide a noise reduction of approximately 9 dB. However, measurements taken following its implementation indicated a lower reduction, averaging approximately 2 dB across the assessed units.

The measured results following the implementation of Whisper Mode are presented below:

Plant Noise Source	Sound Pressure Level (dBA) @ 1 metre in Octave Band Centre Frequency, Hz								Total SPL @1 metre (Whisper Mode) (dBA)	Total SPL @1 metre (100% capacity) (dBA)
	63	125	250	500	1k	2k	4k	8k		
No. 20	14.8	44.6	43.7	37.7	14.8	14.8	25.1	30.4	39.1	41.3
No. 22	55.7	54.8	42.9	38.9	38.0	32.8	27.4	28.8	43.9	46.1
No. 73	55.2	47.9	41.0	39.4	34.2	28.7	24.7	29.3	41.1	43.2
No. 75	47.2	54.6	47.7	37.9	33.9	27.7	34.8	33.1	44.3	43.8

Table 4 – Measured Sound Pressure Level of Condensers on Whisper Mode

Following implementation, measurements indicate that Whisper Mode achieved a reduction in noise emissions of approximately 2 dB for the ASHPs serving Flats 20, 22 and 73. However, the unit serving Flat 75 recorded a slight increase of 0.5 dB when operating in Whisper Mode, indicating that no meaningful noise reduction was achieved for this unit.

Although the measured reductions were lower than the manufacturer's specified performance of approximately 9 dB, the measured noise emission levels have been incorporated into the subsequent acoustic assessment. The implementation of Whisper Mode therefore provides a reduction in the predicted noise impact from three of the four units, alongside the other mitigation measures.

5.3 Plant Servicing Flat 77 Noise Level

Due to the unreliable measurement results for the ASHP serving Flat 77 as mentioned in section 5.1, Azymuth has adopted the average of the reliable measurements obtained from the other ASHPs operating at 100% capacity. This provides a representative estimate of the unit's expected noise emissions for the acoustic assessment.

Plant Noise Source	Sound Pressure Level (dBA) @ 1 metre in Octave Band Centre Frequency, Hz								Total SPL @1 metre (dBA)
	63	125	250	500	1k	2k	4k	8k	
No. 77	47.5	50.6	43.2	41.3	38.3	30.6	25.2	25.6	43.9

Table 5 – Average Sound Pressure Level of All Condensers Operating at Full Capacity for Flat 77

5.4 Grid Noise Map (GNM) based on measured condenser noise

Azymuth has produced the following Grid Noise Map (GNM) of the site, calculated at a receptor height of 1.5 m above ground level. The model incorporates the measured noise emission levels of all ASHPs, with the exception of the unit serving Flat 77, for which the average measured noise level across all ASHPs has been adopted due to the unreliability of its individual measurement results.

The ASHPs serving Flats 20, 22, 73 and 75 have been modelled operating in Quiet Mode to account for the proposed mitigation measures.

