SANDY BROWN

Consultants in Acoustics, Noise & Vibration

Memo:	M005-A	**Date:**	17 May 2023
Project:	21140	**Pages:**	13
From:	William Champ	**Reviewer:**	Bob Albon

The Apex Building

Roof plant noise egress reassessment- Stage 5

This memo reviews the Stage 5 proposals for the rooftop building services at the Apex Building and provides guidance on mitigation measures to achieve the local authority requirements for external building services noise.

The assessment has been done for the combined landlord and tenant plant use, to consider a worst-case scenario.

Local authority requirements

Planning permission has been granted on the condition that the cumulative sound levels from external building services and fixed plant serving all plots on the master plan are 10 dB or more below the lowest background sound level (15 dB if tonal components are present) at the nearest noise sensitive receptors at any time in accordance with Policy A4 of the Camden Local Plan 2017.

Plant noise limits

The cumulative facade noise level resulting from the operation of all Plot A new plant at 1 m from the worst affected windows of the nearest noise sensitive premises shall not exceed the limits set out in Table 1.

Table 1 Plant noise limits at 1 m from the nearest noise sensitive premises

Time of day	Maximum sound pressure level at 1 m from noise sensitive premises ($L_{Aeq,15min}$ dB)	
	Receptors on St Pancras Way	Receptors across Regents Canal
Daytime (07:00-23:00)	39	35
Night-time (23:00-07:00)	37	33

The limits set out in Table 1 do not include any attention catching features. The limits for noise with attention catching characteristics are 5 dB lower than those given in Table 1.

Noise sensitive receptors

The nearest noise sensitive premises are identified as Unite Students, a student residential hall on Beaumont Court, located to the west of the proposed development on the opposite side of St. Pancras Way, and several two-story residential dwellings to the east of the proposed development on the opposite side of Regents Canal.

Rooftop building services

Rooftop noise egress from the operation of building service plant has been assessed based on the information provided by the building services contractor, Priority Engineering. The information provided includes updated plant selections, an updated basement level and roof level plant layout, and elevation drawings of the rooftop plant indicating the height of the proposed plant selections.

Plant information

The assessment of rooftop building services noise is based on the following items of plant:

- 2 x Air Source Heat Pumps ASHP (Trane CMAF 165 HE XLN EC) as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000001.
- ASHPs attenuation package (ALLAWAY Acoustics AA301S) as per the specification in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000076
- 2 x Landlord Air Handling Units, AHU 01 M&Y Q11028-01-15 & AHU 02 M&Y Q11028-02-15, as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000002
- 2 x Tenant Air Handling Units AHU 03 & AHU 04, as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000039.
- 1 x Toilet extract fan Nuaire AXC71P-62A3+12 as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000017

- 2 x Rooftop smoke extract fans AXT90DG*4JA7+2E, 1 x Basement smoke extract fan and 1 x Basement smoke makeup fan AXT80DG*4GA7+2E as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000016
- 1 x Chiller Trane CGAF 165 XE XLN as per the specification in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000073
- Chiller attenuation package (ALLAWAY Acoustics AA301S) as per the specifications in the technical submission TBA-1A-PEL-Z1-ZZ-TS-M-000076
- 1 x Generator DT GEN DT6760 with an acoustic canopy, as per the specifications contained in the technical submission TBA-1A-PEL-Z1-ZZ-TS-E-000008
- 2 x Fume extract fans CMHV710 (1 operational & 1 Standby)

Rooftop plant layout

The locations of the proposed plant are shown in Figure 1.

