Appendix E.5

Soho House, Brighton (Application No: BH2015/02443)

Plant Noise Assessment (Units 6-8)

Report 16/0368/R1-3

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Plant Noise Assessment (Units 6-8)

Report 16/0368/R1-3

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1 Introduction

1.1 It is proposed to open a new club, under the management of Soho House, as part of a wider redevelopment of an area of Brighton's seafront. Planning permission for the redevelopment has been granted (application no: BH2015/02443) subject to conditions, one of which relates to plant noise emissions.

1.2 Cole Jarman has previously undertaken a noise survey in order to determine plant noise limits for another part of the scheme. The background noise levels recorded during the survey have now been used to derive separate limits applicable to plant serving each area.

1.3 This report presents the methodology and results of the noise survey defines appropriate criteria in accordance with the requirements stipulated by the relevant planning condition (no. 8), and details a plant noise assessment and mitigation measures required to achieve compliance.

2 Site Description

2.1 Soho House is to occupy the eastern half of the wider redevelopment site, units no. 6-8. There will be separate mechanical services plant serving a gym and associated facilities on one floor, and the club restaurant and bars on the floor above.

2.2 The opening hours of the various areas have yet to be finalised and our assessment has therefore considered the full range of hours for which consent may be sought. The designer has informed us that the plant may also run for no more than an hour before and after these hours.

2.3 Based on the above the anticipated worst case operational hours of the proposed plant items are summarised below. We understand that plant serving the western half of the scheme is likely to run during the same hours as the club (non-gym) plant.

- Gym plant: 0500-2300
- Club, including restaurant plant: 0600-0300 hours

2.4 The site is shown within the context of the surrounding area in Figure 1 below. Marine Parade lies to the north and Madeira Drive to the south. The nearest noise sensitive receptors to the site are hotels and apartments on the north side of Marine Parade. These are shaded blue.

2.5 Beyond Madeira drive is Brighton Beach and, to the west, Brighton Pier. There are no other noise sensitive locations to consider south of the site.

Figure 1. Aerial view of site showing nearest receptors and measurement position

3 Environmental Noise Survey

3.1 **Methodology**

3.1.1 An unattended noise survey was undertaken at one position for a period of 48 hours, commencing at approximately 1400 hours on Tuesday 7th June.

3.1.2 Measurements were made at a single free-field position at the north boundary of the site, approximately 8m from the kerb of Marine Parade. This position is labelled MP1 on Figure 1 above.

3.1.3 Measurements of the L_{Aeq}, L_{Amax} and L_{A90} indices were recorded over consecutive 15 minute periods (see attached Glossary of Acoustic Terms for an explanation of the noise units used).

3.1.4 Noise measurements were made using the equipment listed in table T1.

Item	Manufacturer	Type
Sound Level Analyser	Norsonic	140
Acoustic Calibrator	Norsonic	1251
Weatherproof windshield	Norsonic	1212

T1 Equipment used during unattended noise survey

3.1.5 The sound level analyser was calibrated before and after the noise survey to ensure a consistent and acceptable level of accuracy was maintained throughout. No significant drift was noted to have occurred.

3.1.6 The weather conditions while setting up and collecting the survey equipment were warm and dry with a gentle breeze; suitable for the measurements. Based on online weather history data, these conditions are not believed to have varied significantly during the survey.

3.2 Results

3.2.1 The results of the noise measurements at MP1 are presented in the attached time history figure 16/0368/TH1.

3.2.2 The lowest background noise levels measured during each of the plant operating periods identified in paragraph 2.3 above are shown in table T2.

Location	Minimum $L_{90,15min}$ Background Noise Level, dB(A)			
	Gym plant (0500-0600)	Units 2-8 (0600-2300)	2-5 & Club (2300-0100)	Club plant (2300-0100)
MP1 – north site boundary	42	48	46	42

T2 Minimum measured background noise levels

3.2.3 While on site, the noise climate was dominated by traffic on Madeira Drive.

4 Noise Emission Criteria

4.1 Planning Condition 8

4.1.1 The site location falls under the jurisdiction of Brighton & Hove City Council. They have granted permission for the redevelopment (application no: BH2015/02443), subject to

conditions. Planning condition 8 relates to noise emissions from new mechanical services plant and reads as follows:

Prior to the installation of plant into the development, an acoustic report shall be submitted for approval to the Local Planning Authority. This must show that the cumulative 'A' weighted sound pressure level from the plant and machinery (including non-emergency auxiliary plant and generators), that will be incorporated into the development, when operating at its noisiest, shall not at any time exceed a value of 10 dB below the minimum external background noise, at a point 1 metre outside any window of the nearest residential or other noise sensitive property, unless and until a fixed maximum noise level is approved by the City Council. The background level should be expressed in terms of the lowest $L_{A90,15mins}$ during the proposed hours of operation. The plant-specific noise level should be expressed as $L_{Aeq,T}$, and shall be representative of the plant operating at its maximum.

Reason: To safeguard the amenities of the occupiers of neighbouring properties and to comply with policies SU10 and QD27 of the Brighton & Hove Local Plan.

4.1.2 It should be noted that the requirements stipulated by this condition differ in certain ways from the guidance in BS 4142:2014, which is typically referenced when assessing noise emissions from mechanical services plant.

4.1.3 The requirement to restrict plant noise to a level no greater than 10 dB below the minimum background level during the operating period goes beyond the intent of BS 4142:2014. The standard states that *"where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact"*.

4.1.4 Conversely, however, BS4142:2014 requires that plant noise is assessed on the basis of a rating level, which may include penalties for various acoustic features, whereas Planning Condition 8 refers to the combined A-weighted sound pressure level of all plant operating at a given time. Therefore, in this case there is no need to add corrections for the character of the plant noise.

4.1.5 Allowance should also be made for plant serving the western area of the redevelopment. Soho House plant intended to run between 0600 and 0100 hours should have noise emissions restricted to a level no greater than 13 dB below the minimum background level for this period. This will permit an equal level of noise to be generated by plant serving each area.

4.2 Plant Noise Limits

4.2.1 Based on the approach detailed in the previous section, the noise limits for the proposed mechanical services plant are shown in table T3.

Location	Plant Noise Emission Limit, dB(A)		
	Gym plant (0500-0600)	All plant (0600-2300)	Club plant (2300-0300)
Residential buildings to north	32	35	32

T3 Plant noise emission limits at the nearest noise sensitive windows

5 Plant Noise Assessment

5.1 Proposed Installation

Cooling Plant

5.1.1 It is proposed to install five VRF air source heat pumps inside a pair of plant rooms on the northern side of the site.

5.1.2 Two units serving the club (ASHP 1 & 2) will be housed within a plant room at the east end of the lower level, with louvred openings in the roof and south external wall.

5.1.3 Two more units serving the club (ASHP 3 & 4) and one serving the gym (ASHP 5) will be located in a plant room near the west end of the upper level with louvred openings in the roof and north external wall.

Ventilation Plant

5.1.4 The gym will be served by an air handling unit (AHU 1) and extract fan (EF 1) located in an internal plant room. The AHU intake and discharge, and extract fan discharge will be ducted vertically out of the building through a louvre covered riser.

5.1.5 A kitchen extract fan (EF 3) is to be installed within the riser, with the exhaust ducted up alongside the AHU 1 and EF 1 atmospheric side ductwork.

5.1.6 An air handling unit (AHU 3) will be installed inside a plant room at the eastern end of the upper floor. The supply air intake for this unit will be ducted to the north external wall and there will be a larger, louvred opening in the roof.

5.1.7 All other plant will be installed fully inside the building, with noise transmitted outside only via ductwork.

5.1.8 A kitchen extract fan (EF 5), two other extract fans (EF 2 & 4) and two heat recovery units (HRU 1 & 2) will connect to grilles in the north side of the building. An air handling unit (AHU 2) will draw air through a grille in the lower floor roof on the same side of the building.