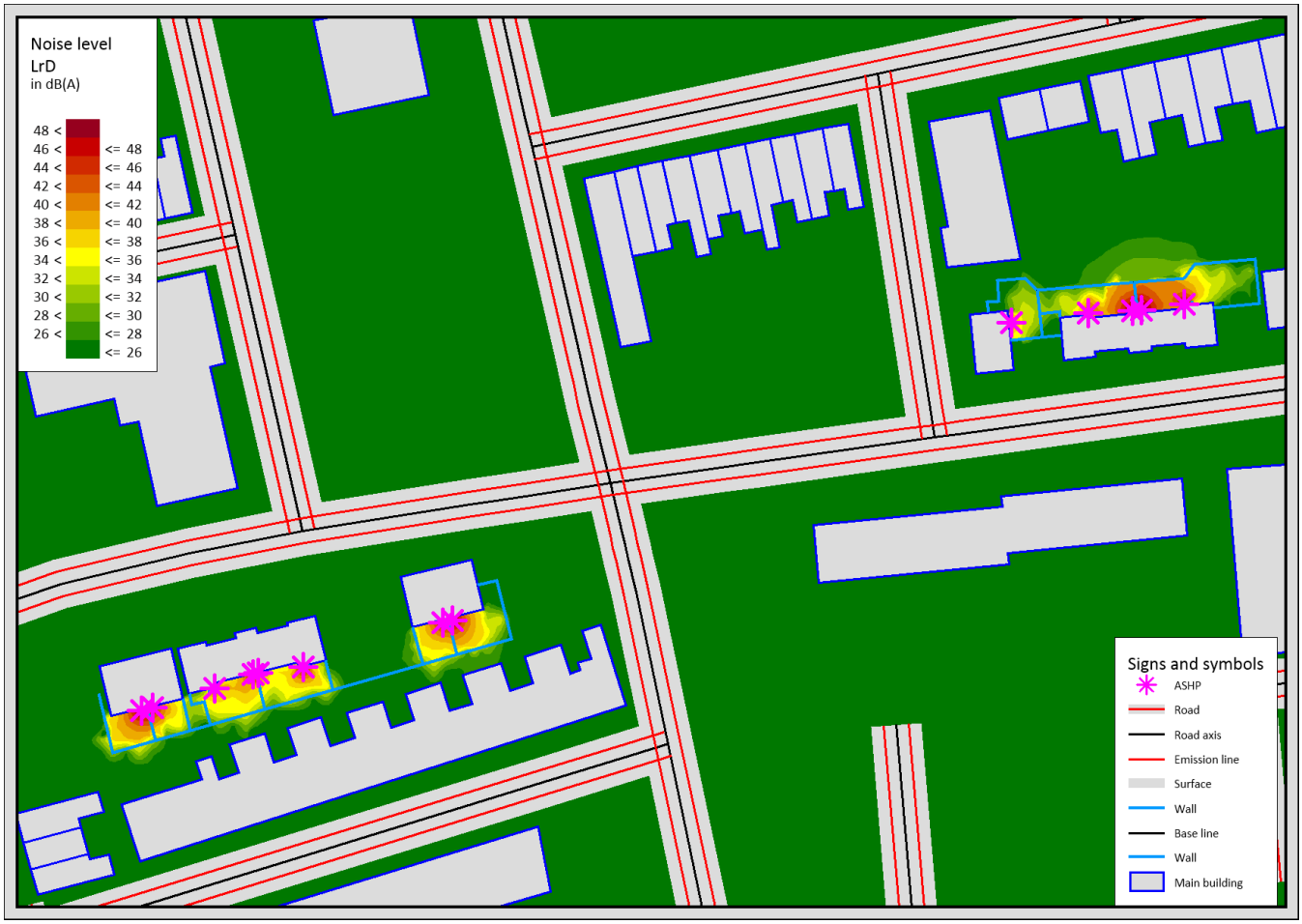


Figure 9 – GNM of the site (calculated at 1.5m above ground height)

6.0 Assessment Results

6.1 Off-Site BS 4142 / Planning Condition 24a Assessment

Azymuth have undertaken a BS 4142 assessment of noise impact on nearby residents against the noise limit set by Manchester City Council Condition 24a: noise should be controlled to 5dB below the background sound level.

The following table identifies the nearest noise sensitive receptors, the predicted sound level as a result of the 13no. units at these receptors and how this noise level relates to the background sound level.

The predictions are based on a scenario in which all units are running at full capacity.

Source receiver distances have been measured as the distance between the closest unit to each respective receptor.

The background noise level is the lowest recorded L_{90} value during the noise survey -5. Refer to Appendix B for details.

All proposed mitigation measures have been incorporated into the following calculations and acoustic modelling.

Based on previous experience and in-situ measurements, the Vaillant aroTHERM units exhibited no significant tonal, impulsive or intermittent characteristics. Therefore, Azymuth considers that the application of an acoustic character correction is not warranted.

Receptor Location	Source – Receiver Distance (~m)	Time Period	Background Noise Level (dBA) (Worst Case L_{90}-5)	Calculated Plant Noise Level (dBA)	Difference between Background Noise and Plant Noise	MCC 24a Criteria
No.13 Sheerness Street	~9m	Daytime	45	30	-15	Compliant
		Night-Time	39	30	-9	Compliant
No.25 Sheerness Street	~8m	Daytime	45	29	-16	Compliant
		Night-Time	39	29	-10	Compliant
No. 34 Highmead Street	~21m	Daytime	42	26	-16	Compliant
		Night-Time	35	26	-9	Compliant
No.38 Highmead Street	~23m	Daytime	42	23	-19	Compliant
		Night-Time	35	23	-12	Compliant

Table 6 – Predicted noise levels at nearest noise sensitive receptors

6.1.1 BS 4142 / Planning Condition 24a Assessment Results Comments

As shown in the table above, the predicted noise levels at the worst affected noise sensitive receptors are 9-19dB below the background sound level – 5dB which shows there is negligible impact on the surrounding receptors and environment.