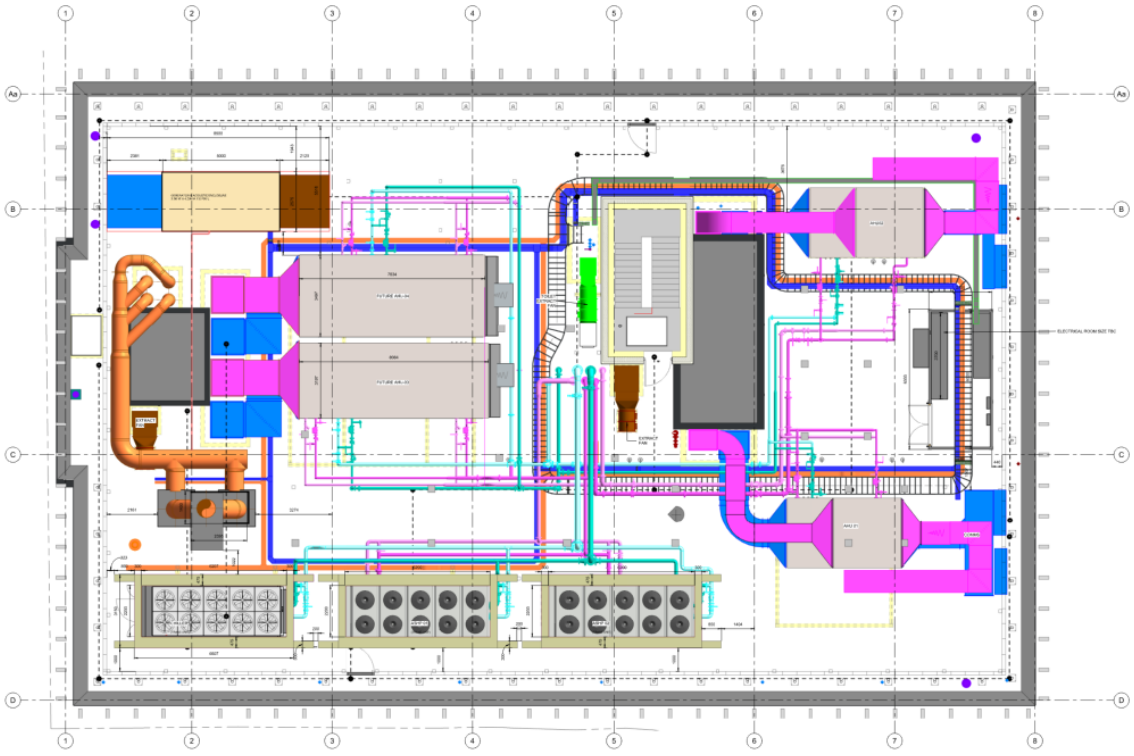

Figure 1 Stage 5 proposed rooftop plant layout.

There is a 3300 mm high plant screen along the perimeter of the building.

Relative to the previous Stage 5 roof plant layout, the generator has been moved from the northwest of the development to the northeast, facing regents canal.

The ASHP's have been repositioned and are now along the western boundary. They have also moved slightly south along the western boundary to make room for a new chiller, which is positioned in the north-western corner of the development.

The fume extract fans, and flue have now been included in the current scheme along the northern boundary.

Basement plant

The basement plant includes a smoke extract fan with a connection to atmosphere at St Pancras Road at ground floor level, and a smoke make-up fan with an atmosphere connection facing the Apex Plot B building at ground floor level.

Plant noise data

AHUs

Octave band sound power levels have been provided for the AHU intake and exhaust fans. The data is provided for a single fan. This is shown in Table 2.

AHUs 01 and 02 are comprised of a 4 fan array for both supply and exhaust systems.

AHUs 03 is comprised of 6 fan supply array and a 4 fan exhaust array.

AHU 04 is comprised of a 6 fan array for both supply and exhaust systems.

Corrections have been applied to account for the total number of fans for each unit.

There is no information related to the case radiated noise for the AHU 1 and 2 and assumptions have been made to undertake the noise egress assessment. Limiting case radiated sound power levels have therefore been determined based on the intake and exhaust fan noise levels and typical AHU casing performances.

The air intakes of the AHU 01 and 02 are ducted to the perimeter plant screens on the south elevation.

