Noise & Vibration Consultants
4 Mulberry Place, Pinnell Road, London, SE9 6AR
**Tel: 020 8859 0303**
Email: **info@acousticsplus.co.uk** Web: www.acousticsplus.co.uk

ACOUSTICS PLUS

# Proposed Residential Development

## 1-11 Hawley Crescent, London, NW1 8NP

## Environmental Noise Assessment

**Author:** Phil Huffer B.Sc. (Hons) MIOA
Principal Consultant

**Doc Ref:** 103203.ph.Issue1

Company Registration Number: 4304440
VAT Registration Number: 788 2610 94

| Proposed Residential Development | |
|---|---|
| Project Address: | 1-11 Hawley Crescent<br>Camden Town<br>London<br>NW1 8NP |
| Project Reference: | 103203 |

| Issue/Revision Record | | | |
|---|---|---|---|
| **Issue:** | **Date:** | **Remarks:** | **Author:** |
| 1 | 01/08/2016 | First Issue | Phil Huffer |
| | | | |
| | | | |
| | | | |
| | | | |

| | Signature: | Print: | Title: | Date: |
|---|---|---|---|---|
| **Author:** |  | **Phil Huffer** | **Principal Consultant** | **01/08/2016** |
| **Reviewer:** |  | **Andy Dodd** | **Senior Consultant** | **01/08/2016** |

# 1. INTRODUCTION

1.1 Acoustics Plus Ltd (APL) is an independent firm of multi-disciplinary acoustic engineers. APL is engaged by both private and public sector clients.

1.2 APL is a registered member of The Association of Noise Consultants (ANC) and the author is a corporate member of The Institute of Acoustics (IOA).

1.3 APL has been instructed by the applicant's M&E Consultant, KUT LLP, to consider and advise upon the noise implications associated with the creation of a number of new self-contained residential units.

1.4 The noise implications are in connection with the sites proximity to traffic noise at the front of the site and the impact of the proposal to install a number of items of mechanical plant on the roof.

1.5 This report will outline the findings of a background noise measurement exercise and determine that:

*(a) Suitable fenestration measures may be incorporated into the scheme to demonstrate that the ingress of noise may be properly controlled;*

*(b) Suitable mitigation measures may be incorporated into the scheme to ensure that the installation of mechanical plant meets with Local Authority criteria.*

1.6 These items will be presented in line with relevant British Standards and the specific requirements of Camden Council's Unitary Development Plan.

## 2. BASELINE SITUATION

2.1 The Application Site (the "site") is situated at 1-11 Hawley Crescent, London, NW1 8NP. The site location plan is shown in Diagram 1. The roof area of the site and its proximity to adjacent buildings can be seen in Figures 1 to 10.

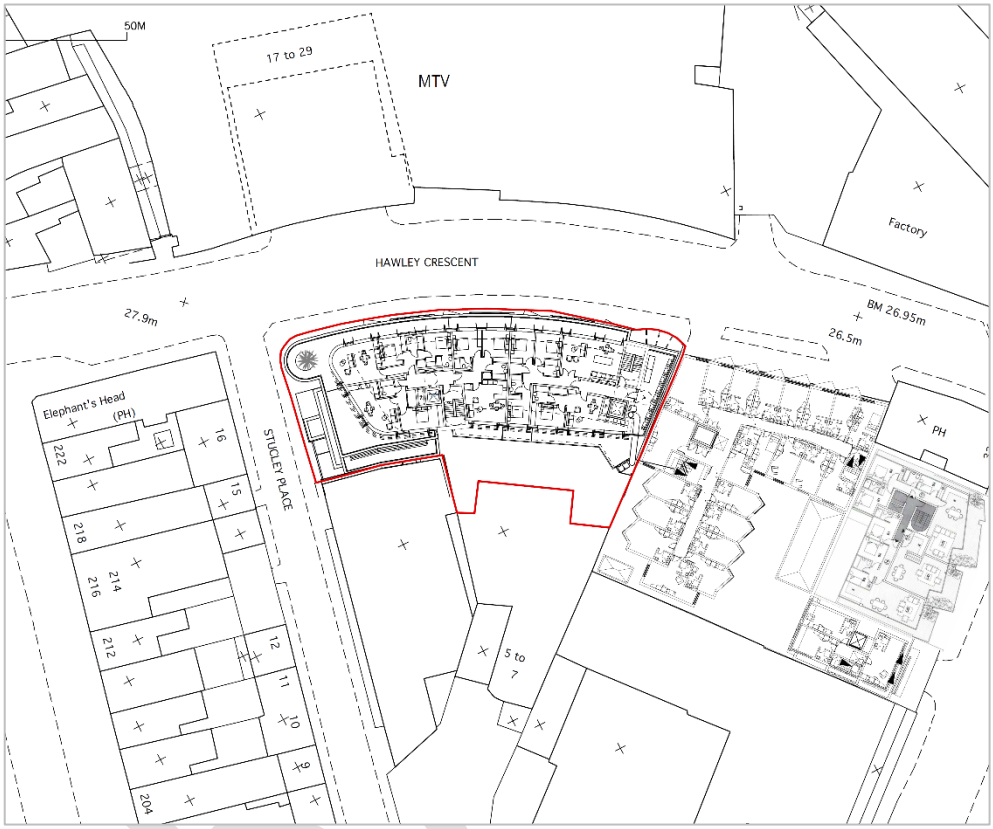



Diagram 1 – Site location plan

2.2 The site consists of an existing building arranged over basement, ground and four upper storeys. The basement, ground, 1st and 2nd floor levels are designated B1 use and are occupied by The Open University. The existing 3rd and 4th floors are designated C3 use and are arranged as 6no. self-contained dwellings.

2.3 The proposal is to demolish the existing 3rd and 4th floors to allow the creation of an additional storey to create 3No. storeys of C3 residential use. The 3rd, 4th and 5th floors would be arranged as follows:

*(a) 3rd floor – 7no. flats*

*(b) 4th floor – 5no. flats*

*(c) 5th floor – 3no. flats*

2.4 As part of the redevelopment of the site, proposed residential flats will benefit from a mechanical climate control system. This will require the installation of external heat pumps and an air condenser unit. The mechanical plant will be located on an area of flat roof at 4th floor level. The units will be enclosed with louvred screening around the roof perimeter and therefore will not be visible from outside the curtilage of the property.