It should be noted that Azymuth Acoustics do not deem the noise from the condensers installed at this location to have any (audible) specific tonal or intermittent characteristics, hence no penalty has been applied to the specific levels derived from the measurements and SoundPlan calculations. It would also be noted that even if a (very much) worst case penalty of 6dB were applied to the noise levels set out in Table 4 then the noise levels would remain at least 5dB below the background noise.

6.2 On-Site BS 4142 / Planning Condition 24a Assessment

Azymuth has undertaken an assessment against the MCC Condition 24a criteria for all on-site noise-sensitive receptors. The assessment considers the cumulative noise contribution from all neighbouring ASHPs operating simultaneously, using their respective measured noise emission levels with all mitigation methods included.

The ASHPs serving Flats 20, 22, 73 and 75 have been modelled operating in Whisper Mode to account for the implemented mitigation measures.

The ASHP serving Flat 77 has been modelled using the average noise emission level derived from all reliable ASHP measurements, as its individual measurement results were considered unreliable.

The assessment has been undertaken in accordance with BS 4142 and MCC Condition 24a, considering the combined noise impact at the nearest noise-sensitive façades of neighbouring dwellings.

Noise Receptor Flat No.	A Cumulative Noise at Receiver Location (dBA) with all ASHPs Operational Excluding its own (MCC Planning 24a)	MCC 24a Target (dBA) (Worst case Background L_{90} -5dB)	MCC 24a Policy (A-(L_{90}-5))	Compliance
14 (Semi-D)	27	39	-12	Compliant
16 (Semi-D)	30		-9	Compliant
18 (GF Flat)	29		-10	Compliant
20 (1F Flat)	25		-14	Compliant
22 (1F Flat)	21		-18	Compliant
24 (GF Flat)	33		-6	Compliant
26 (Semi-D)	30		-9	Compliant
28 (Semi-D)	29		-10	Compliant

Table 7 – MCC 24a / BS 4142 noise assessment for The Cross Lane Site

Noise Receptor Flat No.	A Cumulative Noise at Receiver Location (dBA) with all ASHPs Operational Excluding its own (MCC Planning 24a)	MCC 24a Target (dBA) (Worst case Background L_{90} -5dB)	MCC 24a Policy (A-(L_{90}-5))	Compliance
69 (House)	24	**35**	**-11**	**Compliant**
71 (GF Flat)	31		**-4**	**Compliant**
73 (1F Flat)	30		**-5**	**Compliant**
75 (1F Flat)	30		**-5**	**Compliant**
77 (GF Flat)	32		**-3**	**Compliant**

Table 8 – MCC 24a / BS4142 noise assessment for The Varey Street Site

6.2.1 BS 4142 / Planning Condition 24a Assessment Results Comments

Following the implementation of the mitigation measures recommended within the Condenser Noise Impact Assessment, all receptors now demonstrate compliance with the specified noise criteria. Previously, Flats 18, 24, 71 and 77 exceeded the target levels by 8–13 dB. However, the revised assessment indicates that noise levels at these receptors are now 3–10 dB below the worst-case assessment target, which is set 5 dB below the measured background noise level.

6.3 On-Site MCS 020a Noise Assessment

Azymuth has assessed the noise impact of individual adjacent ASHPs on neighbouring dwellings, with noise levels calculated at the nearest window serving a habitable room in accordance with MCS 020.

The results presented below incorporate all proposed mitigation measures, with the assessment target being a noise level of 37 dB or below at the nearest habitable room window.