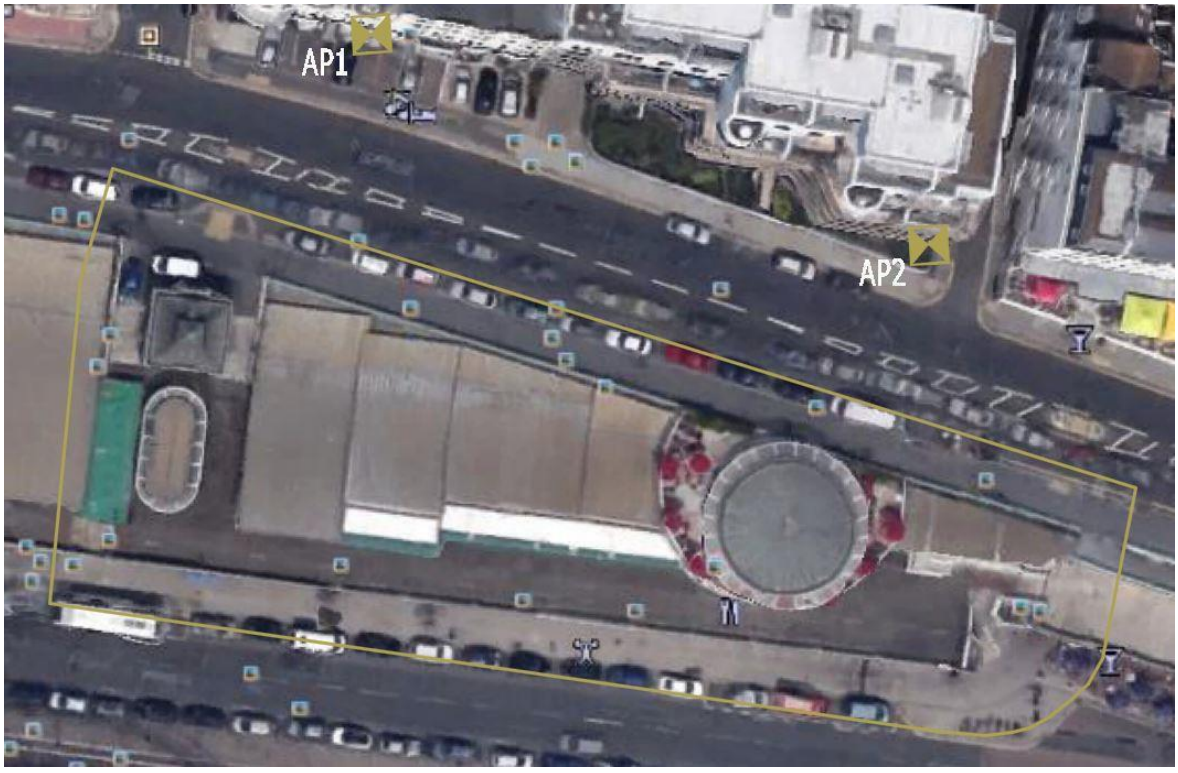
5.1.9 A pair of heat recovery units (HRU 3 & 4) and three supply fans will be ducted to grilles on the south side of the building.

5.2 Assessment

5.2.1 An assessment has been conducted on the basis of drawings by CD International Building Services Engineers (CDBSE), dated 5th August 2016, and accompanying schedules of plant equipment. The reference codes used in this report to identify each unit and the location of any mitigation requirements correspond to those shown on the drawings and schedules by CDBSE. The drawings are attached as Appendix A.

5.2.2 For our assessment we have used manufacturers' octave band noise data for each plant item, as shown in the attached schedule 16/0368/SCH1.

5.2.3 The assessment has considered two residential receptors that will be most exposed to the new plant, north of the site, one near each end. These are labelled AP1 and AP2 on Figure 2 below.



5.2.4 Our assessment has taken into account reverberant sound build-up inside the various plant rooms and riser, sound radiated from louvred openings and transmitted along ducts to the atmosphere via grilles.

5.2.5 The specific noise levels generated by the equipment at each location have been calculated by correcting plant noise levels for distance and radiation losses, façade reflections and screening where appropriate.

5.2.6 Duct and grille dimensions are not currently available, due to the outline stage of the design. Conservative estimates, proportional to the size of each plant item, have therefore been made in calculating losses for bands, end reflections and grille directivities where appropriate.

5.2.7 A sample of calculations detailing the assessment are attached as Appendix B. A full set of calculation sheets detailing the assessment for each of the plant items can be provided on request.

5.3 Required Mitigation Measures

5.3.1 It will be necessary to implement a range of noise mitigation measures to meet the proposed plant noise limits. These are listed along with their minimum octave band insertion losses in the attached schedule 16/0368/SCH2-1.

5.3.2 The ducted units will generally be the most amenable to noise control, as silencers can be installed in the air intake and discharge ductwork. Other measures will need to be considered to control noise emissions from the cooling plant and externally mounted fans.

5.3.3 In order to sufficiently reduce noise radiated from the fan casing of kitchen extract fan EF 3, it will be necessary to house the fan inside an acoustic enclosure. The fan manufacturer, Nuarire, state in their literature that they can provide this but it should be ensured that the enclosure achieves the insertion losses shown in the attached schedule (ENC 1) while ensuring adequate airflow to the fan and motor and acoustic isolation of the unit from the enclosure.

5.3.4 A sound absorbent lining will also need to be applied to a minimum of $6m^2$ of the riser in which fan EF 3 is installed. This must be supplied and installed in accordance with the attached specification 16/0368/SPC1.

5.3.5 In order to control noise from the air source heat pumps breaking out of the two plant rooms at either end of the site, the louvres to each room should be acoustic louvres achieving the minimum insertion losses in the attached schedule (AL1 & 2).

5.3.6 The minimum louvre insertion losses would typically be achieved by 300mm deep acoustic louvres. Acoustic louvres must be supplied to meet the requirements set out in the attached specification 16/0368/SPC2-1.

5.3.7 Minimum octave band insertion losses for atmospheric side silencers for the ventilation plant, where required, are provided in the attached schedule (AS 1 – 16) along with typical lengths and percentage free areas of silencer that would achieve these values.

5.3.8 The suggested silencer configurations are generally standard rectangular splitter silencers although in the case of kitchen extract fans, understood to be EF 3 and 5, Melinex faced splitter silencers should be used. We understand from the manufacturer's data sheets that fans EF 1, 2 and 4 are likely to have circular ductwork and a cylindrical silencer may be preferable.

5.3.9 All silencers should be supplied and installed in accordance with the requirements of the attached specification 16/0368/SPC3. Silencer pressure drops should be limited to no more than 40 Pascals.

5.4 Results

5.4.1 With the mitigation measures described in the previous section in place, the assessed plant noise levels are as follows:

Location	Plant Noise Emission Level, dB(A) *(Limit)*		
	Gym plant (0500-0600)	**All plant (0600-2300)**	**Club plant (2300-0300)**
AP1 - New Madeira Hotel	30 *(32)*	34 *(35)*	32 *(32)*
AP2 – Van Alen Building	25 *(32)*	33 *(35)*	32 *(32)*

T4 Calculated plant noise levels at assessment position

5.4.2 It can be seen that the predicted plant noise levels at the assessment positions satisfy the plant noise emissions criteria required by Planning Condition 8.

5.4.3 A summary of the total octave band noise levels predicted at each assessment position, as well as the relative contributions from each assessed plant item, during each time period are included here as Appendix C.

5.4.4 As explained in paragraph 4.1.5 above, by designing to the limits specified here allowance has also been made for equal levels of noise generated by plant serving the western area of the redevelopment, which will contribute to avoiding excessively onerous restrictions on this plant.

5.4.5 Suitable isolation measures will need to be incorporated into the detailed plant design to prevent excessive levels of structure-borne noise from being transmitted to other parts of the building.

6 Conclusions

6.1 It is proposed to open a new club, under the management of Soho House, as part of a wider redevelopment of an area of Brighton's seafront. New mechanical services plant is proposed to serve the Soho House site and other areas of the redevelopment.

6.2 An unattended noise survey has been undertaken at the site to quantify the existing noise climate and plant noise emissions limits proposed to meet the requirements stipulated by a planning condition imposed by Brighton & Hove City Council.

6.3 An assessment of the noise from the proposed plant items has been undertaken at the nearest noise sensitive windows. The assessment has shown that the proposed emission limits can be met and a programme of mitigation measures recommended to achieve this.

