ACAACOUSTICS

Acoustic Assessment of Mechanical Services Equipment at Hend House, 233 Shaftesbury Avenue, London, WC2H 8EE

Report Reference: 160608-002A

Date: July 2016

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Client:	FHP ESS 34-42 Woburn Place London WC1H 0JR
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0. SUMMARY

- ACA Acoustics Limited have been commissioned by the client to assess noise emissions from relocated external mechanical services equipment associated with a server room at Hend House, London.

- The assessment is required in order to provide evidence that noise emissions from the equipment will not be detrimental to the amenity of nearby residential properties and complies with the requirements of London Borough of Camden Council. London Borough of Camden Council's requirement, applicable at this site, is that noise from the equipment shall not exceed 10dB below the existing background LA90 outside nearby noise-sensitive properties.

- A survey has been carried out in the vicinity to establish existing background sound levels. Lowest background sound levels during the proposed operating times of the new equipment were measured at LAF90 48dB to outside the closest noise-sensitive properties. Based on results of the sound level survey and London Borough of Camden Council's requirement, the overall noise limit for the equipment to outside nearest noise-sensitive windows is set at ≤ 38dBA.

- Calculated sound levels from the proposed equipment to outside the nearest residential properties, including benefit of acoustic treatment detailed within this report, are LAeq 38dB and therefore achieve London Borough of Camden Council's requirements. Noise from the equipment should not be detrimental to the amenity of residential occupiers in the vicinity. The assessment includes benefit of noise control treatments as set out in this report.

- The mechanical equipment is to be indirectly structurally linked to adjoining non-associated properties and therefore it is recommended that the equipment is installed on high-performance vibration isolators. Details of suitable isolators are included in this report.

1. INTRODUCTION

Ventilation equipment serving server rooms has been re-located at Hend House, London to ensure adequate airflow around the units.

The Planning Department of London Borough of Camden Council requires information in the form of an acoustic report regarding noise from the equipment. The report is required to demonstrate that the equipment will comply with London Borough of Camden Council's acoustic requirements applicable for mechanical services equipment affecting nearby noise-sensitive properties.

ACA Acoustics Limited has been commissioned by the client to carry out an assessment of noise from the equipment and, where necessary, make recommendation to reduce noise and vibration levels to ensure that the amenity of the adjoining residential properties is not compromised.

This report presents results of the noise survey and assessment and includes:

- Review of London Borough of Camden Council's noise-related planning requirements;
- Measurement of existing background sound levels;
- Calculation of proposed equipment sound levels;
- Review of any noise/vibration control treatments necessary to the equipment to ensure compliance with the requirements of London Borough of Camden Council.

2. CAMDEN BOROUGH COUNCIL ACOUSTIC CRITERIA

London Borough of Camden Council's policies relating to noise from new mechanical services equipment are contained within the Council's Local Development Framework; Policy DP28.

In Summary, London Borough of Camden's noise-related conditions are:

Noise level from plant and machinery at which planning permission will not be granted:	
Noise at 1m external to a sensitive façade;	*5dBA < LA90*
Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1m external to a sensitive façade;	*10dBA < LA90*
Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1m external to a sensitive façade;	*10dBA < LA90*
Noise at 1m external to sensitive façade where LA90 > 60dB	*55dB LAeq*

Table 1: London Borough of Camden Council noise-related planning conditions

Each of the above is applicable over a period of 60 minutes and measured at 1m external to noise-sensitive facades.

The characteristic of noise from the condensing units would typically be described as being intermittent, with clicks as they power up and down. Therefore, to ensure that the assessment is robust and that the amenity of nearby occupiers is not detrimentally affected, the more onerous noise condition of 10dBA below the existing background noise is used for the assessment in this report.

3. REVIEW OF SITE LOCATION & DEVELOPMENT PROPOSALS

The new location for the condensing units is at a balcony at 1st floor level at Hend House, Shaftesbury Avenue, London. Hend House is a 5 storey property backing onto a light well and a church. The proposed development includes the relocation of three condensing units to a balcony at the rear façade within the light well.

Closest residential properties to the relocated equipment are considered by the author to be flats above Bloomsbury Central Baptist Church. These will be around 12m from the proposed equipment and windows overlook the light well and new condenser location.