2.5 A plan showing the proposed plant area is shown in Diagrams 2 and 3 below:

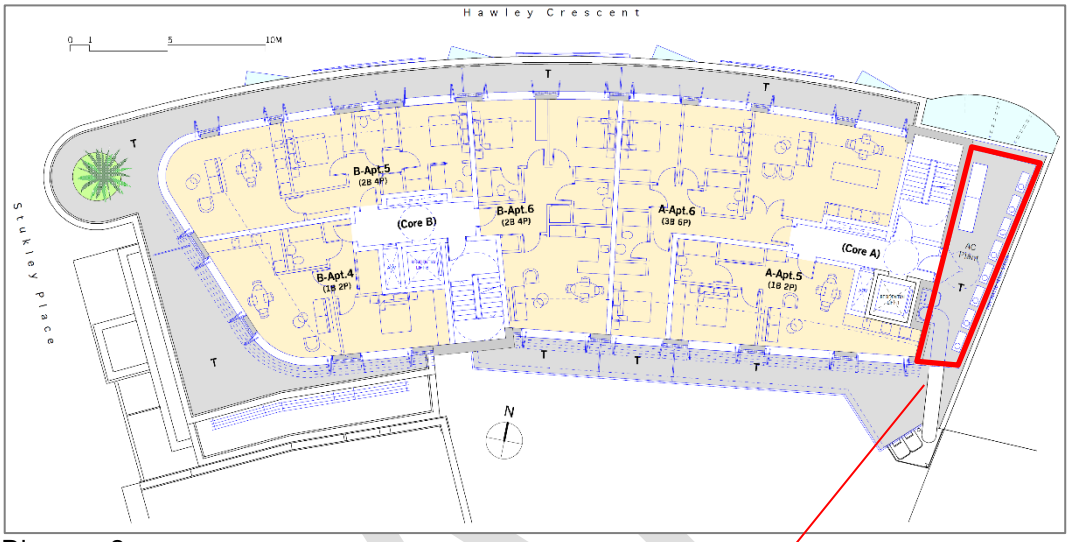



Diagram 2

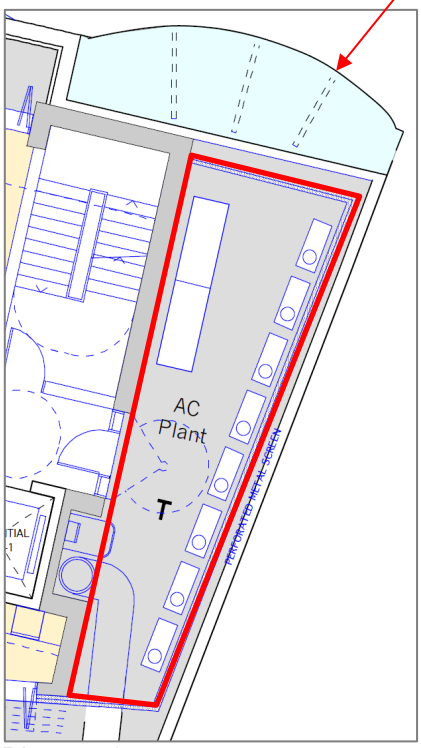



Diagram 3

2.6 In order to demonstrate compliance with Local Authority planning requirements, the following noise impacts have been considered:

*(a) Noise impact from traffic noise to the front of the property;*

*(b) Noise impact from proposed mechanical plant noise related to the property.*

2.7 The specified heat pumps and condenser unit are detailed as follows:

- *10no. Mitsubishi PUHZ-HW140*
- *1No. Mitsubishi PURY-EP900YSLM*

2.8 The nearest noise sensitive façade to the plant enclosure belongs to the rear 4th and 5th floor windows of 13 Hawley Crescent, a development of student accommodation arranged as studios.

## 3. NOISE OUTLINE

3.1 In order to produce an environmental noise assessment, consideration must be given to the prevailing background noise.

3.2 Measurements of background noise were obtained over a 24 hour period at the following locations:

*(a) 4th floor roof level (front of building) - deemed to be representative of highest noise exposure to background noise levels at the front of the proposed development;*

*(b) 4th floor roof level (rear of building) – deemed to be representative of the lowest background noise levels at the nearest noise sensitive façade to the proposed location of plant.*

3.3 The particulars of the measurement exercise are recorded below. The weather conditions were considered appropriate to monitor environmental noise.

Date: 21st – 22nd July 2016
Start Time: 13:45 hrs
Location: roof level, 1-11 Hawley Crescent

Weather conditions

| Date | Wind speed | Precipitation | Temp |
|---|---|---|---|
| 21/07/16 | 11 km/h | 0mm | 20 ºC |
| 22/07/16 | 7 km/h | 0.6mm | 20 ºC |

3.4 Minimum background and average noise levels are shown in Tables 1 and 2 below:

| Time period | Lowest $L_{A90,15min}$ | Average $L_{Aeq,T}$ |
|---|---|---|
| 07:00-19:00hrs | 48 | 59 |
| 19:00-23:00hrs | 49 | 57 |
| 23:00-07:00hrs | 42 | 53 |

Table 1 – Front of site

| Time period | Lowest $L_{A90,15min}$ | Average $L_{Aeq,T}$ |
|---|---|---|
| 07:00-19:00hrs | 49 | 58 |
| 19:00-23:00hrs | 49 | 55 |
| 23:00-07:00hrs | 42 | 53 |