Table 2 AHU octave band sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU01								
Intake fan, L_w dB (per fan)	74	75	84	75	73	74	70	69
Exhaust fan, L_w dB (per fan)	72	78	78	78	77	73	67	61
AHU02								
Intake fan, L_w dB (per fan)	74	75	84	75	73	74	70	69
Exhaust fan, L_w dB (per fan)	77	74	84	79	79	77	72	68
AHU03								
Intake fan, L_w dB (per fan)	78	76	82	75	71	73	69	70
Exhaust fan, L_w dB (per fan)	79	81	84	81	81	80	73	71
AHU04								
Intake fan, L_w dB (per fan)	79	77	83	76	72	74	70	71
Exhaust fan, L_w dB (per fan)	75	74	81	78	78	81	72	71

ASHPs

Octave band sound power levels have been provided for the ASHPs selections. These are shown in Table 3.

ASHPs will operate at full duty during the daytime. In the event of night-time operation these will run at a significantly reduced duty to maintain the minimum requirements set out for heating/cooling and are not expected to contribute to the overall plant noise levels at the noise sensitive receivers. For the purposes of the assessment these units have not been considered to contribute to the cumulative noise level at night. The noise levels for the reduced night time duty need to be confirmed by the manufacturer to validate this assumption.

Table 3 ASHPs sound power levels (full duty)

`	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
ASHP 01 &02								
L_w dB	99	95	90	89	86	79	78	70

An Allaway Acoustics AA301S attenuation package is proposed for the ASHPs. The specifications state that the chiller is compatible with a sound pressure level of L_A 58 dB at 1 m with the attenuation package, however no insertion losses or calculation data has been provided for the attenuator to demonstrate the attenuated sound pressure level.

Toilet Extract fans

Octave band sound power levels have been provided for the toilet extract fans. These are shown in Table 4

Table 4 Toilet extract sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Toilet extract fan (TEF)								
Fan outlet, L_w dB	84	95	93	95	88	79	71	63
Case radiated, L_w dB	67	74	79	70	60	60	52	38

Smoke extract fans

Octave band sound power levels have been provided for the toilet extract fans. These are shown in Table 5.

Table 5 Smoke extract sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Rooftop smoke extract fan								
Fan outlet, L_w dB	100	111	103	97	91	85	81	75
Case radiated, L_w dB	76	88	87	72	63	67	63	49
Basement smoke extract & makeup fan								
Fan outlet, L_w dB	100	110	103	97	91	85	81	75
Case radiated, L_w dB	77	88	87	72	63	67	63	49

Generator

The generator provides emergency plant support only.

A single broadband sound power level of 119 dBA has been provided for the generator. No spectral data has been provided for review.

For the assessment, the spectral sound power levels of a similar generator have been used and shifted in level to match the provided 119 dBA sound power level. These are shown in Table 6.

Table 6 Assumed generator sound power level

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Generator, L_w dB	116	119	118	114	114	113	107	100

The generator specifications state that an attenuation package for this unit capable of achieving a sound pressure level of L_A 63 dB in free field conditions has been allowed for. The attenuation package is comprised of a 2100 mm long inlet attenuator, a 2400 mm long outlet attenuator, a 1600 mm long flue attenuator and a 100 mm thick acoustic enclosure.

No insertion losses or calculations have been provided for review to demonstrate the attenuated sound pressure level and assumptions have been made on the spectral sound power level of the attenuated generator for the purposes of the assessment.

Fume extract fans

Octave band sound power levels have been provided for the fume extract fans and flue. These are shown in Table 7.

There is no information related to the case radiated noise for the fume extract fan and assumptions have been made to undertake the noise egress assessment. Limiting case radiated sound power levels have therefore been determined based on the intake and exhaust fan noise levels and typical fan casing performances.

Table 7 Fume extract sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Fume extract, L_w dB	107	105	101	106	97	91	80	79

Chiller

A single broadband sound power level of 90 dBA has been provided for the chiller, with no spectral data provided for review. Spectral noise data for a similar plant has been used and shifted in level to match the broadband sound power level of the chiller for the purposes of the assessment. The resulting octave band noise data is shown in Table 8.

Table 8 Chiller extract sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Chiller, L_w dB	98	94	89	88	85	78	77	69

Allowance has been made for an attenuation package for the Chiller based on an Allaway Acoustics AA301S. The specifications state that the chiller is compatible with a sound pressure level of L_A 56 dB at 1 m with the attenuation package, however no insertion losses or calculation data has been provided for the attenuator to demonstrate the attenuated sound pressure level.