Sound levels in the vicinity comprise mostly of traffic noise from Shaftesbury Avenue and the A400, though some screening is provided by buildings surrounding the light well to the residential windows causing low night-time background sound levels.

4. BACKGROUND SOUND LEVEL SURVEY

In order to assess noise from the mechanical services equipment it is necessary to establish representative background sound levels in the vicinity. Details of the background sound level survey carried out by ACA Acoustics Limited are provided in Sections 4.1 to 4.3 below.

4.1 Sound Level Survey Measurement and Assessment Procedure

The proposed equipment will operate over nominally a 24-hour period.

A 24-hour unattended background survey was carried out between 15th and 16th June 2016 at 3rd floor level from an open window overlooking the light well at Hend House. The position was deemed equivalent to 1m from the window of the residential property. The weather remained calm and dry over the duration of the survey.

4.2 Instrumentation

The following equipment was used during the sound level survey; the sound level meter was calibrated before the survey, and checked after, with no change noted:

Equipment	Serial Number
Rion sound level meter type NL31 Class 1	00773045
NTi Audio calibrator type CAL200 94/114dB. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	11441

Table 2: Equipment used

4.3 Sound Level Survey Measurement Results

The lowest measured background sound level during operating times of the equipment was LAF90 48dB. Full results are shown in graphical form in Figure 1 on the following page.

Summary of the survey results are provided in Table 3.

Description	Lowest measured LAF90
15th to 16th June 2016	48dBA

Table 3: Summary sound level survey results

The lowest measured background sound level during operating times of the equipment over the survey was LAF90 48dBA. Full results are shown in graphical form in Figure 1 below.

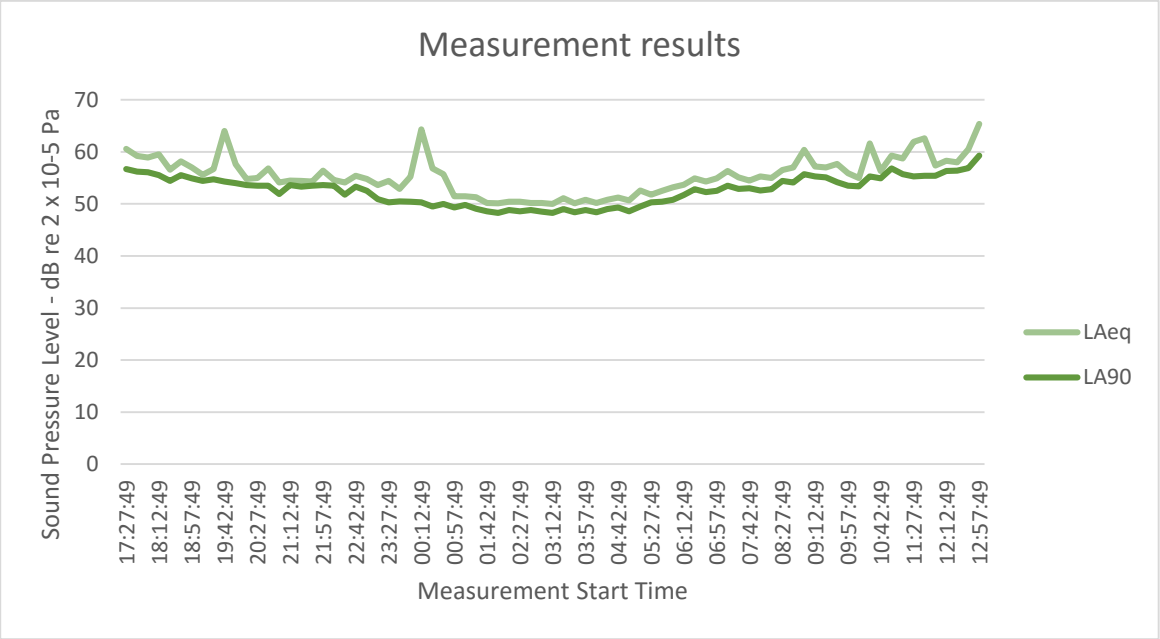

Figure 1: Sound level survey results

From the results shown in Figure 1 it can be seen the measured background sound level is fairly consistent. The values recorded by ACA Acoustics Limited are used as basis for acoustic design such that sound levels from the relocated equipment are ≤38dBA outside the closest noise sensitive residential windows.