Table 2 – Rear of site

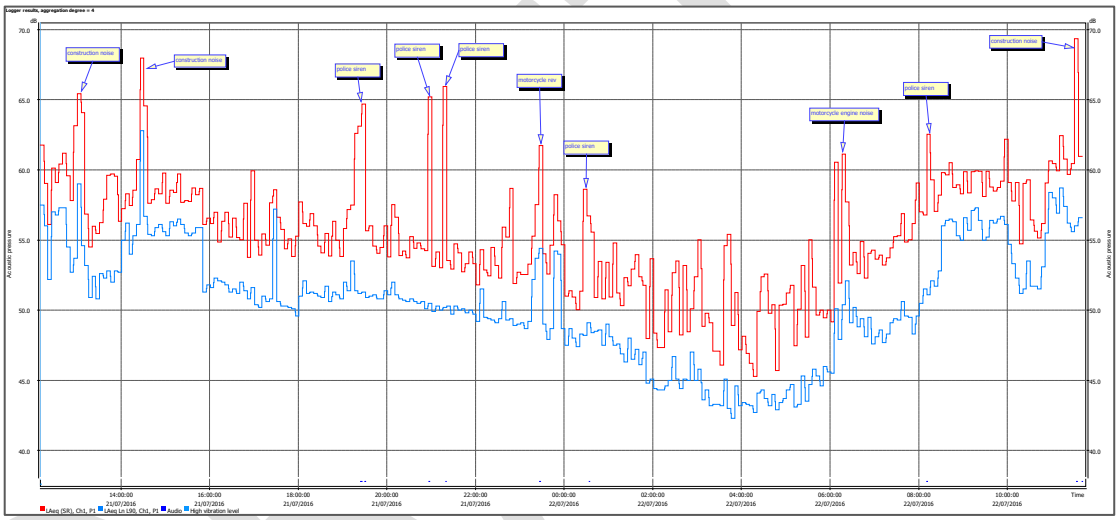



Diagram 4 – Level vs time (front of site)

## 4. EQUIPMENT

4.1 All background noise measurements were obtained using the following equipment:

- Svantek Svan 971 Class 1 Serial No. 51704
- Svantek Svan 958 Class 1 Serial No. 45530
- Rion Calibrator Type NC-74 Class 1 Serial No. 00410215

4.2 The relevant equipment carries full and current traceable calibration. The equipment, where necessary, was calibrated prior to and after the measurements were carried out.

# 5. DESIGN CRITERIA

5.1 With regard to determining appropriate design criteria in terms of noise, consideration was given to the LPA (London Borough of Camden) Local Development Framework 2010-2025 Section DP28 Noise and Vibration. It states:

*"The Council will only grant planning permission for development sensitive to noise in locations that experience noise pollution, and for development likely to generate noise pollution, if appropriate attenuation measures are taken, such as double-glazing. Planning permission will not be granted for development sensitive to noise in locations that have unacceptable levels of noise. Where uses sensitive to noise are proposed close to an existing source of noise or when development that generates noise is proposed, the Council will require an acoustic report to ensure compliance with PPG24: Planning and noise. A condition will be imposed to require that the plant and equipment which may be a source of noise pollution is kept working efficiently and within the required noise limits and time restrictions. Conditions may also be imposed to ensure that attenuation measures are kept in place and effective throughout the life of the development.*

*In assessing applications, we will have regard to the Noise and Vibration Thresholds, set out below. These represent an interpretation of the standards in PPG24 and include an evening period in addition to the day and night standards contained in the PPG, which provide a greater degree of control over noise and vibration during a period when noise is often an issue in the borough."*

**Table A: Noise levels on residential sites adjoining railways and roads at which planning permission will not be granted**

| Noise description and location of measurement | Period | Time | Sites adjoining roads |
|---|---|---|---|
| Noise at 1m external to a sensitive façade | Day | 0700-1900 | 72dB $L_{Aeq, 12h}$ |
| Noise at 1m external to a sensitive façade | Evening | 1900-2300 | 72dB $L_{Aeq, 4h}$ |
| Noise at 1m external to a sensitive façade | Night | 2300-0700 | 66dB $L_{Aeq, 8h}$ |

Table 3

**Table B: Noise levels on residential streets adjoining railways and roads at and above which attenuation measures will be required**

| Noise description and location of measurement | Period | Time | Sites adjoining roads |
|---|---|---|---|
| Noise at 1m external to a sensitive façade | Day | 0700-1900 | 62dB $L_{Aeq, 12h}$ |
| Noise at 1m external to a sensitive façade | Evening | 1900-2300 | 57dB $L_{Aeq, 4h}$ |
| Noise at 1m external to a sensitive façade | Night | 2300-0700 | 52dB $L_{Aeq, 8h}$ |
| Individual noise events several times an hour | Night | 2300-0700 | >82dB $L_{Amax}$ (S time weighting) |

Table 4

5.1 The notes contained within the LDF cite PPG24. Planning Policy Guidance Note 24 'Planning and Noise' (PPG24 – now withdrawn) was the main guidance document with regards acceptable noise levels for dwellings. That guidance was augmented by the internal noise level guidance contained within BS8233. Therefore consideration was also given to BS8233:2014.

| Activity | Location | 07:00 to 23:00 | 23:00 to 07:00 |
|---|---|---|---|
| Resting | Living room | 35 dB $L_{Aeq,1hour}$ | - |
| Dining | Dining room / area | 40 dB $L_{Aeq,1hour}$ | - |
| Sleeping (daytime resting) | Bedroom | 35 dB $L_{Aeq,1hour}$ | 30 dB $L_{Aeq,1hour}$ |

Table 5

5.2 The British Standard goes on to state in Note 4:

*Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values.*

5.3 In determining the appropriate $L_{Amax}$ value to use, consideration was given to The World Health Organisation's Guidelines for Community Noise which suggests that:

*"For a good sleep, it is believed that indoor sound pressure levels should not exceed approximately 45 dB $L_{Amax}$ more than 10–15 times per night".*

5.4 For the purposes of this assessment the 10$^{th}$ highest $L_{Amax}$ event has been considered. This procedure excludes atypical events. Such events were identified using the triggered audio recordings obtained on site. The events are labelled in Diagram 4. This accepts that the 45dB criteria will be exceeded no more than 10 times per night, this being the lowest point of the 10-15 range suggested by WHO.