6.4 Headroom has been allowed for noise emissions from further plant equipment serving the other half of the redevelopment, which is covered by the same planning condition.

End of Section

Glossary of Acoustic Terms

L_{Aeq}:

The notional steady sound level (in dB) which over a stated period of time, would have the same A-weighted acoustic energy as the A-weighted fluctuating noise measurement over that period. Values are sometimes written using the alternative expression dB(A) L_{eq}.

L_{Amax}:

The maximum A-weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise when occasional loud noises occur, which may have little effect on the L_{Aeq} noise level. Unless described otherwise, L_{Amax} is measured using the "fast" sound level meter response.

L_{A10} & L_{A90}:

If non-steady noise is to be described, it is necessary to know both its level and degree of fluctuation. The L_{An} indices are used for this purpose. The term refers to the A-weighted level (in dB) exceeded for n% of the time specified. L_{A10} is the level exceeded for 10% of the time and as such gives an indication of the upper limit of fluctuating noise. Similarly L_{A90} gives an indication of the lower levels of fluctuating noise. It is often used to define the background noise.

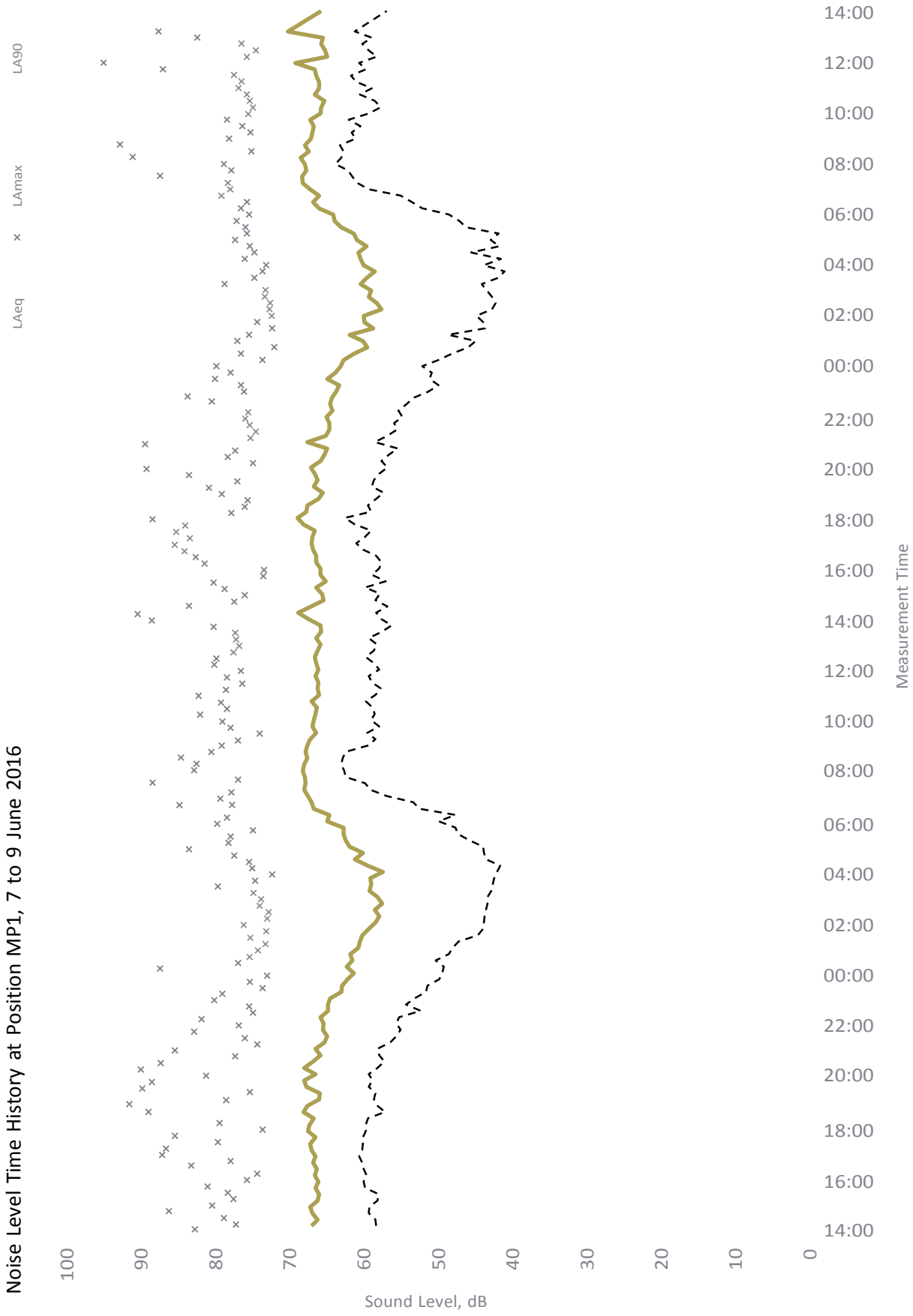
L_{A10} is commonly used to describe traffic noise. Values of dB L_{An} are sometimes written using the alternative expression dB(A) L_n.

L_{AX}, L_{AE} or SEL

The single event noise exposure level which, when maintained for 1 second, contains the same quantity of sound energy as the actual time varying level of one noise event. L_{AX} values for contributing noise sources can be considered as individual building blocks in the construction of a calculated value of L_{Aeq} for the total noise. The L_{AX} term can sometimes be referred to as Exposure Level (L_{AE}) or Single Event Level (SEL).

End of Section

Figure 16/0276/TH01



Schedule of Plant and Air Handling Equipment Sound Levels, dB

Reference	Unit Details	Data[1] Source	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
ASHP 1	PUHY-P200YKB-A1.TH	Man	Sound Pressure, Lp @ 1m	72	63	60	55	48	44	38	33
ASHP 2	PUHY-P200YKB-A1.TH	Man	Sound Pressure, Lp @ 1m	72	63	60	55	48	44	38	33
ASHP 3	PUHY-P200YKB-A1.TH	Man	Sound Pressure, Lp @ 1m	72	63	60	55	48	44	38	33
ASHP 4	PUHY-P200YKB-A1.TH	Man	Sound Pressure, Lp @ 1m	72	63	60	55	48	44	38	33
ASHP 5	PUHY-P200YKB-A1.TH	Man	Sound Pressure, Lp @ 1m	72	63	60	55	48	44	38	33
AHU 1i	XBC75-H-LESWP	Man	Sound Power, Lw	76	75	74	77	70	64	58	54
AHU 1d	XBC75-H-LESWP	Man	Sound Power, Lw	80	79	74	82	81	73	66	62
AHU 2i	ESBHS5-L	Man	Sound Power, Lw	92	87	83	83	76	73	67	62
EF 1o	AVT5	Man	Sound Power, Lw	73	69	65	65	60	55	51	45
EF 4o	AVT5	Man	Sound Power, Lw	73	69	65	65	60	55	51	45
EF 5o	SQFA44ES	Man	Sound Power, Lw	83	85	84	84	77	78	78	64
AHU 3b	XBC65-H-LES	Man	Sound Power, Lw	63	65	52	47	41	37	31	16
AHU 3i	XBC65-H-LES	Man	Sound Power, Lw	75	75	68	62	60	55	44	30
AHU 3d	XBC65-H-LES	Man	Sound Power, Lw	81	81	75	71	68	65	57	51

