

# 65 Fleet Street London

## RIBA Stage 3 Acoustic Report

27804/RS3

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For:  
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## RIBA Stage 3 Acoustic Report 27804/RS3

### Document Control

Rev	Date	Comment	Prepared by	Authorised by
Stage 3 Issue	14/05/2021	-		
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## **RIBA Stage 3 Acoustic Report 27804/RS3**

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## **Attachments**

Draft Form of Words for Tenants Handbook

Acoustic Specification for Lifts

Acoustic Specification for Internal/Atrium Glazing

Plant Noise Schedule

Attenuator Schedule

Vibration Isolation Schedule



## 1.0 Acoustic Design Criteria

The acoustic design criteria are in accordance with the following, unless noted herein:

- British Standard BS8233: 2014 “Guidance on sound insulation and noise reduction for buildings”.
- British Standard BS6472-1: 2008 “Guide to evaluation of human exposure to vibration in buildings”.
- British Council for Offices Guide to Specification 2019.
- BREEAM Hea05 and Pol05.
- CIBSE Guides issued by the Chartered Institution of Building Services Engineers.
- City of London planning requirements.
- Statutory noise nuisance legislation.

BREEAM recommends that the indoor ambient noise level criteria detailed within BS8233 should be achieved in order to satisfy the Hea05 credit. For office space, BS8233 in turn references the guidance provided by BCO. Therefore, by adopting the recommendations within BS8233 and BCO, the BREEAM criteria for Hea05 should be met.

## 2.0 External Building Fabric

### 2.1 Office Areas

External noise intrusion levels will be controlled to achieve NR38  $L_{eq,T}$  when the office floor space is fitted out to a Cat A level of finish. In addition, to avoid speech interference, regular individual noise events should not normally be more than 55 dB  $L_{A01,1 \text{ hour}}$ .

The above is based on BCO 2019 guidance for speculative offices and is a compromise between the ideals for open plan and cellular offices.

There is an atrium in the South Building. Rain noise should be controlled so it does not exceed 60 dB  $L_{Aeq,T}$  in the office spaces during heavy rainfall (as defined within BS EN ISO 140-18:2006 Acoustics - Measurement of sound insulation in buildings and of building



elements - Part 18: Laboratory measurement of sound generated by rainfall on building elements).

## 2.2 Reception

No specific acoustic criteria are proposed for external noise intrusion into the reception areas, since this is normally dictated by the (often open) entrance doors.

## 3.0 Internal Sound Insulation

BCO Guide to Specification 2019 states:

### ***“Sound Insulation Across Floors***

*Vertical sound level difference between individual office floors should be at least  $D_{nT,w}$  45 dB at shell and core stage or at least  $D_{nT,w}$  48 dB if fitted to Cat A standards. This is when tested in accordance with BS EN ISO 16283-1:2014 Acoustics - Field measurement of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation and rated in accordance with BS EN ISO 717-1: 2013 Acoustics. Rating of sound insulation in buildings and of building elements. Where mock-up rooms are used for testing, they should have a floor area of no more than 20 m<sup>2</sup> to ensure that the sound field is uniform and ideally include a section of façade. The façade design and specification should include this requirement. Where it is envisaged that the fit-out may not include a ceiling, the shell and core shall achieve  $D_{nT,w}$  48 dB without the need for further enhancement later - which may necessitate enhancing some elements -e.g. the slab edge detail.*

*Impact noise due to footfall in office areas should be controlled. This is normally achieved with carpet, but where hard floor finishes are proposed additional impact sound control will be required both to control sound to adjacent areas and within the space itself. A weighted standardised impact sound pressure level ( $L_{nT,w}$ ) of 60 dB is considered a reasonable maximum value for floors over office areas. Individual situations that may require superior impact sound insulation should also be considered.*

### ***Sound Insulation Across Demise Walls Between Different Occupiers***

*Demise walls, separating different office occupiers, should give a sound level difference of at least  $D_{nT,w}$  48 dB when tested in accordance with BS EN ISO 16283-1:2014 and rated in accordance with BS EN ISO 717-1: 2013.*