5.5 Information regarding the noise levels not to be exceeded by the proposed installation of mechanical plant was extracted from the LPA (London Borough of Camden) Local Development Framework 2010-2025 Section DP28 Noise and Vibration:

**Table E: Noise levels from plant and machinery at which planning permission will not be granted**

| Noise description and location of measurement | Period | Time | Noise level |
|---|---|---|---|
| Noise at 1m external to a sensitive façade | Day, evening and night | 0000-2400 | 5dB(A)<LA90 |
| Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1m external to a sensitive façade | Day, evening and night | 0000-2400 | 10dB(A)<LA90 |
| Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1m external to a sensitive façade | Day, evening and night | 0000-2400 | 10dB(A)<LA90 |
| Noise at 1m external to a sensitive façade where LA90>60dB | Day, evening and night | 0000-2400 | 55dB(A) $L_{Aeq}$ |

Table 6

5.6 It is not expected that the proposed plant will generate distinguishable discrete continuous notes. The octave band data sheet shows no such characteristic. As the proposed plant will be utilised for residential use, the anticipated operational hours are at any time. The plant noise emission criteria that should not be exceeded is therefore based on 5dB(A)<LA90 and is shown in Table 7.

| Daytime (07:00-19:00hrs) | Evening (19:00-23:00hrs) | Night (23:00-07:00hrs) |
|---|---|---|
| $L_{Aeq}$ 44dB | $L_{Aeq}$ 44dB | $L_{Aeq}$ 37dB |

Table 7

# 6. EXTERNAL NOISE ASSESSMENT

6.1 Given the 24 hour monitoring positions and measurements obtained, it is possible to calculate $L_{Aeq,\ T}$ values experienced during the day, evening and night time periods. Camden Council makes specific reference to the following time periods:

*(a) 07:00 hrs to 19:00 hrs*
*(b) 19:00 hrs to 23:00 hrs*
*(c) 23:00 hrs to 07:00 hrs*

6.2 In accordance with these time periods, the data collected during the measurement exercise was averaged on an energy basis.

| Location | $L_{Aeq,\ 12hr}$ 0700-1900hrs | $L_{Aeq,\ 4hr}$ 1900-2300hrs | $L_{Aeq,\ 8hr}$ 2300-0700hrs | $L_{Amax,\ 8hr}$ 2300-0700hrs |
|---|---|---|---|---|
| Front façade | 59 | 57 | 53 | 71 |

Table 8

6.3 The measured level for the daytime is below which Camden Council would require attenuation measures. The measured level for the evening period is at the same level at which Camden Council would require attenuation measures. The measured level for the night time period is 1dB above the level at which Camden Council would require attenuation measures.

6.4 Minimal attenuation measures should ensure that internal noise levels meet the requirements of BS8233:2014.

6.5 To reduce evening and night time noise exposure in the proposed dwellings, attention should be given to the sound insulation of the façade of the building. The windows will normally be the weakest part of any façade.

6.6 It is understood that as whole house ventilation systems will be provided, there is no specific requirement to provide additional background trickle ventilation. It is anticipated that the external building envelope construction will have an insulation value of around 50-55dB $R_w$.

6.7 For the purposes of the current review and to demonstrate to planning that external noise egress may be adequately attenuated, the sound insulation of the glazing has been specified in accordance with BS8233:2014 G.1. A more thorough study will be carried out during detailed design phase once the apartment room layouts/glazing sizes etc. have been fully determined.

6.8 From the measured external noise levels, it is possible to predict the internal noise levels within habitable rooms.

6.9 Due to the varying methods of quantifying the sound insulation performance of building elements, the following parameters are described:

- $R_w$ Weighted Sound Reduction Index: Single figure sound insulation value derived from the measured sound reduction index R.

- $C_{tr}$ Spectrum adaptation term: The correction to a sound insulation quantity (such as $D_{nT,w}$ ) to take account of a specific sound spectra. See BS EN ISO 717 – 1: 1997 – Noise spectrum No. 2 - noise from traffic, aircraft, factories, railways and disco's

6.10 The façade specification required in order to achieve the internal noise levels as set out in the requirements are as shown in Table 9.

| Room type | Required Insulation ($R_w+C_{tr}$) |
|---|---|
| | All other façades |
| Living room (day) | 24 |
| Bedroom (night based on $L_{Aeq}$) | 23 |
| Bedroom (night based on $L_{Amax}$) | 26 |

Table 9

6.11 The required window performances can be readily achieved using the following glazing configurations:

| Required glazing performance | Glazing configuration (example) |
|---|---|
| All façades<br>30dB $R_w+C_{tr}$ | 6mm float glass<br>6-24mm cavity<br>4mm float glass<br>(Guardian Glass or similar approved)<br>**See Appendix A** |

Table 10

# 7. PLANT NOISE ASSESSMENT

7.1 In order to predict the noise impact of the heat pumps and condenser unit, consideration has been given to noise egress from the equipment to the nearest noise sensitive façade. The equipment will be utilised by the residential flats and therefore will operate as demand dictates.

7.2 In determining a rating level, corrections to account for tonality and impulsivity must be added to the specific noise level of the unit. The octave band sound levels of the units (see Appendix B) do not indicate any tonal component. As the units are inverter driven, the units should not exhibit a marked onset of noise when the units turn on. Therefore, it is considered that no corrections are necessary for tonality or impulsivity.

7.3 Attenuation to account for distance propagation has been accounted for, along with the sound reduction of an acoustic louvred screen that will surround the units. Distances were obtained from scaled drawings.