5. SOUND LEVELS FROM NEW MECHANICAL SERVICES EQUIPMENT

The development includes the relocation of 3 condensers.

A computer model has been used to calculate the noise contribution from the equipment to outside nearest noise-sensitive windows. The model takes account of environmental corrections set out in ISO 9613-2:1996.

The cumulative calculated sound level from the proposed equipment, including benefit of acoustic treatment detailed within Section 7, to outside the noise sensitive residential window compared with the planning requirement is shown in Table 4. Summary print-outs from the calculation models are included in Appendix A.

Description	Calculated Equipment Sound Levels	London Borough of Camden Noise Limit
Closest residential property	38dBA	≤ 38dBA

Table 4: Calculated cumulative equipment sound levels at 1m outside noise-sensitive windows

Table 4 shows that the overall sound level from the equipment does not exceed a level 10dB below the lowest measured background sound level to outside the closest residential property. Resultant noise from the equipment will not be disturbing or detrimental to the amenity of nearby residential occupants. The calculation includes benefit of noise control treatments to the new equipment. Details of the noise control treatments are provided in Section 7 below.

6. VIBRATION FROM MECHANICAL EQUIPMENT

The condensers are not structurally connected to adjoining properties, however as is considered good practise to minimise noise to the client's premises, it is recommended that the equipment be installed on suitable vibration isolators.

To control the potential for vibration or vibration-induced noise transmitting to the premises, it is recommended that the condensers are installed on rubber or neoprene turret type mounts or pads providing a deflection of not less than 6mm at the working load.

The rubber turret type vibration isolators proposed are readily available from most acoustic hardware suppliers, including Allaway Acoustics Limited (Contact Chris Williams – Tel: 01992 550825).

7. RECOMMENDATIONS FOR NOISE CONTROL TREATMENTS

Note that consideration of non-acoustic aspects such as structural, visual, airflow and construction material are outside the scope of ACA Acoustics Limited and should be considered by others accordingly.

Alternative methods of attenuation to those detailed below may be acceptable, for example relocation of noisy equipment to other, less sensitive, areas of the development. Full details of any alternative scheme, including working drawings and expected attenuation should be submitted and approved prior to manufacture.

7.1 Acoustic Louvered Enclosure

It is advised that the condensers are installed within an acoustic louvred enclosure. A single enclosure may be installed to all condensers, with all sides requiring acoustic treatment. A suitable louvred enclosure would typically be formed from 300mm deep acoustic louvres such as Allaway Acoustics Limited's type AL3015 or equivalent. Minimum insertion loss performance for the louvres is shown on the schedule in Appendix B.

Structural supports/steelwork and access panels or doors for the proposed enclosures may be required and should be determined by the successful supplier accordingly.

APPENDIX A

Acoustic Calculations

APPENDIX B

Acoustic Mitigation Schedule

Calculation Sheet

Condenser 1 to Nearest residential reciever

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - Condenser 1										
Sound Power Levels		**75.0**	**78.0**	**73.0**	**70.0**	**68.0**	**64.0**	**57.0**	**53.0**	
Noise Control Treatments										
Treatment - Acoustic Louvred Enclosure										
Attenuated Lw		**70.0**	**72.0**	**65.0**	**59.0**	**50.0**	**39.0**	**37.0**	**37.0**	**Row A**
ISO 9613 Calculation										
Horiz. Distance (m)	5.0									
Source Height (m)	3.0									
Receiver Height (m)	15.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Q Factor - Junction										
Direct Lp		**45.7**	**47.7**	**40.7**	**34.7**	**25.7**	**14.6**	**12.3**	**11.2**	
ISO 9613 Calculation - Reflections										
Type of Reflecting Surface - Walls with windows, recesses or bays										
Q Factor - Plane										
Source Height (m)	3.0									
Reflecting Height (m)	6.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Reflected Lp		**27.3**	**29.3**	**22.2**	**16.2**	**7.2**	**-3.9**	**-6.1**	**-7.1**	
Cumulative Lp at Receiver										
External Receiver										
External Receiver - Nearest residential reciever										
Sound Pressure, Lp:		**45.8**	**47.8**	**40.8**	**34.8**	**25.7**	**14.7**	**12.4**	**11.3**	