Noise egress assessment

The assessment has been done for the combined landlord and tenant plant use, to consider a worst-case scenario. Two conditions have been assessed:

- Normal plant operation which includes typical daily operating landlord and tenant plant (all plant except for generators and smoke extract fans).

  For the assessment the plant is considered to operate at design duty during the daytime. At night-time the ASHPs are not considered to be operational.

- Emergency plant testing, which includes the emergency plant operating solely (generators and smoke extract and makeup fans).

  For the assessment the plant is considered to operate at design duty. It is assumed testing will be done during the daytime only. All emergency plant will be tested individually.

Calculation methodology

Noise levels at the nearest noise sensitive receivers have been calculated based on plant layout shown in Figure 1. The methodology for prediction is described as follows:

- Distance attenuation has been calculated as geometrical spreading of sound power.
- Screening effects from building mass and the perimeter barrier were included in the calculation, wherever applicable, based on Maekawa's method.
- A 3 dB facade level correction is applied at the receptors.
- Tonality corrections have not been applied as it is understood that the plant is not tonal.

Mitigation strategies

To comply with the plant noise limits in Table 1, the following mitigation and attenuation requirements must be included in the design.

AHUs

Atmosphere side attenuators will be required for the proposed AHUs. Table 9 and Table 10 identifies the required minimum insertion losses and maximum regenerated sound power levels for the Landlord AHUs and tenant AHUs respectively. The minimum insertion losses for Landlord AHU's can typically achieved with attenuators of 1500 mm in length, whilst tenant AHU's insertion losses can typically be achieved with attenuators 1200 mm in length.

Table 9 Atmosphere side attenuator performance requirements – Landlord AHUs

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU01								
Intake min. insertion losses, dB	-11	-21	-25	-43	-47	-44	-39	-22
Intake max. regen sound power, dB	65	56	61	34	28	32	33	49
Exhaust min. Insertion losses, dB	-6	-7	-13	-21	-29	-39	-20	-14
Exhaust max. regen sound power, dB	68	73	67	59	50	36	49	49
AHU02								
Intake min. insertion losses, dB	-11	-21	-25	-43	-47	-44	-39	-22
Intake max. regen sound power, dB	65	56	61	34	28	32	33	49
Exhaust min. Insertion losses, dB	-6	-7	-13	-21	-29	-39	-20	-14
Exhaust max. regen sound power, dB	73	69	73	60	52	40	54	56

Table 10 Atmosphere side attenuator performance requirements – Tenant AHUs

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU03								
Intake min. insertion losses, dB	-3	-5	-10	-19	-18	-12	-8	-6
Intake max. regen sound power, dB	73	69	70	54	51	59	59	62
Exhaust min. Insertion losses, dB	-3	-4	-9	-18	-17	--12	-9	--8
Exhaust max. regen sound power, dB	72	73	71	59	60	64	60	59
AHU04								
Intake min. insertion losses, dB	-3	-5	-10	-19	-18	-12	-8	-6
Intake max. regen sound power, dB	74	70	71	55	52	60	60	63
Exhaust min. Insertion losses, dB	-3	-4	-9	-18	-17	-12	-9	-8
Exhaust max. regen sound power, dB	70	68	70	58	59	67	61	61

To control case radiated noise from the AHUs, case radiated sound power levels shall not exceed the levels indicated in Table 11.

Table 11 AHU maximun case radiated noise sound power levels

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
AHU01								
Max. case radiated sound power level, dB	77	77	77	67	59	52	46	44
AHU02								
Max. case radiated sound power level, dB	80	75	79	67	61	54	48	46
AHU03								
Max. case radiated sound power level, dB	77	77	72	63	59	56	48	46
AHU04								
Max. case radiated sound power level, dB	74	72	69	59	55	55	46	45

Air source heat pumps ASHPs

The proposed ASHPs in conjunction with the proposed Allaway Acoustics attenuation package is compatible with the required plant noise limits.