*Where mock-up rooms are used for testing, they should have a floor area of no more than 20 m<sup>2</sup> - to ensure that the sound field is uniform - and ideally include a section of external facade. Demise walls separating offices from non-office uses may require enhancement depending on the non-office use.*

### **Mullions Within Occupier Spaces**

*The sound insulation requirement for internal partitions within individual occupier office areas will depend on the desired degree of privacy and the levels of background masking noise. (See BCO Guide to Fit Out.)*

*Flanking transmission horizontally across cladding mullions at potential partitions locations should achieve a weighted normalised flanking level difference of at least  $D_{nf,w}$  45 dB when tested in a laboratory in general accordance with BS EN ISO 10848-2: 2017 Acoustics. Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms and rated in accordance with BS EN ISO 717-1: 2013.*

*Flanking constructions should be capable of being upgraded in the occupier (Cat B) fit out to at least  $D_{nf,w}$  53 dB to accommodate high performance partitions required for special areas. This may necessitate over-cladding mullions with a dense material such as steel to either side. The façade design and specification should include this requirement."*

## **3.1 Atrium Glazing**

The atrium glazing shall comply with the enclosed Acoustic Specification for Atrium Glazing.

## **3.2 Floor Constructions**

With regard to sound insulation across floors, the guidance presented in BCO 2019 is as presented above.

We understand the floor slab constructions for the existing and new floors are as follows:

- North Building- 175mm slab -Drawing 1046-ID-01
- South Building (Existing Floors)- 130mm slab- Drawing 1046-ID-02
- South Building (New Floors)-130mm profiled metal deck- Drawing 1046-ID-03



We are pleased to confirm that provided the cladding and the slab edge details comply with the requirements stated above, we would expect the above constructions to be capable of satisfying the BCO guidance for airborne sound insulation between typical office floors.

Drawing reference 1046-ID-70 shows the flanking detail of the slab edge to the atrium in the South Building. We are pleased to confirm that provided the cladding and the slab edge details comply with the BCO requirements stated above, we would expect the above constructions to be capable of satisfying the BCO guidance for airborne sound insulation between typical office floors.

Impact noise due to footfall in office areas should be controlled. This is normally achieved with carpet, but where hard floor finishes are proposed additional impact sound control will be required both to control sound to adjacent areas and within the space itself. A weighted standardised impact sound pressure level ( $L_{nT,w}$ ) of 60 dB is considered a reasonable maximum value for floors over office areas.

### 3.3 Party/Demise Wall/Floor Constructions

Planning Condition Number 9 states:

*“The proposed office development sharing a party element with non-office premises shall be designed and constructed to provide resistance to the transmission of sound. The sound insulation shall be sufficient to ensure that NR40 is not exceeded in the proposed office premises due to noise from the neighbouring non-office premises and shall be permanently maintained thereafter. A test shall be carried out after completion but prior to occupation to show the criterion above have been met and the results shall be submitted to and approved in writing by the Local Planning Authority.*

*REASON: To protect the amenities of occupiers of the building in accordance with the following policy of the Local Plan: DM15.7.”*

We understand that the floor slab between tenant's areas and offices within the North Building is a 175mm thick concrete slab. This should provide reasonable airborne sound insulation. Should any additional measures be required this shall be the responsibility of the tenants.

Details of party walls between Landlord and Tenants areas will be detailed in RIBA Stage 4.



Tenants shall be responsible for controlling noise and vibration from their plant and activities. A draft form of words for inclusion in the tenant's handbook regarding acoustics is enclosed.

### 3.4 Internal Wall Constructions

Advice concerning internal wall performances and constructions will be developed in RIBA Stage 4, commensurate with appropriate sound insulation requirements.