7.4 According to the Department of Energy and Climate Change Planning Standard MCS020 (Note 5):

*"Note 5: Barriers between the heat pump and the assessment position (STEP 5)*
*A correction should be made for attenuation due to barriers between the air source heat pump and an assessment position. A correction will be necessary if an installer is unable to see an assessment position from the top edge of the air source heat pump. Use the following instructions to determine whether a correction is appropriate:*

*For a solid barrier (e.g. a brick wall or a fence) that completely obscures an installer's vision of an assessment position from the top edge of the air source heat pump attenuation of -10 dB may be assumed.*
*Where a solid barrier completely obscures an installer's vision of an assessment position from the top or side edges of the air source heat pump, but moving a maximum distance of 25 cm in any direction to the air source heat pump allows an assessment position to be seen, attenuation of -5 dB may be assumed.*
*If it is possible for an installer to see any part of an assessment position from the top or side edges of the air source heat pump no attenuation may be assumed."*

7.5 The manufacturers noise levels of the heat pumps and condenser unit are reproduced in table 11 below.

| **Equipment noise level** | Octave Band Centre Frequency (Hz) | | | | | | | | dBA |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| PUHZ-HW140 (standard) | 60 | 55 | 53 | 51 | 47 | 43 | 37 | 30 | 53 |
| PUHZ-HW140 (low noise) | 53 | 48 | 46 | 44 | 40 | 36 | 30 | 23 | 46 |
| PURY-EP900 (standard) | 76 | 72 | 68 | 64 | 59 | 54 | 50 | 44 | 66 |
| PURY-EP900 (low noise) | 68 | 64 | 55 | 53 | 50 | 47 | 42 | 43 | 56 |

Table 11

7.6 The assessment is shown in Table 12 (standard mode) and Table 13 (low noise mode) below. For the purposes of this assessment it has been assumed that the position of the condenser units on the flat roof would cause the units to be approximately 3dB higher than the manufacturers data sheet due to local acoustic reflections. It has also been assumed that all the equipment would be operational simultaneously. A further reduction of 10dB to account for building edge diffraction caused by the perimeter screening has been included.

| Condenser noise impact (standard mode) | Octave Band Centre Frequency (Hz) | | | | | | | | dBA |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| PUHZ-HW140 | 60 | 55 | 53 | 51 | 47 | 43 | 37 | 30 | 53 |
| Unit 1 @ 6.4m | 37 | 32 | 30 | 28 | 24 | 20 | 14 | 7 | 29 |
| Unit 2 @ 7.6m | 35 | 30 | 28 | 26 | 22 | 18 | 12 | 5 | 28 |
| Unit 3 @ 8.9m | 34 | 29 | 27 | 25 | 21 | 17 | 11 | 4 | 27 |
| Unit 4 @ 10m | 33 | 28 | 26 | 24 | 20 | 16 | 10 | 3 | 26 |
| Unit 5 @ 11.3m | 32 | 27 | 25 | 23 | 19 | 15 | 9 | 2 | 25 |
| Unit 6 @ 12.6m | 31 | 26 | 24 | 22 | 18 | 14 | 8 | 1 | 24 |
| Unit 7 @ 13.9m | 30 | 25 | 23 | 21 | 17 | 13 | 7 | 0 | 23 |
| Unit 8 @ 14.2m | 30 | 25 | 23 | 21 | 17 | 13 | 7 | 0 | 23 |
| Unit 9 @ 15.4m | 29 | 24 | 22 | 20 | 16 | 12 | 6 | -1 | 22 |
| Unit 10 @ 15.6m | 29 | 24 | 22 | 20 | 16 | 12 | 6 | -1 | 22 |
| Combined heat pumps | 43 | 38 | 36 | 34 | 30 | 26 | 20 | 13 | 35 |
| PURY-EP900YSLM | 76 | 72 | 68 | 64 | 59 | 54 | 50 | 44 | 66 |
| Unit 1 @ 14m | 46 | 42 | 38 | 34 | 29 | 24 | 20 | 14 | 36 |
| **TOTAL All units** | **47** | **43** | **40** | **37** | **32** | **28** | **23** | **17** | **39** |

Table 12

| Condenser noise impact (low noise mode) | Octave Band Centre Frequency (Hz) | | | | | | | | dBA |
|---|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | |
| PUHZ-HW140 | 53 | 48 | 46 | 44 | 40 | 36 | 30 | 23 | 46 |
| Unit 1 @ 6.4m | 30 | 25 | 23 | 21 | 17 | 13 | 7 | 0 | 22 |
| Unit 2 @ 7.6m | 28 | 23 | 21 | 19 | 15 | 11 | 5 | -2 | 21 |
| Unit 3 @ 8.9m | 27 | 22 | 20 | 18 | 14 | 10 | 4 | -3 | 20 |
| Unit 4 @ 10m | 26 | 21 | 19 | 17 | 13 | 9 | 3 | -4 | 19 |
| Unit 5 @ 11.3m | 25 | 20 | 18 | 16 | 12 | 8 | 2 | -5 | 18 |
| Unit 6 @ 12.6m | 24 | 19 | 17 | 15 | 11 | 7 | 1 | -6 | 17 |
| Unit 7 @ 13.9m | 23 | 18 | 16 | 14 | 10 | 6 | 0 | -7 | 16 |
| Unit 8 @ 14.2m | 23 | 18 | 16 | 14 | 10 | 6 | 0 | -7 | 16 |
| Unit 9 @ 15.4m | 22 | 17 | 15 | 13 | 9 | 5 | -1 | -8 | 15 |
| Unit 10 @ 15.6m | 22 | 17 | 15 | 13 | 9 | 5 | -1 | -8 | 15 |
| Combined heat pumps | 36 | 31 | 29 | 27 | 23 | 19 | 13 | 6 | 28 |
| PURY-EP900YSLM | 68 | 64 | 55 | 53 | 50 | 47 | 42 | 43 | 56 |
| Unit 1 @ 14m | 38 | 34 | 25 | 23 | 20 | 17 | 12 | 13 | 26 |
| **TOTAL All units** | **40** | **36** | **30** | **28** | **25** | **21** | **15** | **13** | **30** |

Table 13

7.7 The calculated noise impact is 39dBA in standard mode and 30dBA in low noise mode.

# 8. CONCLUSION

8.1 With regard to internal noise levels from traffic noise, the use of proprietary glazing systems will reduce internal noise levels down to a level that meets with the requirements of Camden Council's Local Development Framework and BS8233:2014.

8.2 Average day time noise levels were below a level where Camden Council requires an attenuation strategy. Evening and night time levels fell marginally short of this requirement and hence an attenuation strategy has been provided. This utilises moderate double glazed panels as specified.

8.3 It is recommended that consideration is given to the loss of performance due to workmanship and glazing with an improved laboratory performance of 5dB over and above that required may be more appropriate.

8.4 Utilising the recommended glazing strategy would reduce internal noise levels to 30dB $L_{Aeq,8hr}$ for bedrooms and 35dB $L_{Aeq,16hr}$ for living rooms.