Further information (insertion losses or calculation sheets) will need to be requested from the attenuator manufacturer to support the attenuated sound pressure level of L_A 58 dB at 1 m.

Chiller

The proposed chiller selection in conjunction with the proposed Allaway acoustics attenuation package is compatible with the required plant noise limits.

Further information (insertion losses or calculation sheets) will need to be requested from the attenuator manufacturer to support the attenuated sound pressure level of L_A 56 dB at 1 m.

Fume extract fans

To achieve the plant noise limits, two attenuators will be required within the flue. The attenuators should be positioned with attenuator 1 at the base of the flue and attenuator 2 to the atmosphere side of the flue, with a minimum of 1.5 m between the two attenuators. The minimum required insertion losses and maximum regenerated sound power levels for the attenuators are set out in Table 12.

Table 12 Flue attenuator performance requirements (dB)

	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Attenuator 1 min. insertion loss	11	21	38	46	49	39	29	19
Attenuator 1 max. regen sound power	68	64	65	66	61	61	64	61
Attenuator 2 min. insertion loss	9	13	22	36	31	17	13	13
Attenuator 2 max. regen sound power	47	42	46	44	46	51	46	38

The insertion losses for attenuator 1 and attenuator 2 can typically be achieved with attenuators 2100 mm in length.

Noise from the casing of the fume extract fans is also required to be mitigated through the use of an acoustic enclosure. Provided that the enclosure achieves the octave band insertion losses outlined in Table 13, the proposed units are compatible with achieving the required plant noise limits. Enclosure insertion losses listed in Table 13 can be achieved with an IAC Noise-Lock 5 enclosure.

Table 13 Fume extract fan acoustic enclosure minimum performance requirements (dB)

	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Fume extract fan enclosure minimum insertion losses	15	20	22	23	24	27	25	20

Toilet extract fans

The toilet extract fans require atmosphere side attenuators compatible with the minimum insertion losses listed in Table 14. Maximum permissible regenerated sound power levels are also listed. Minimum insertion losses required for the toilet extract fans can typically be achieved with a 1500 mm long attenuator.

Table 14 Attenuator and regenerated noise requirements for toilet extract fans

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Exhaust min. insertion losses, dB	-7	-16	-22	-38	-45	-46	-41	-26
Exhaust max. regen sound power, dB	83	84	70	49	36	29	30	39

Smoke extract fans

Atmosphere side attenuators will be required for the proposed basement level and rooftop level smoke extract and makeup fans. Table 15 identifies the required minimum insertion

losses and maximum regenerated sound power levels for the smoke extract and make-up exhausts. Minimum insertion losses required for the toilet extract fans can typically be achieved with a 1200 mm long attenuator.

Table 15 Attenuator and regenerated noise requirements for smoke extract and makeup fans

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Exhaust min. insertion losses, dB	-9	-14	-25	-29	-31	-25	-19	-15
Exhaust max. regen sound power, dB	81	86	68	58	55	59	59	53

Case radiated noise from the basement smoke extract fan requires mitigation to control noise transfer through the ground floor louvre discharging at St Pancras Way. This louvre was specified as a 300 mm thick acoustic louvre as part of the Employer Requirements and minimum insertion losses were provided for this. It is understood however that an acoustic louvre will not be able to withstand high temperatures in the event of a fire, in which case, an acoustic enclosure should be fitted to the basement smoke extract fan compatible with the insertion losses outlined in Table 16.

Table 16 Minimum acoustic enclosure insertion losses to basement level smoke extract fans

Item	Octave band centre frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Minimum insertion losses, dB	-5	-7	-11	-12	-13	-14	-12	-12

Generator

The proposed generator in conjunction with the proposed attenuation package complies with the required plant noise limits.

Further information (insertion losses or calculation sheets) will need to be requested from the attenuator manufacturer to confirm the attenuated sound pressure level of L_A 63 dB at 1 m and the octave band noise data.

Other tenant plant

Any other tenant plant shall be designed to achieve a cumulative facade noise level of 10 dB below the limits identified in Table 1.