Reference	Unit Details	Data Source	Noise Level Type	Noise Levels (dB)							
				63	125	250	500	1k	2k	4k	8k
EF 2o	AVT3	Man	Sound Power, Lw	79	75	75	70	63	62	52	52
EF 3b	SQFA43-3	Man	Sound Power, Lw	82	88	74	69	66	67	61	47
EF 3o	SQFA43-3	Man	Sound Power, Lw	85	95	78	75	80	81	77	71
SF 1i	ESBHS1-L	Man	Sound Power, Lw	76	70	63	52	52	52	47	38
SF 2i	ESBHS1-L	Man	Sound Power, Lw	76	70	63	52	52	52	47	38
SF 3i	ESBHS1-L	Man	Sound Power, Lw	76	70	63	52	52	52	47	38
HRU 1i	XBC25-H-NES	Man	Sound Power, Lw	70	64	62	64	59	55	47	46
HRU 1d	XBC25-H-NES	Man	Sound Power, Lw	76	77	71	74	65	65	63	64
HRU 2i	XBC45-H-NES	Man	Sound Power, Lw	79	71	71	60	60	58	50	41
HRU 2d	XBC45-H-NES	Man	Sound Power, Lw	84	77	81	67	68	68	62	60
HRU 3i	XBC45-H-NES	Man	Sound Power, Lw	79	71	71	60	60	58	50	41
HRU 3d	XBC45-H-NES	Man	Sound Power, Lw	84	77	81	67	68	68	62	60
HRU 4i	XBC45-H-NES	Man	Sound Power, Lw	79	71	71	60	60	58	50	41
HRU 4d	XBC45-H-NES	Man	Sound Power, Lw	84	77	81	67	68	68	62	60

Notes

1 - Man refers to data supplied by the equipment manufacturer or supplier, Emp refers to data calculated using empirical formulae, and Meas refers to data measured by Cole Jarman

Schedule of silencers and required insertion loss, dB [1]

Reference	Location	Silencer Type	Face Velocity [2] (m/s)	Insertion Losses (dB)							
				63	125	250	500	1k	2k	4k	8k
AL 1	Lower Level Plant Room	High Attenuation (300)		5	7	10	12	14	16	13	12
AL 2	Upper Level Plant Room	High Attenuation (300)		5	7	10	12	14	16	13	12
ENC 1	EF 3 (breakout)	Acoustic fan enclosure		5	8	10	15	20	25	25	25
AS 1	EF 1 (outlet)	1 Diameter 300mm		0	1	2	3	8	9	8	7
AS 2	EF 2 (outlet)	2 Diameter 300mm (Podded)		3	8	14	22	31	28	20	19
AS 3	EF 3 (outlet)	38% - 1800 (Melinex)		8	17	32	40	42	30	23	13
AS 4	EF 4 (outlet)	2 Diameter 300mm (Podded)		3	8	14	22	31	28	20	19
AS 5	EF 5 (outlet)	38% - 2100 (Melinex)		9	19	36	45	47	38	25	15
AS 6	AHU 1 (intake)	50% - 900		2	4	9	15	17	14	10	8
AS 7	AHU 1 (discharge)	40% - 900		4	7	13	19	23	23	16	13
AS 8	AHU 2 (intake)	30% - 1800		9	17	29	46	50	50	49	34
AS 9	AHU 3 (intake)	30% - 900		5	10	16	25	34	34	29	22
AS 10	AHU 3 (discharge)	30% - 900		5	10	16	25	34	34	29	22

Reference	Location	Silencer Type	Face Velocity (m/s)	Insertion Losses (dB)							
				63	125	250	500	1k	2k	4k	8k
AS 11	HRU 1 (intake)	50% - 1200		2	6	11	20	23	19	12	9
AS 12	HRU 1 (discharge)	35% - 1200		5	11	19	29	36	37	29	18
AS 13	HRU 2 (intake)	50% - 1200		2	6	11	20	23	19	12	9
AS 14	HRU 2 (discharge)	35% - 1200		5	11	19	29	36	37	29	18
AS 15	HRU 3 (discharge)	50% - 600		1	2	7	10	11	9	8	7
AS 16	HRU 4 (discharge)	50% - 600		1	2	7	10	11	9	8	7

Notes

1 - To be read in conjunction with silencer specification
2 - Silencers should be sized such that the stated air velocity (in m/s) is not exceeded. Air velocity is evaluated by dividing the flow rate by the entire cross-sectional area of the silencer, not just the open or free area. The face velocity is calculated so that the pressure drop through the silencer does not exceed 50 Pa.

Specification 16/0368/SPC1

Project: **Soho House, Brighton**
Subject: **External Sound Absorbent Lining**
Date: **2 September 2016**

1 General

This specification defines the applicable requirements for mineral fibre lining to the Fish Bar kitchen riser. The suppliers of the materials shall provide the necessary information and data to verify the required performance.

The supplier shall be responsible for ensuring that all the performance criteria set out herein are met by the product being offered.

2 Products

The acoustic lining is to be supplied in the minimum thickness stated and shall be inorganic glass fibre material with a minimum density of 48 kg/m^3. The absorbent internal lining shall be faced with glass fibre cloth or other infill protection membrane and retained by perforated galvanised mild steel sheet having an open area preferably in excess of 20%, or expanded metal.

The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

Provision shall be made to prevent settling of the acoustic medium. The panels shall be suitably weather protected. In particular panels shall have drain holes as required to avoid soaking of the acoustic medium.

The sound absorption provided by the material (with the erosion resistive facing) shall meet or exceed the values tabulated below:

Minimum Thickness (mm)	Octave Band Centred Frequency (Hz)					
	125	250	500	1k	2k	4k
75	0.30	0.50	0.75	0.95	0.95	0.95

T1 Absorption Coefficients of Acoustically Absorbent Plant Area Lining

3 Execution

3.1 The acoustic lining shall be applied to an area covering at least 6m2 of the riser walls. Do not extend down to closer than 0.15m above the local ground level.

3.2 All available portions of the area designed to receive the acoustic liner shall be completely covered. All joints shall be neatly butted and there shall be no interruptions or gaps.

3.3 The acoustic lining shall be secured with mechanical fasteners which shall compress the lining sufficiently to hold it firmly in place.

End of Section

Specification 16/0368/SPC2-1

Project: **Soho House, Brighton**
Subject: **Low pressure drop acoustic louvres**
Date: **15 June 2017**

1.1 The acoustic louvres shall provide an insertion loss of not less than indicated below.

Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
5	7	10	12	14	16	13	12

1.2 The louvre blades will be so spaced as to provide the above insertion loss, whilst allowing the free range of air, in accordance with the passive ventilation system requirements.

1.3 The louvres and supporting framework shall be constructed from aluminium or galvanised steel of appropriate gauge for the proposed installation. The acoustic louvre blades shall be solid on the upper face and perforated galvanised mild steel or aluminium on the lower face. The overall depth shall be 300mm.

1.4 The acoustic infill behind the perforated metal to be mineral fibre, shall have a density of 60-100 kg/m^2 and shall be insert, rot and vermin proof, non-hygroscopic and incombustible. It will be mineral fibre tissue or cloth faced.

1.5 The design of the louvres shall be such that there is no pooling of rainwater in any elements.

1.6 The louvres shall be finished as per the architect's specification.

1.7 The acoustic media shall not comprise materials which are generally composed of mineral fibres, either man made or naturally occurring, which have a diameter of 3 microns or less and a length of 200 microns or less or which contain any fibres not sealed or otherwise stabilised to ensure that fibre migration is prevented.

End of Section

Specification 16/0368/SPC3

Project: **Soho House, Brighton**
Subject: **Acoustic specification of in-duct silencers**
Date: **2 September 2016**

1 General

1.1 Description

1.1.1 Furnish and install duct silencers of the types and sizes shown on the schedule.

1.1.2 Transitions and support or suspension systems are not included.

1.2 Quality Assurance

1.2.1 The dynamic insertion loss shall meet or exceed the values given in the schedules.

1.2.2 The static pressure drop shall not exceed 40 Pascals.

1.2.3 The levels of airflow noise generated by the silencers themselves at the operating conditions shall be provided by the supplier, if requested.

1.2.4 Performance data relating to dynamic insertion loss, static pressure drop and self-noise shall be obtained in accordance with BS 4718:1971 or BS EN ISO 7235 : 1996.

1.3 Submittals

1.3.1 Data sheets on the specific silencers utilised.

1.3.2 An itemised list showing the specific silencer utilised, its size, pressure drop at the required airflow volume, certified test data on dynamic insertion loss and self-noise power levels.

2 Materials and Construction

2.1 Outer casings and interior construction

2.1.1 Outer casings of rectangular silencers shall be made of 18 gauge galvanized steel or thicker in accordance with the HVCA recommended construction for high pressure rectangular ductwork. Seams shall be lock formed and mastic sealed.