Noise Receptor Flat No.	A Noise Level (dBA) at Noise Receptor's Window (MCS)	MCS Assessment Results (A-37)	Compliance
14 (Semi-D)	5 (No.16)	-32	Compliant
16 (Semi-D)	9(No. 14)	-28	Compliant
18 (GF Flat)	28 (No. 20)	-9	Compliant
20 (1F Flat)	5 (No. 14)	-32	Compliant
22 (1F Flat)	1 (No. 18)	-36	Compliant
24 (GF Flat)	31 (No. 22)	-6	Compliant
26 (Semi-D)	7(No. 28)	-30	Compliant
28 (Semi-D)	5(No. 26)	-32	Compliant
69 (House)	2(No. 71)	-35	Compliant
71 (GF Flat)	31 (No. 77)	-6	Compliant
73 (1F Flat)	7 (No. 71)	-30	Compliant
75 (1F Flat)	8 (No. 77)	-29	Compliant
77 (GF Flat)	32 (No. 75)	-5	Compliant

Table 9 – MCS Noise Assessment

6.4 MCS Commentary

All ASHPs continue to demonstrate compliance with the MCS 020a assessment criteria at the nearest On-Site Noise Receptor, as established in the previous report. The revised assessment shows a slight improvement in predicted noise levels, providing additional margin below the 37 dB(A) criterion at the nearest neighbouring habitable room windows. Measurements and predictions at plots where no additional mitigation was implemented remain broadly consistent with the previous assessment, further supporting the reliability of the results.

7.0 Summary

Azymuth Acoustics UK (henceforth Azymuth) has been appointed by R&M Property Group to produce a condenser noise verification report regarding the installation of 13 Air Source Heat Pumps (ASHPs) at a new build development site consisting of 8no. apartments and 5no. houses located at the Cross Lane / Varey Street, Manchester.

This report has been produced to assist with the discharge of Planning Condition 24b in relation to the verification of condenser noise, as per Planning Application 136203/FO/2023 and 139774/JO/2024.

Daytime background noise levels were measured to be ~52-59dB L_{A90}. Night-time background noise levels were measured to be ~41-45dB L_{A90}.

Azymuth undertook noise measurements of each plant item on site to establish their operational noise levels. Additional measurements were also carried out for the ASHPs serving Flats 20, 22, 73 and 75 while operating in Whisper Mode to assess the effectiveness of the reduced-noise setting.

A noise model was developed in SoundPLAN 9.1 using the on-site measurements to predict and visualise the noise impact of the external units at the nearest noise-sensitive receptors.

BS 4142 / Manchester City Council Planning Condition 24a Results

Azymuth has undertaken a BS 4142 assessment of noise associated with the premises against the noise limit set by Manchester City Council Planning condition 24a: noise should be controlled to 5dB below the background sound level at the nearest receptor.

- All worst-case off-site noise-sensitive receptors comply with the specified noise criteria.
- All on-site noise-sensitive receptors comply with the specified noise criteria.

All results incorporate the mitigation measures recommended within the Condenser Noise Impact Assessment, which have been installed on site.

MCS 020a Results

Azymuth undertook an assessment in accordance with MCS 020a to evaluate the noise impact of individual ASHP units at all on-site noise-sensitive receptors, with predicted noise levels assessed at the nearest window serving a habitable room.

- All assessed receptors demonstrate compliance with the specified noise criteria, with predicted noise levels remaining within the required limits.

Conclusion for Planning Condition 24b

Azymuth has undertaken a review of the installed ASHPs, including on-site noise measurements and post-completion acoustic assessments, to verify that the recommendations within the approved Condenser Noise Impact Assessment have been implemented.

The results demonstrate that all assessed on-site and off-site noise-sensitive receptors comply with the specified noise criteria following the implementation of the recommended mitigation measures.

Where individual measurements were unreliable due to fluctuating background noise, representative values from reliable measurements were used within the acoustic model. These instances have been identified within this report.

Based on the measurements, implemented mitigation measures and revised acoustic assessments, Azymuth considers that the development complies with the approved acoustic requirements and that no further mitigation is necessary.

Appendix A – Glossary of Acoustic Terms

Decibel (dB)
This is the unit used to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro Pascal to 100 Pascal).

dB (A)
This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. A-weighting) to compensate for the sensitivity of the human ear to sound of different frequencies. The A-weighting curve is implemented in sound level meters using an electronic filter that approximately corresponds to the frequency response of the ear.

Octave Band Noise Level
The human ear is sensitive to sound over a range of frequencies between approximately 20Hz to 20kHz. The ear is also generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum can be divided into frequency bands. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it.