8.5 The foregoing assessment indicates that the proposed installation of mechanical plant can meet the requirements imposed by the LPA. Additional mitigation measures will not be required. Lest there be any misunderstanding, the mitigation measures included in this report are as follows:

*(a) Acoustic louvred or solid screening around perimeter of plant area to a nominal height of 2m.*

8.6 In order to meet the LPA requirements, the units should be used in standard mode during the day and evening period but should be set to operate in low noise mode during the night time period.

8.7 If an alternative supplier or manufacturer of equipment is chosen, the acoustic performance should be checked prior to installation to ensure that the installation will still meet the requirements imposed by the LPA.

# Figures

**Proposed development of residential units, 1-11 Hawley Crescent, London**


Figure 1


Figure 2


Figure 3


Figure 4


Figure 5


Figure 6


Figure 7


Figure 8

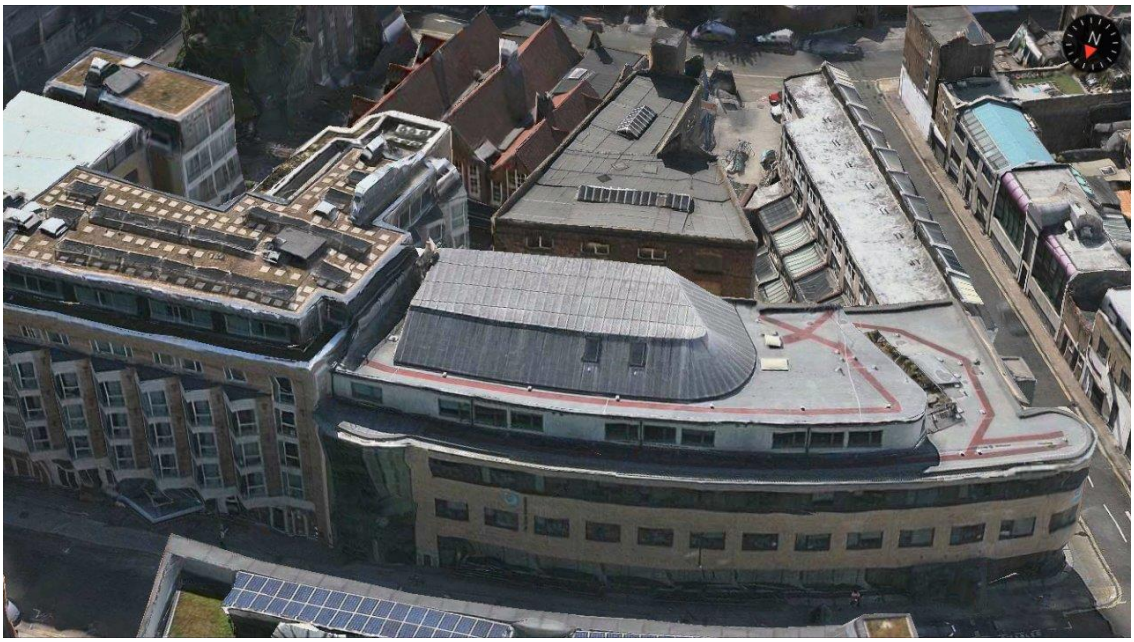


Figure 9

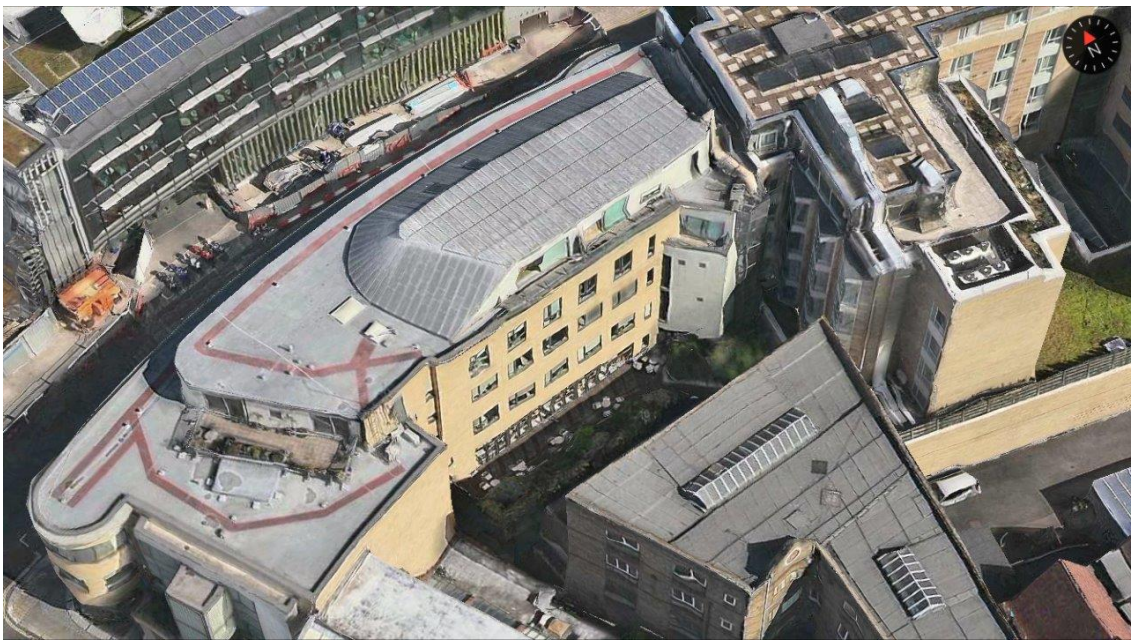


Figure 10

# Appendix A

GUARDIAN
Glass • Automotive • Building Products

# Acoustic Performance

# Guardian Float Glass

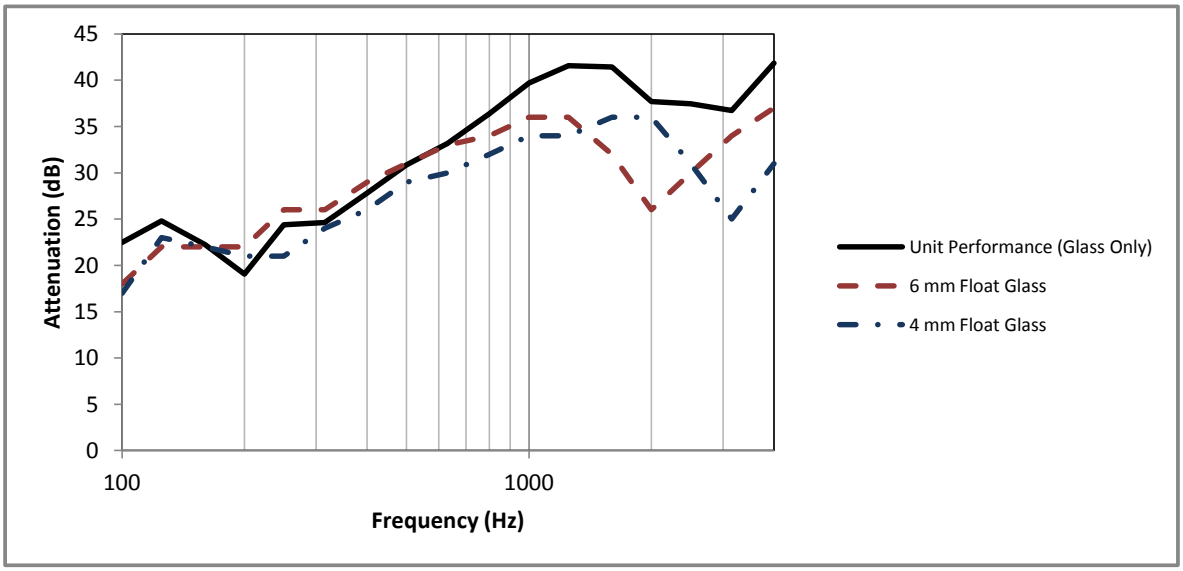