2.1.2 Interior partitions for rectangular silencer splitters shall be made of not less than 26 gauge galvanized perforated steel.

2.1.3 Interior construction of tubular silencers shall be compatible with the outside casings.

2.1.4 Splitters in rectangular silencers of length not less than 900mm shall have aerodynamically shaped leading and trailing edges. Square or blunt ends are not acceptable.

2.1.5 Silencers shall be fitted with drilled angle flange connections unless other forms of connection are specified by the Mechanical Services Consultant or Contractor.

2.2 Configuration

2.2.1 Splitters within the silencer should generally be aligned with half width splitters affixed to each side wall of the casing. Splitters shall preferably be aligned vertically, and there shall be a regular splitter/airway dimension across the full width of the silencer. Horizontal splitters, where this orientation is required, shall be suitably supported and stiffened to prevent sagging and restriction of the airways. It is of particular importance that the supplier ensures that parallel splitter elements are orientated to suit the aerodynamic conditions arising from the adjacent duct geometry, particularly in the vicinity of bends and other transitions.

2.2.2 For silencers manufactured in modules, this specification shall apply to the unit as a whole.

2.2.3 The supplier shall comply with the cross-sectional sizes as shown in the schedule, unless alternative dimensions are agreed and approved by the Mechanical Services Contractor and the Acoustic Consultant. Silencers which are constructed to alternative cross-sectional dimensions must achieve the dynamic insertion loss and pressure drop requirements as set out in the schedule.

2.3 Standard silencers

2.3.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; rot, vermin and moisture proof; non-combustible and non-hygroscopic.

2.3.2 The filler material shall be retained in the splitters in such a manner that there is no egress of the fibres into the air stream at the prevailing flow conditions. Splitters will normally be faced with perforated galvanised sheet steel: any other facing material must be approved by the Acoustic Consultant.

2.4 Silencers with non-porous fibre protection membrane

2.4.1 Filler material shall be of inorganic mineral or glass fibre of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert; rot, vermin and moisture

proof; non-combustible and non hygroscopic. Filler material shall be totally encapsulated and sealed with Melinex film of a thickness no less than 0.03mm.

2.5 **Special silencers with no acoustical fill**

2.5.1 No acoustic fill material: glass fibre, mineral wool, foam, etc., are not permitted.

2.5.2 Insertion loss provided by broadly tuned resonators and impedance membranes.

2.6 **Special Operating Conditions**

2.6.1 Where corrosive or toxic gases are contained in the air stream, special constructions and materials may be specified as an addendum to this specification.

2.6.2 Silencers which are expected to operate at high temperatures (e.g. turbine exhausts, boiler flues etc.) shall be constructed of a suitable gauge material, with precautions taken to allow for thermal expansion and shock. The filler material inside the splitters shall generally comply with the provisions outlined in Paragraph 2.1.C, with modifications as required to accommodate the high operating temperature. For very high temperatures, steel wool or equivalent approved may be used as the filler material.

3 Execution

3.1 Silencer units shall be delivered to site with blocked ends to prevent the ingress of rubble prior to installation and to reduce the risk of damage. The silencer identification shall be clearly marked on the casing, as shall the direction of airflow.

3.2 The silencers shall be installed in accordance with the manufacturer's recommendations to obtain the published acoustic and air flow performance.

3.3 The silencers shall be located as shown in the drawings.

3.4 Orientate the internal silencer splitters as follows for rectangular silencers:

- Silencer splitters be oriented so as to be parallel to the plane of the turn if the silencer is located in a position less than 3 duct diameters in distance from the elbow. The duct diameter shall be based upon the maximum duct cross sectional dimension of the silencer.
- If the silencer is located greater than 3 duct diameters away from an elbow, the orientation is not critical.

3.5 Locate no rectangular or circular silencers within one duct diameter from elbows, fan suction or discharge openings takeoffs, etc., unless indicated on the drawings and/or approved by the Acoustic Consultant.

4 Potential Product Suppliers

4.1 Allaway Acoustics

- Contact: Jim Grieve
- Telephone: 01992 550825
- enquiries@allawayacoustics.co.uk
- Address
  Old Police Station
  1 Queens Road, Hertford,
  Hertfordshire, SG14 1EN
- www.allawayacoustics.co.uk

4.2 Caice Acoustic Air Movement Ltd

- Telephone: 0118 9186470
- enquiries@caice.co.uk
- Head Office Address
  Riverside House
  3 Winnersh Fields
  Gazelle Close, Winnersh
  Wokingham, RG41 5QS
- www.caice.co.uk

4.3 Environmental Equipment Corporation

- Contact: Tim Meed
- Telephone: 01932 230940
- info@eecnoisecontrol.co.uk
- Address
  Richmond House
  Churchfield Road
  Walton-on-Thames,
  Surrey, WV13 3RS
- www.eecnoisecontrol.co.uk

4.4 IAC Ltd

- Contact: Mike Jackson
- Telephone: 01962 873000
- info@iacl.co.uk
- Head Office Address
  IAC House
  Moorside Road, Winchester
  Hampshire, SO23 7US
- www.industrialacoustics.com/uk

4.5 Noico Ltd

- Telephone: 01256 766207
- sales@noico.co.uk
- Address
  Patrick House
  Station Road, Hook
  Hampshire, RG27 9HU
- www.noico.co.uk

4.6 TEK Limited

- Contact: Paul Virgo
- Telephone: 0121 766 5005
- sales@tek.ltd.uk
- Address
  Seeleys Road, Greet
  Birmingham B11 2LQ
- www.tek-ltd.com

End of Section

A1

Electrical Cold Water Storage Tank

AHU 1

TWIN EXTRACT FAN 1

Boiler HWS & CWS Storage Plantroom
Cold & Dry Storage for Kitchen
Electrical Room
Electrical Riser
Area for Kitchen
Electrical Riser

In-Line EF 5

RTA

EF 4

Install double doors
Swimming Pool Plant
Remove wall
Install double doors
2No ASHP units

HRU 4

HRU 3

Glazing removed and an accoustic louvre fitted (full height)
(Air for Heat Pumps)

Heat Rejection Plant

Notes

1. Refer to Architects and Structural Engineers drawings for building details.

2. Dimensions to be checked on site before any works is put in hand or prefabricated.

3. Figured dimensions where shown are in millimeters.

4. This drawing is to be read in conjunction with the relevant Technical Specification and the Contractors working drawings.

5. For purpose of construction, this drawing must not be scaled. Only written or calculated dimensions should be used.

6. The position of all equipment is approximate as shown. The precise positions shall be agreed on site with other trades and Architects scaled layouts.

Location Key Plan (Not to Scale)

Rev	Description / By / Chk'd / App'd	Date
A	Updated layout	18.04.2017
#	Issued for Information	23.11.2015

Purpose of Issue

Information

London

30B Wilds Rents
London SE1 4QG
+44 (0) 203 589 0090

www.cdbse.net CD International Building Services Engineers Ltd

Registered office: 16 Crucifix Lane, London, SE1 3JW. Registered in England and Wales No.7343303 cdbse@cdbse.net