L_{Aeq}
This is the equivalent steady sound level in dB(A) containing the same acoustic energy as the actual fluctuating sound level over a given time period.

Reverberation Time (RT or sometimes T_{30} or T_{60})
This is the time taken for the reverberant sound energy in an enclosure to decay one millionth of its equilibrium value, i.e. by 60dB, after the source has been switched off. The reverberation time is frequency dependent and it is customary to measure its value in octave or one-third octave bands. Reverberation occurs when sound waves are repeatedly reflected from each surface of the room.

Sound Reduction Index (SRI)
Difference measured between the amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room (usual range 100 - 3150Hz for one third octave band values). The SRI varies with frequency and is measured in a laboratory in either octave or one-third octave bands.

SRI = L1 - L2 + 10 log (S/A), where:
L1 = Noise level in the source room
L2 = Noise levels in the receiving room
S = Surface area of test specimen
A = Equivalent acoustic absorption area in the receiving room

Weighted Sound Reduction Index (R_w)
This is a weighted single figure descriptor of the sound insulation performance of a partition measured under laboratory conditions. The procedure used to quantify the R_w is to compare the sound reduction index (SRI) in each of the one-third octave bands from 100Hz to 3150Hz against a set of standard reference curves.

Appendix B – Noise Survey Data

Start	Position	Time	L_{Amax}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
Wednesday 6th March 2024							
15:42:00	1	00:05:00	75.4	61.4	64.6	59	55.9
15:47:00	1	00:05:00	73.3	61.7	64.8	59.2	55.8
15:52:00	1	00:05:00	74.9	61.1	64	59.3	55.1
17:02:00	2	00:05:00	72.8	60.2	64.7	53.8	47.8
17:07:00	2	00:05:00	73.4	59.9	64.5	53.3	48.2
17:12:00	2	00:05:00	78.2	61	64.8	54.1	48
17:17:00	2	00:05:00	72.3	60.6	65.3	54.3	48.4
17:22:00	2	00:05:00	75	60.5	64.5	56.2	48.6
17:27:00	2	00:05:00	72	59	63.1	54.7	47
17:32:00	2	00:05:00	72.4	61.3	66.3	55.7	48.8
17:37:00	2	00:05:00	70.8	58.9	63.5	52.4	47.9
17:42:00	2	00:05:00	76.5	61.3	65.7	54.8	47.4
17:47:00	2	00:05:00	73.8	60.1	64.5	53.4	48.2
17:53:00	3	00:05:00	74.6	65.6	68.7	64.2	59.8
Wednesday 13th March 2024							
10:32:00	1	00:05:00	75.8	62.6	64.8	59.4	53.7
10:37:00	1	00:05:00	70.3	59.2	62.7	55.8	50.6
10:42:00	1	00:05:00	79.9	59.2	61.7	57.1	52.4
10:47:00	1	00:05:00	70	60.4	64.6	57.6	51.8
10:52:00	1	00:05:00	74.8	61.9	63.8	59.6	53.7
10:57:00	1	00:05:00	75.8	59.9	63.8	57.3	50.4
11:05:00	3	00:05:00	74.5	64.9	68.1	63.2	57.5
11:10:00	3	00:05:00	76	65.8	68.8	64.6	58.5
11:15:00	3	00:05:00	77.3	66	69	65	59.6
11:20:00	3	00:05:00	83.8	67.4	70.2	64.1	57.8
11:25:00	3	00:05:00	77.3	66.2	68.8	64.8	59.6
11:30:00	3	00:05:00	84.5	67	70.3	65.3	59.4
11:38:00	1	00:05:00	73.5	64.2	68	62	54.4
11:43:00	1	00:05:00	72.6	64.4	68	62.7	56.6
11:48:00	1	00:05:00	79.7	65.7	69.3	63.3	55.2
Tuesday 19th March 2024							
23:05:00	1	00:05:00	71.5	60.3	64.8	52.6	44.3
23:10:00	1	00:05:00	72.4	59.8	64.4	52.9	45.8
23:15:00	1	00:05:00	71.1	58.6	63.3	50.5	44.9
23:20:00	1	00:05:00	72.2	60.4	64.9	52	44.3
23:30:00	2	00:05:00	74.8	57.7	61.1	47.8	43
23:35:00	2	00:05:00	75.3	57.8	59.7	45.8	41.5
23:40:00	2	00:05:00	72.1	54.9	55.1	46	41.7
23:45:00	2	00:05:00	71	56.5	58.7	46.3	41.3
23:56:00	3	00:05:00	72.6	56.5	59.8	49	40.4
Wednesday 20th March 2024							
00:01:00	3	00:05:00	73.3	59.8	63.3	50.5	41.6
00:06:00	3	00:05:00	76	59.3	62.6	53.8	41.8
00:11:00	3	00:05:00	69.7	58	62	50.9	39.9