The acoustic performance data within this document is determined by calculation, based on factors derived from certified data. Due to inherent variations in acoustic performance when testing in accordance with EN ISO 140-3, some variation in the calculated performance can also be expected. As such, the weighted performance, Rw, and adaptation terms, C and Ctr, should typically be considered to be accurate within ±2 dB. However, wider deviations can occur.

**6 mm Float Glass**

**(6-24 mm Cavity)**

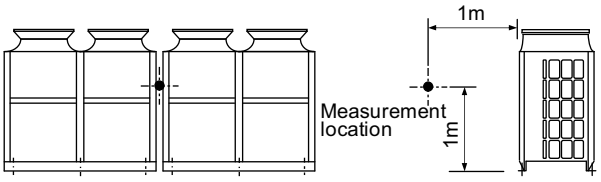
**4 mm Float Glass**

| Sound Reduction Indices - dB | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency - Hertz | | | | | | $R_w(C;C_{tr})$ | $R_w$ | $R_w + C$ | $R_w + C_{tr}$ |
| 125 | 250 | 500 | 1000 | 2000 | 4000 | | | | |
| **25** | **24** | **31** | **40** | **38** | **42** | **34(-1;-4)** | **34** | **33** | **30** |

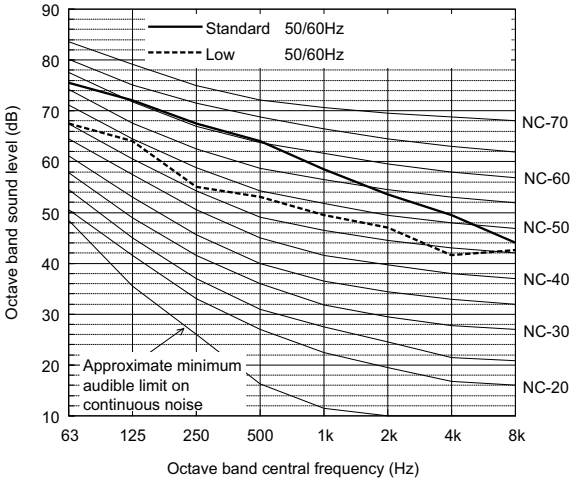


# Appendix B

**Measurement condition**
**PURY-EP800, 850, 900YSLM-A(-BS)**



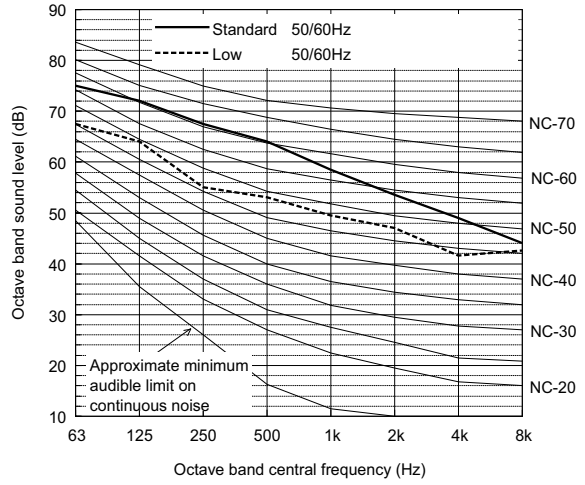

**Sound level of PURY-EP900YSLM-A(-BS)**




| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard | 50/60Hz | 75.5 | 72.0 | 67.5 | 64.0 | 58.5 | 53.5 | 49.5 | 44.0 | 65.5 |
| Low noise mode | 50/60Hz | 67.5 | 64.0 | 55.0 | 53.0 | 49.5 | 47.0 | 41.5 | 42.5 | 56.0 |