### 3.5 Acoustic Privacy and Electronic Sound Masking

BCO Guide to Specification 2019 states:

*“The level of acoustic privacy attained between two areas is normally associated with the absence of intelligible speech from the adjacent area. If speech is audible from one room to another, it may not be a cause of distraction provided intelligibility is low. Acoustic privacy between two areas is dependent upon:*

*The sound attenuation between source and receiver locations. In an open plan environment, the attenuation over any given distance depends on any acoustic screening blocking the direct noise transmission path and the acoustic absorption of the soffit to reduce primary reflections.*

*The background noise level in the speech frequency range in the receive location to mask unwanted noise. This would typically comprise a combination of building services and road traffic noise, plus electronic sound masking if installed.*

*Acoustic privacy, whether in an open plan or cellular situation, requires steady, moderate, background noise to mask unwanted sounds. Modern energy-efficient air conditioning systems and office equipment can be quiet and, as a result, offices are often too quiet to achieve reasonable acoustic privacy.*

*Where noise levels at speech frequencies are often likely to be significantly below the recommended NR levels, especially in the critical speech frequencies, an electronic sound masking system may be installed as part of the Cat B occupier fit out.*

*Sound masking is provided by an electronic system that produces a constant background noise – via a grid of speakers that is generally suspended in the ceiling void.*





*Although the concept of artificially elevating noise levels may appear to conflict with the normal desire to reduce sounds, it is important to distinguish between wanted and unwanted sounds. Sound masking generates a characterless broad band noise – like the sound of a fan – to which occupants become virtually oblivious after a brief acclimatisation period.*

*Sound masking systems can now be addressable and programmed to reset to suit changes in the environment.”*

## 4.0 Control of Reverberation

Room finishes affect the acoustic environment. Acoustically reflective surfaces can reinforce unwanted noise and reduce speech privacy in open plan areas. Sound absorbing finishes reduce the reverberant noise build-up from sources both inside and outside the office space. The most effective method of controlling reverberant sound is through the provision of an acoustically absorbent finish to the ceiling or exposed soffit. This reduces sound from primary reflections and thus assists acoustic privacy in open plan/shared work spaces.

Sound absorption is measured using the coefficient alpha ( $\alpha$ ), which has a value from 0.0 and 1.0. A surface with a value of 0.0 absorbs no sound and a surface with a value 1.0 absorbs all the incident sound. Acoustic materials are classed on a scale from A to E, with A-rated products having the highest rated sound absorption performance, as illustrated in Figure 1.

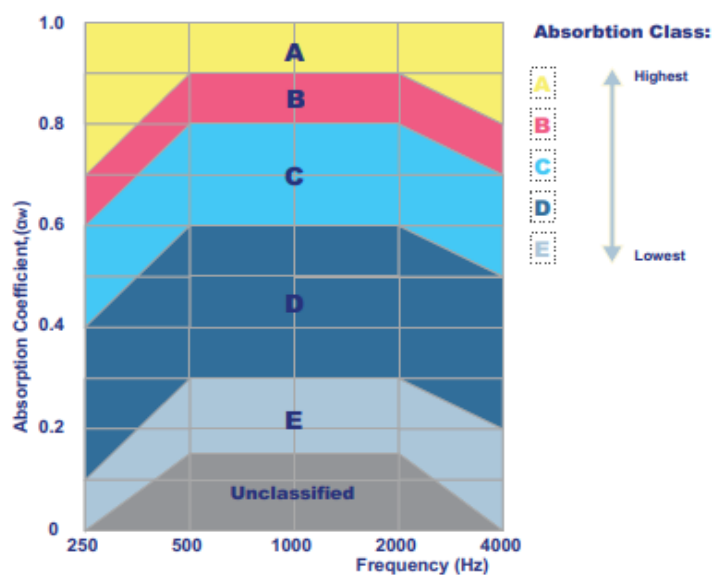


Figure 1. Absorption Classes



These octave band absorption coefficients are also shown in the table below.

Absorption Class	Minimum Practical Absorption Coefficient ( $\alpha_p$ ) at Octave Band Centre Frequency (Hz)				
	250	500	1k	2k	4k
Class A	0.7	0.9	0.9	0.9	0.8
Class B	0.6	0.8	0.8	0.8	0.7
Class C	0.4	0.6	0.6	0.6	0.5
Class D	0.1	0.3	0.3	0.3	0.2
Class E	0.0	0.15	0.15	0.15	0.0

Typically, a Cat A fit out includes an acoustically absorbent suspended ceiling achieving Absorption Class A (ref BS EN ISO 11654:1997 Acoustics. Sound absorbers for use in buildings. Rating of sound absorption), which extends over all areas except for light fittings, air diffusers, grilles and relatively narrow plasterboard margins. However, recent trends towards exposed services and soffits mean that Cat A installations may include little or no acoustic absorption. Where an acoustically absorbent suspended ceiling is not provided, the soffit may be treated with alternative absorption products instead.