Table B1 – Fully tabulated noise measurement results

Appendix C – ASHP Noise Data

Sound power pressure level

aroTHERM plus	3.5 kW	5 kW	7 kW	10 kW	12 kW
Sound power level A7/W55	54 dB	54 dB	55 dB	60 dB	60 dB

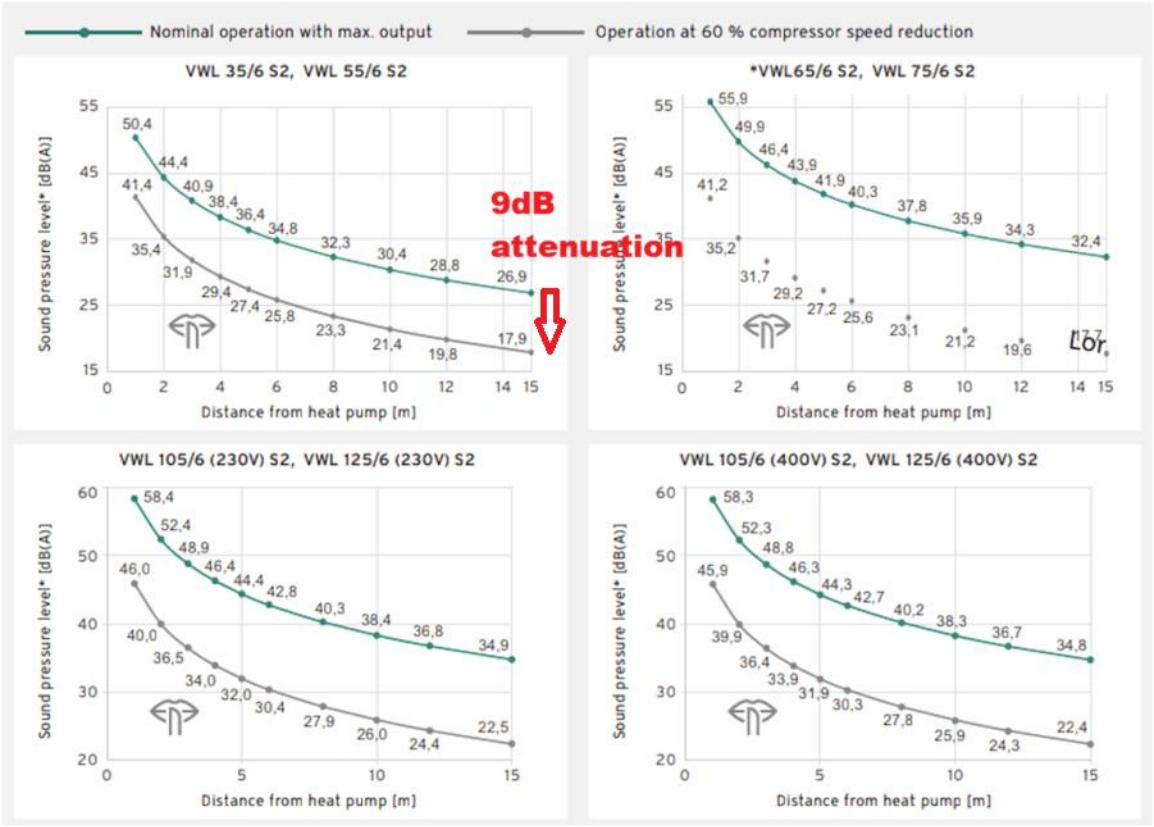


Figure C1 – Noise Specification Sheet for the Vaillant aroTHERM plus 3.5kW/5kW