Client

Robin Mallin

Project

Soho House Brighton

Drawing

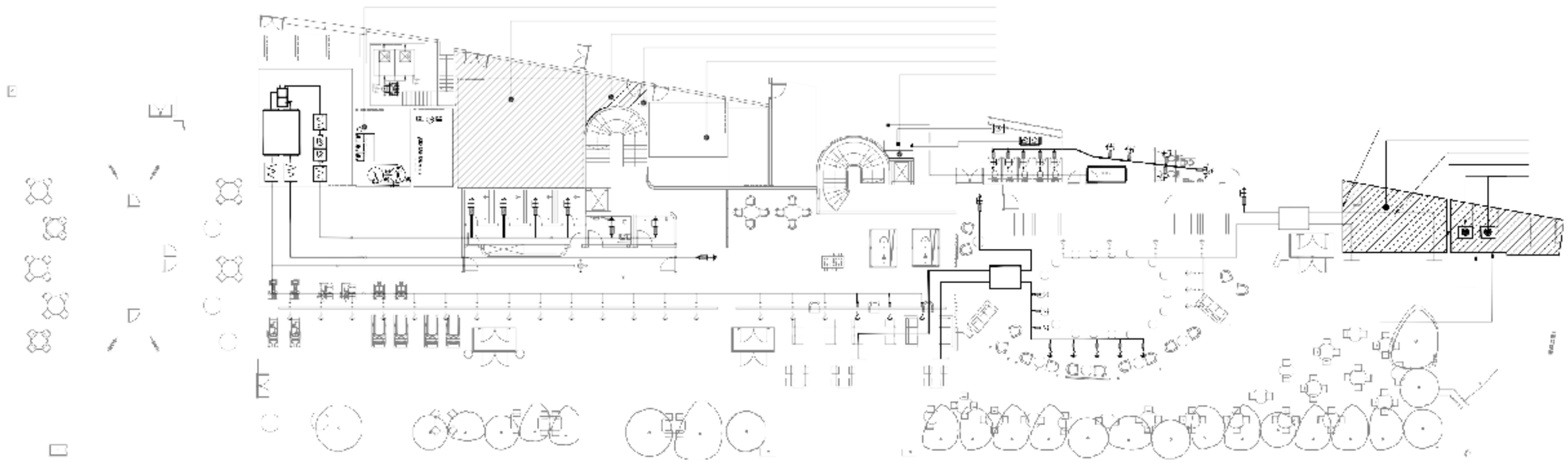
Mechanical Services
Proposed Lower Tier Plan

Date	05.08.2016
Scale @ A1	1:150
Drawn	JL
Checked	JR
Approved	JR
Project No.	1534

Drawing Identifier — BS1192 / Uniclass Compliant

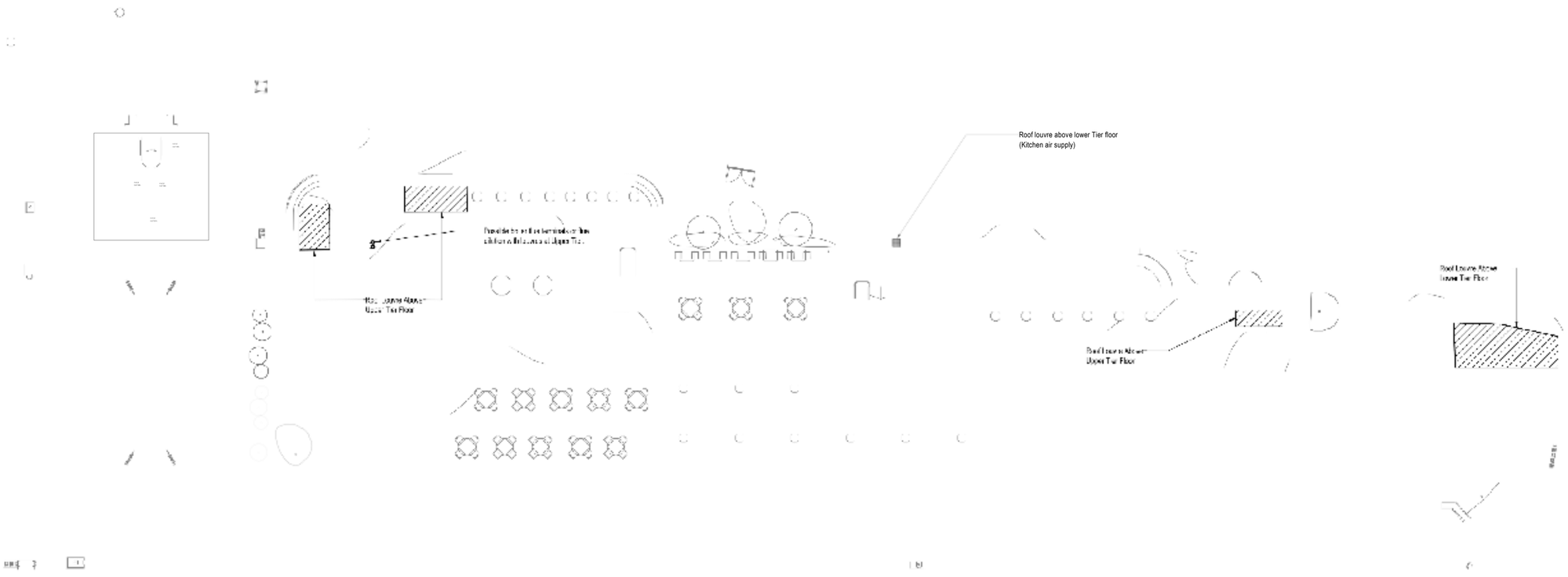
project | zone | level | file type | role | uniclass | number | revision

Print Date: 19/4/2017 08:57:51



CDI International Building Services Engineers

A1



Notes

1. Refer to Architects and Structural Engineers drawings for building details.
2. Dimensions to be checked on site before any works is put in hand or prefabricated.
3. Figured dimensions where shown are in millimeters.
4. This drawing is to be read in conjunction with the relevant Technical Specification and the Contractors working drawings.
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Location Key Plan (Not to Scale)

Rev	Description / By / Chk'd / Appr'd	Date
A	Updated layout	18.04.2017
#	Issued for Information	23.11.2015

Purpose of Issue

Information

CD International Building Services Engineers

London

30B Wilds Rents
London SE1 4QG
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www.cdbse.net CD International Building Services Engineers Ltd

Registered office: 16 Crucifix Lane, London, SE1 3JW. Registered in England and Wales No.7343303 cdbse@cdbse.net

Client

Robin Mallin

Project

Soho House Brighton

Drawing

Mechanical Services
Proposed Roof Plan

Date	05.08.2016
Scale @ A1	1:150
Drawn	JL
Checked	JR
Approved	JR
Project No.	1534

Drawing Identifier — BS1192 / Uniclass Compliant

project	zone	level	file type	role	uniclass	number	revision
1534	XX	R01	DFP	MS	G76	001	A

Print Date: 19/04/2017 08:58:06

A1

Flue Dilution Intake

Flue Dilution Exhaust

Heat Rejection Intake Louvre

Heat Rejection Equipment

TWIN EXTRACT
FAN 2

Electrical Riser

Rise from L/L to H/L

In-Line EF3

Boiler Flue Riser

Electrical Riser

Roof louvre above lower Tier floor
(Kitchen air supply)

Kitchen extract rising from below and connecting to louvres in facade.

Heat Recovery Fresh Air Supply / Extract Units
HRU 1 & 2

Changing Area AHU

Exhaust duct to grille in roof

FA Supply

AHU 3

Linear Diffuser

Linear Diffuser

Notes

1. Refer to Architects and Structural Engineers drawings for building details.

2. Dimensions to be checked on site before any works is put in hand or prefabricated.

3. Figured dimensions where shown are in millimeters.

4. This drawing is to be read in conjunction with the relevant Technical Specification and the Contractors working drawings.

5. For purpose of construction, this drawing must not be scaled. Only written or calculated dimensions should be used.

6. The position of all equipment is approximate as shown. The precise positions shall be agreed on site with other trades and Architects scaled layouts.