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Calculation Sheet

Condenser 2 to Nearest residential reciever

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - Condenser 2										
Sound Power Levels		**67.0**	**69.0**	**64.0**	**65.0**	**60.0**	**53.0**	**51.0**	**40.0**	
Noise Control Treatments										
Treatment - Acoustic Louvred Enclosure										
Attenuated Lw		**62.0**	**63.0**	**56.0**	**54.0**	**42.0**	**28.0**	**31.0**	**24.0**	**Row A**
ISO 9613 Calculation										
Horiz. Distance (m)	5.0									
Source Height (m)	3.0									
Receiver Height (m)	15.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Q Factor - Junction										
Direct Lp		**37.7**	**38.7**	**31.7**	**29.7**	**17.7**	**3.6**	**6.3**	**-1.8**	
ISO 9613 Calculation - Reflections										
Type of Reflecting Surface - Walls with windows, recesses or bays Q Factor - Plane										
Source Height (m)	3.0									
Reflecting Height (m)	6.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Reflected Lp		**19.3**	**20.3**	**13.2**	**11.2**	**-0.8**	**-14.9**	**-12.1**	**-20.1**	
Cumulative Lp at Receiver										
External Receiver										
External Receiver - Nearest residential reciever										
Sound Pressure, Lp:		**37.8**	**38.8**	**31.8**	**29.8**	**17.7**	**3.7**	**6.4**	**-1.7**	

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Calculation Sheet

Condenser 2 to Nearest residential reciever

		Octave Band Centre Frequency (Hz)								
		63	125	250	500	1k	2k	4k	8k	
Noise Source										
Noise Source - Condenser 2										
Sound Power Levels		**67.0**	**69.0**	**64.0**	**65.0**	**60.0**	**53.0**	**51.0**	**40.0**	
Noise Control Treatments										
Treatment - Acoustic Louvred Enclosure										
Attenuated Lw		**62.0**	**63.0**	**56.0**	**54.0**	**42.0**	**28.0**	**31.0**	**24.0**	**Row A**
ISO 9613 Calculation										
Horiz. Distance (m)	5.0									
Source Height (m)	3.0									
Receiver Height (m)	15.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Q Factor - Junction										
Direct Lp		**37.7**	**38.7**	**31.7**	**29.7**	**17.7**	**3.6**	**6.3**	**-1.8**	
ISO 9613 Calculation - Reflections										
Type of Reflecting Surface - Walls with windows, recesses or bays Q Factor - Plane										
Source Height (m)	3.0									
Reflecting Height (m)	6.0									
Barrier - No Barrier										
Distance to Barrier (m)	-									
Barrier Height (m)	-									
Screening at (m)	-									
Reflected Lp		**19.3**	**20.3**	**13.2**	**11.2**	**-0.8**	**-14.9**	**-12.1**	**-20.1**	
Cumulative Lp at Receiver										
External Receiver										
External Receiver - Nearest residential reciever										
Sound Pressure, Lp:		**37.8**	**38.8**	**31.8**	**29.8**	**17.7**	**3.7**	**6.4**	**-1.7**	

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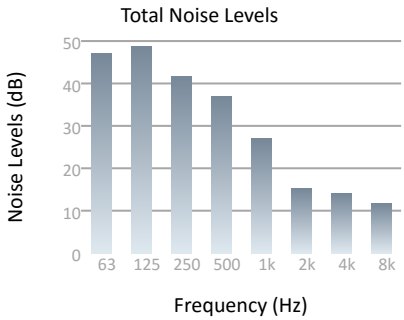
Project Name	Hend House, Shaftesbury Avenue
Project Reference	160608
Reference	Nearest residential reciever
Description	
Noise Limit	38
dBA	38.4



Noise Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
Condenser 1	1	45.8	47.8	40.8	34.8	25.7	14.7	12.4	11.3
Condenser 2	1	37.8	38.8	31.8	29.8	17.7	3.7	6.4	-1.7
Condenser 2	1	37.8	38.8	31.8	29.8	17.7	3.7	6.4	-1.7

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Schedule of Noise Control Treatments

Reference	Description	Location	Pressure Drop (Pa)	Insertion Losses (dB)							
				63	125	250	500	1k	2k	4k	8k
Acoustic Louvred Enclosure	AL3015			5	6	8	11	18	25	20	16

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