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

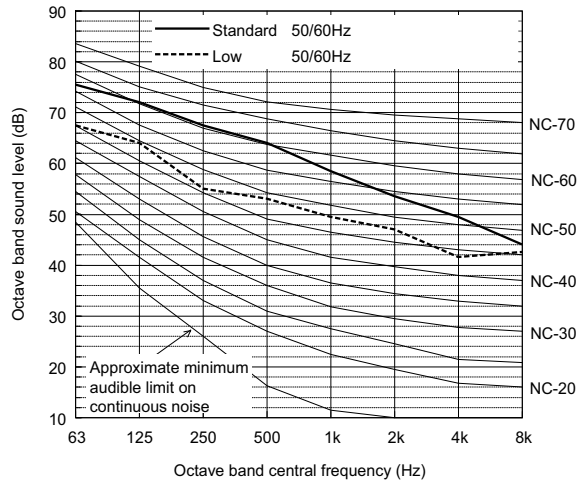
**Sound level of PURY-EP800YSLM-A(-BS)**




| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard | 50/60Hz | 75.0 | 72.0 | 67.5 | 64.0 | 58.5 | 53.5 | 49.0 | 44.0 | 65.5 |
| Low noise mode | 50/60Hz | 67.5 | 64.0 | 55.0 | 53.0 | 49.5 | 47.0 | 41.5 | 42.5 | 56.0 |

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

**Sound level of PURY-EP850YSLM-A(-BS)**



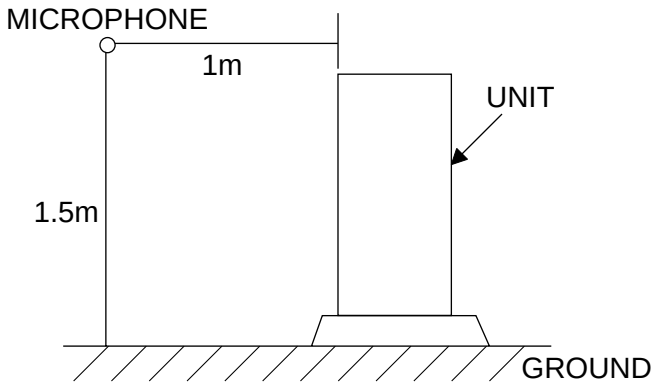

| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k | dB(A) |
|---|---|---|---|---|---|---|---|---|---|---|
| Standard | 50/60Hz | 75.5 | 72.0 | 67.5 | 64.0 | 58.5 | 53.5 | 49.5 | 44.0 | 65.5 |
| Low noise mode | 50/60Hz | 67.5 | 64.0 | 55.0 | 53.0 | 49.5 | 47.0 | 41.5 | 42.5 | 56.0 |

When Low noise mode is set,the A/C system's capacity is limited. The system could return to normal operation from Low noise mode automatically in the case that the operation condition is severe.

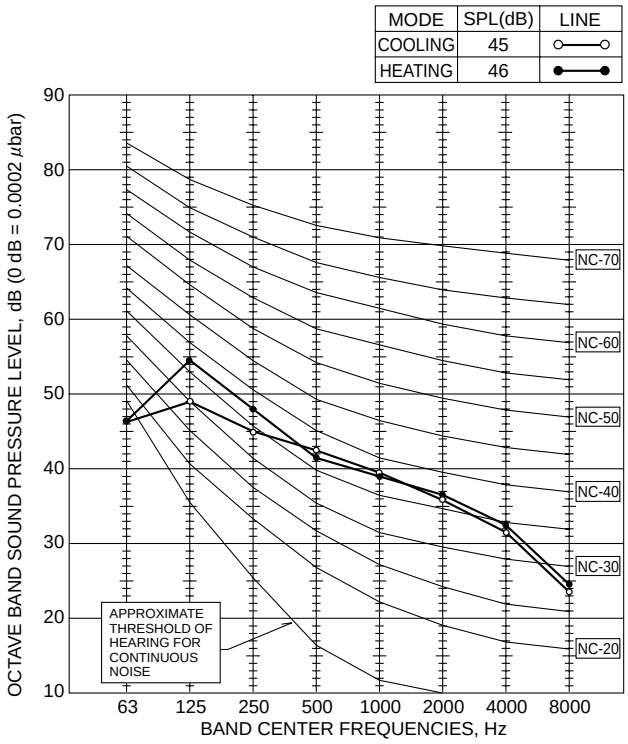
- Depending on the operation conditions, the unit generates noise caused by valve actuation, refrigerant flow, and pressure changes when operating normally. Please consider to avoid location where quietness is required.
  For BC controller, it is recommended to be installed in places such as ceilings of corridor, rest rooms and plant rooms.

# 4 DATA

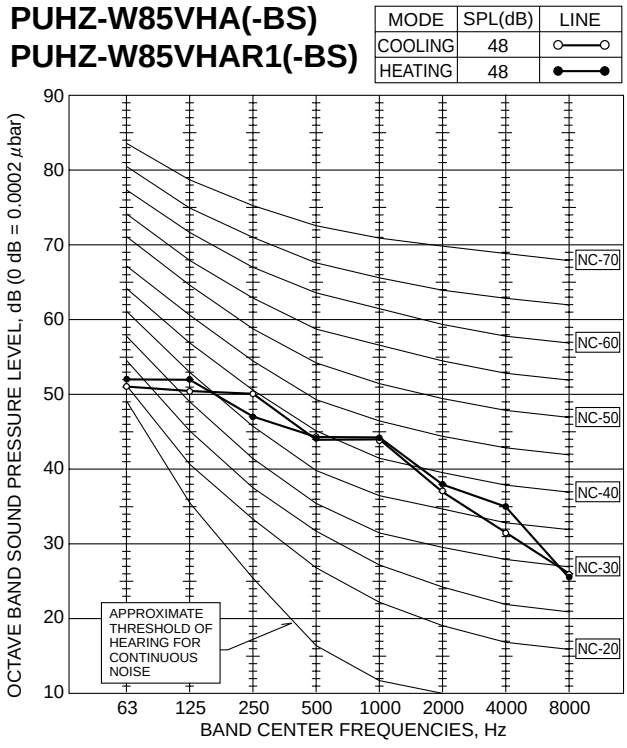
## 4-1. NOISE CRITERION CURVES




### PUHZ-W50VHA(-BS)




### PUHZ-W85VHA(-BS)
### PUHZ-W85VHAR1(-BS)




### PUHZ-HW112YHA(-BS)
### PUHZ-HW140VHA(-BS)
### PUHZ-HW140YHA(-BS)
### PUHZ-HW112YHA2(-BS)
### PUHZ-HW140VHA2(-BS)
### PUHZ-HW140YHA2(-BS)