Location Key Plan (Not to Scale)

Rev	Description / By / Chk'd / Appr'd	Date
A	Updated layout	18.04.2017
#	Issued for Information	23.11.2015

Purpose of Issue

Information

London

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Client

Robin Mallin

Project

Soho House Brighton

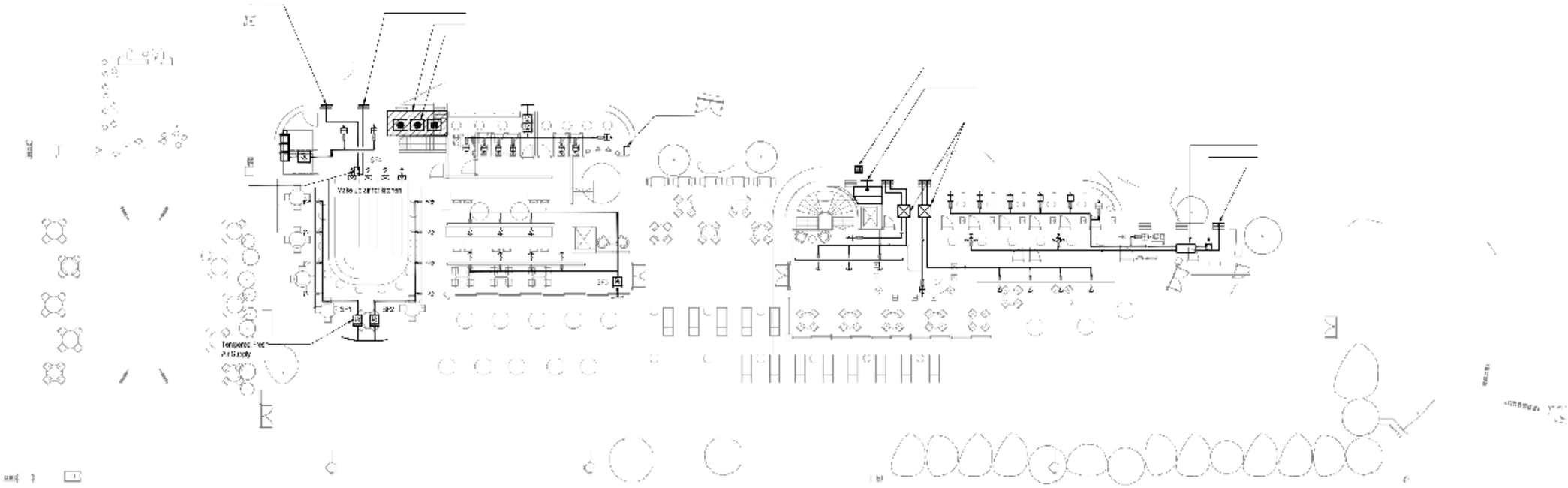
Drawing

Mechanical Services
Proposed Upper Tier Plan

Date	05.08.2016
Scale @ A1	1:150
Drawn	JL
Checked	JR
Approved	JR
Project No.	1534

Drawing Identifier BS1192 / Uniclass Compliant
project zone level file type role uniclass number revision

Print Date: 19/04/2017 08:58:24



ASHP 5 to AP1a

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Noise Source									
Noise Source - ASHP 5									
Sound Pressure Levels @ 1m		**72.0**	**63.0**	**60.0**	**55.0**	**48.5**	**44.0**	**38.5**	**33.0**
Full Conformal Area									
Conformal Distance (m)	1.0								
Type - Semi-anechoic									
		14.5	*14.5*	*14.5*	*14.5*	*14.5*	*14.5*	*14.5*	*14.5*
Lw to LpRev (Src In Room)									
Receiver - PR2									
		-6.1	*-6.1*	*-6.1*	*-6.2*	*-6.2*	*-6.2*	*-6.6*	*-6.9*
Rev to Free Field									
Scenario - Small Room, Refl Surface									
		-6.0	*-6.0*	*-6.0*	*-6.0*	*-6.0*	*-6.0*	*-6.0*	*-6.0*
Silencer									
Silencer - AL 2									
		-5.0	*-7.0*	*-10.0*	*-12.0*	*-14.0*	*-16.0*	*-13.0*	*-12.0*
Rathe Distance Loss									
Shortest Dim (m)	4.0								
Longest Dim (m)	5.0								
Distance (m)	33.0								
		-27.3	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*	*-27.3*
Facade Reflection									
Reflection (dB)	2.5								
		2.5	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*

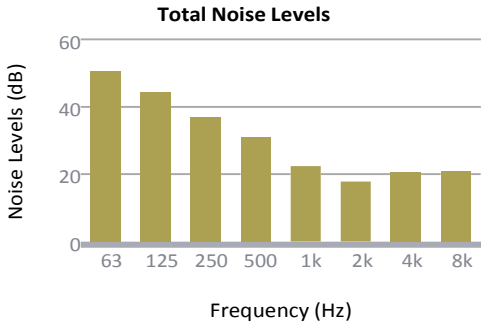
	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
External Receiver								
External Receiver - AP1a								
Sound Pressure, Lp	**44.6**	**33.6**	**27.6**	**20.5**	**12.0**	**5.5**	**2.5**	**-2.2**

EF 5o to AP1a

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
Noise Source									
Noise Source - EF 5o									
Sound Power Levels		**83.0**	**85.0**	**84.0**	**84.0**	**77.0**	**78.0**	**78.0**	**64.0**
Silencer									
Silencer - AS 5									
		-9.0	*-19.0*	*-36.0*	*-45.0*	*-47.0*	*-38.0*	*-25.0*	*-15.0*
Bend Loss CJ									
Dimension (mm)	600.0								
No. of Bends (no.)	1.0								
Type - Unlined Square Bend - With Vanes									
		0.0	*0.0*	*-1.0*	*-2.0*	*-3.0*	*-3.0*	*-3.0*	*-3.0*
End Reflection									
Width/Diameter (m)	0.6								
Length (m)	0.6								
Rec or Circ - Rectangular									
Free or Flush - Flush									
		-7.3	*-2.9*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
External Grille Directivity									
Width (m)	0.6								
Height (m)	0.6								
Vertical (°)	0.0								
Horizontal (°)	45.0								
		0.5	*1.5*	*2.0*	*2.8*	*3.2*	*4.0*	*4.0*	*4.0*

		Octave Band Centre Frequency (Hz)							
		63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
Point Source Radiation Loss									
Radiation - Quarterspherical									
		-5.0	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*	*-5.0*
Point Source Distance Loss									
End Distance (m)	49.0								
		-33.8	*-33.8*	*-33.8*	*-33.8*	*-33.8*	*-33.8*	*-33.8*	*-33.8*
Facade Reflection									
Reflection (dB)	2.5								
		2.5	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*	*2.5*
External Receiver									
External Receiver - AP1a									
Sound Pressure, Lp		**30.9**	**28.4**	**12.7**	**3.5**	**-6.0**	**4.7**	**17.7**	**13.7**

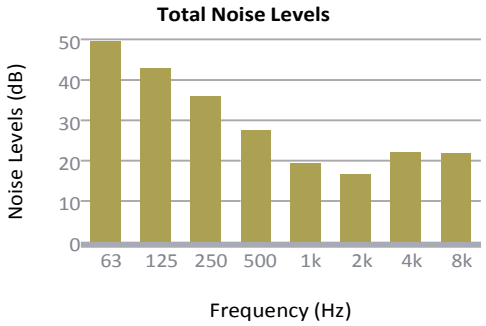
Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP1a
Description	New Madeira Hotel (all plant)
Noise Limit	35
dBA	34



Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
AHU 2i	39	31	17	-1	-17	-23	-28	-18
EF 4o	26	22	17	9	-4	-5	-1	-6
EF 5o	31	28	13	3	-6	5	18	14
AHU 3b	20	22	9	3	-3	-7	-15	-31
AHU 3i	23	23	15	0	-11	-16	-23	-30
AHU 3d	25	25	17	3	-10	-15	-19	-18
EF 2o	36	32	31	19	4	7	5	6
EF 3b	36	38	21	10	1	-3	-9	-24
EF 3o	31	38	9	-4	-2	10	13	17
SF 1i	23	20	13	-3	-7	-9	-17	-29
SF 2i	23	20	13	-3	-7	-9	-17	-29
SF 3i	23	20	13	-4	-7	-9	-17	-29
HRU 1i	18	13	11	9	3	4	3	5
HRU 1d	21	21	12	10	-4	-4	2	14
HRU 2i	27	20	20	5	4	7	6	0
HRU 2d	29	21	22	3	-1	-1	1	10

Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
HRU 3i	17	12	14	1	-1	-5	-16	-28
HRU 3d	21	16	17	-2	-4	-4	-12	-16
HRU 4i	15	11	13	2	-3	-7	-18	-30
HRU 4d	19	15	16	-1	-6	-6	-14	-18
ASHP 1	33	22	16	9	0	-6	-9	-14
ASHP 2	33	22	16	9	0	-6	-9	-14
ASHP 3	45	34	28	20	12	5	3	-2
ASHP 4	45	34	28	20	12	5	3	-2
AHU 1i	28	31	28	23	13	9	7	5
AHU 1d	30	32	24	24	18	9	9	8
EF 1o	21	22	22	25	15	8	5	0
ASHP 5	45	34	28	20	12	5	3	-2

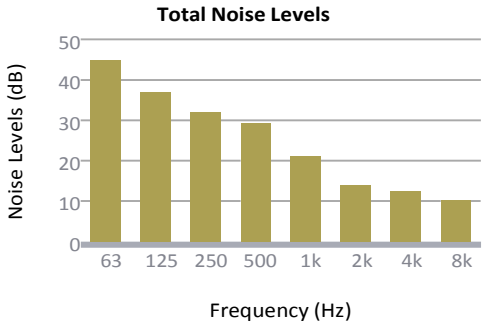
Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP2a
Description	Van Alen Building (all plant)
Noise Limit	35
dBA	33



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AHU 2i	43	35	20	2	-14	-20	-25	-15
EF 4o	29	26	20	13	-1	-2	2	-3
EF 5o	34	32	16	7	-3	8	21	17
AHU 3b	28	30	17	11	5	1	-7	-23
AHU 3i	31	32	24	10	-1	-6	-13	-20
AHU 3d	33	33	25	11	-2	-7	-11	-10
EF 2o	34	30	28	15	0	1	-1	0
EF 3b	30	33	16	4	-4	-8	-15	-29
EF 3o	26	32	3	-10	-8	4	7	11
SF 1i	20	18	12	-3	-10	-12	-20	-32
SF 2i	20	18	12	-3	-10	-12	-20	-32
SF 3i	23	21	14	-1	-8	-10	-18	-29
HRU 1i	21	17	15	13	6	7	6	8
HRU 1d	24	25	16	14	-1	-1	5	17
HRU 2i	30	24	24	9	7	10	9	3
HRU 2d	32	25	26	7	2	2	4	13

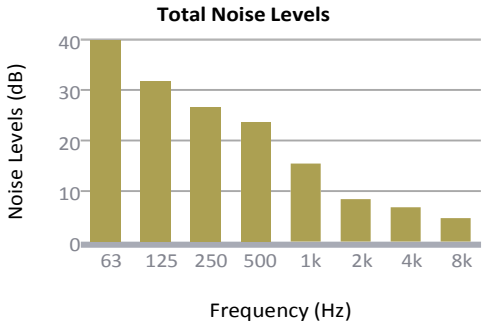
Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
HRU 3i	20	15	17	5	2	-2	-12	-24
HRU 3d	24	19	20	2	-1	-1	-8	-12
HRU 4i	22	18	19	7	5	0	-10	-22
HRU 4d	26	22	22	4	2	1	-6	-10
ASHP 1	41	30	24	17	9	2	-1	-6
ASHP 2	41	30	24	17	9	2	-1	-6
ASHP 3	40	29	23	16	7	1	-2	-7
ASHP 4	40	29	23	16	7	1	-2	-7
AHU 1i	23	25	22	17	7	3	1	-1
AHU 1d	25	26	18	18	12	3	3	2
EF 1o	16	16	16	19	9	2	-1	-6
ASHP 5	40	29	23	16	7	1	-2	-7

Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP1g
Description	New Madeira Hotel (gym plant)
Noise Limit	32
dBA	30



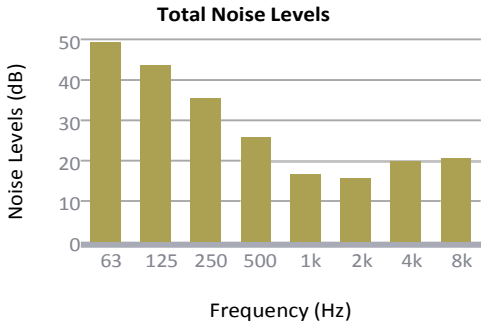
Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AHU 1i	28	31	28	23	13	9	7	5
AHU 1d	30	32	24	24	18	9	9	8
EF 1o	21	22	22	25	15	8	5	0
ASHP 5	45	34	28	20	12	5	3	-2

Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP2g
Description	Van Alen Building (gym plant)
Noise Limit	32
dBA	25



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AHU 1i	23	25	22	17	7	3	1	-1
AHU 1d	25	26	18	18	12	3	3	2
EF 1o	16	16	16	19	9	2	-1	-6
ASHP 5	40	29	23	16	7	1	-2	-7

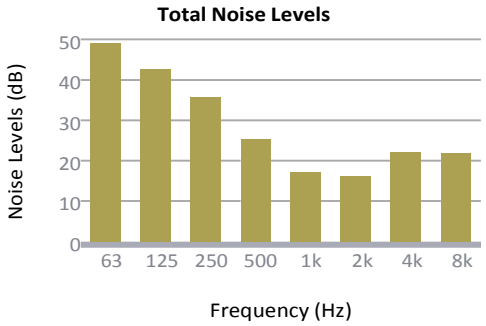
Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP1c
Description	New Madeira Hotel (club plant)
Noise Limit	32
dBA	32



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AHU 2i	39	31	17	-1	-17	-23	-28	-18
EF 4o	26	22	17	9	-4	-5	-1	-6
EF 5o	31	28	13	3	-6	5	18	14
AHU 3b	20	22	9	3	-3	-7	-15	-31
AHU 3i	23	23	15	0	-11	-16	-23	-30
AHU 3d	25	25	17	3	-10	-15	-19	-18
EF 2o	36	32	31	19	4	7	5	6
EF 3b	36	38	21	10	1	-3	-9	-24
EF 3o	31	38	9	-4	-2	10	13	17
SF 1i	23	20	13	-3	-7	-9	-17	-29
SF 2i	23	20	13	-3	-7	-9	-17	-29
SF 3i	23	20	13	-4	-7	-9	-17	-29
HRU 1i	18	13	11	9	3	4	3	5
HRU 1d	21	21	12	10	-4	-4	2	14
HRU 2i	27	20	20	5	4	7	6	0
HRU 2d	29	21	22	3	-1	-1	1	10

Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
HRU 3i	17	12	14	1	-1	-5	-16	-28
HRU 3d	21	16	17	-2	-4	-4	-12	-16
HRU 4i	15	11	13	2	-3	-7	-18	-30
HRU 4d	19	15	16	-1	-6	-6	-14	-18
ASHP 1	33	22	16	9	0	-6	-9	-14
ASHP 2	33	22	16	9	0	-6	-9	-14
ASHP 3	45	34	28	20	12	5	3	-2
ASHP 4	45	34	28	20	12	5	3	-2

Project Name	Soho House, Brighton
Project Reference	16/0368
Receiver Reference	AP2c
Description	Van Alen Building (club plant)
Noise Limit	32
dBA	32



Reference	Noise Levels (dB)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AHU 2i	43	35	20	2	-14	-20	-25	-15
EF 4o	29	26	20	13	-1	-2	2	-3
EF 5o	34	32	16	7	-3	8	21	17
AHU 3b	28	30	17	11	5	1	-7	-23
AHU 3i	31	32	24	10	-1	-6	-13	-20
AHU 3d	33	33	25	11	-2	-7	-11	-10
EF 2o	34	30	28	15	0	1	-1	0
EF 3b	30	33	16	4	-4	-8	-15	-29
EF 3o	26	32	3	-10	-8	4	7	11
SF 1i	20	18	12	-3	-10	-12	-20	-32
SF 2i	20	18	12	-3	-10	-12	-20	-32
SF 3i	23	21	14	-1	-8	-10	-18	-29
HRU 1i	21	17	15	13	6	7	6	8
HRU 1d	24	25	16	14	-1	-1	5	17
HRU 2i	30	24	24	9	7	10	9	3
HRU 2d	32	25	26	7	2	2	4	13

Reference	Noise Levels (dB)							
	63	125	250	500	1k	2k	4k	8k
HRU 3i	20	15	17	5	2	-2	-12	-24
HRU 3d	24	19	20	2	-1	-1	-8	-12
HRU 4i	22	18	19	7	5	0	-10	-22
HRU 4d	26	22	22	4	2	1	-6	-10
ASHP 1	41	30	24	17	9	2	-1	-6
ASHP 2	41	30	24	17	9	2	-1	-6
ASHP 3	40	29	23	16	7	1	-2	-7
ASHP 4	40	29	23	16	7	1	-2	-7

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