#### 4.1 Acoustic Absorption Examples

There are a wide range of alternative options for providing acoustic absorption to the soffit. (See images below).



*Suspended Acoustically Absorbent Ceiling*



*Vertical Acoustic Baffle*



*Rectangular Acoustic Raft*



*Circular Acoustic Raft*



*Melamine Foam to Soffit*



*Chilled Beam with Acoustic Absorption*



*Acoustic Plaster*



*Stretched Fabric Panels*



The following table gives some ideas of the types of product that could be expected to achieve each Absorption Class:

Absorption Class	Example Products
A	<ul style="list-style-type: none"><li>• 40mm mineral fibre panels (e.g. Ecophon or similar) direct fixed (overall system depth 50mm).</li><li>• 20mm mineral fibre lay-in-grid ceiling tile on 200mm airspace.</li><li>• 40mm acoustic plaster, 200mm suspension</li><li>• 40mm acoustic rafts hanging 400mm below the soffit to approximately 85% coverage (depending on product).</li></ul>
B	<ul style="list-style-type: none"><li>• 40mm acoustic Plaster, fine finish</li><li>• Gyptone Quattro Sixto 60 (or similar) perforated plasterboard tiles, 17% open area, sound absorbent backing.</li><li>• 40mm acoustic rafts hanging 400mm below the soffit to approximately 75% coverage (depending on product).</li></ul>
C	<ul style="list-style-type: none"><li>• 30mm acoustic plaster, coarse finish</li><li>• 25mm mineral fibre panel, direct fixed</li><li>• Gyptone Quattro 41 (or similar) perforated plasterboard, 16% open area, sound absorbent backing.</li><li>• 40mm acoustic rafts hanging 400mm below the soffit to approximately 55% coverage (depending on product).</li><li>• 600mm vertical acoustic baffles hung 600mm apart, approximately 90% coverage (depending on product).</li></ul>
D	<ul style="list-style-type: none"><li>• Gyptone Quattro 47 perforated plasterboard or similar, sound absorbent backing.</li><li>• 40mm acoustic rafts hanging 400mm below the soffit to approximately 30% coverage (depending on product).</li><li>• 600mm vertical acoustic baffles hung 600mm apart, approximately 50% coverage (depending on product).</li></ul>

N.B. Above raft/baffle examples are based on Ecophon Solo range of products.

## 4.2 Relevant Guidance

### 4.2.1 British Council for Offices

BCO 2019 states:

*“Where an acoustically absorbent ceiling achieving Absorption Class A, or acoustically equivalent soffit treatment, is not provided, the base-build definition (BBD) should clearly state that what provisions are to be made for sound absorbing finishes in the offices. It is likely that the level of information provided could vary between developments but, as a minimum, it is envisaged that either the total quantity of acoustic absorption ( $m^2$  Sabines in the 500 Hz, 1kHz and 2kHz octave bands) for each treatment type, or the predicted mid-frequency reverberation time ( $T_{mf}$  i.e. the average of the 500 Hz, 1kHz and 2kHz octave band values), should be stated.*



*The BBD should draw explicit attention to occupiers to consider potential augmentation of sound absorbing finishes in the offices for the purposes of acoustic privacy and, in certain cases where the evacuation strategy utilises a voice alarm system, any additional sound absorption they need to introduce as part of the fit out works to achieve the speech intelligibility target agreed with the district surveyor/approved inspector.”*

#### 4.2.2 BREEAM

BREEAM UK New Construction: *Non-Domestic Buildings Technical Manual* 2018 gives the following guidance:

*“Acoustic environment (control of reverberation and sound absorption): Achieve the requirements relating to sound absorption and reverberation times, where applicable, set out in Section 7 of BS 8233: 2014.”*

#### 4.2.3 BS 8233

British Standard BS 8233: 1999 (now superseded but arguably better written on this matter) provides following typical reverberation times for rooms used for speech, based on their volume.

Room Volume m <sup>3</sup>	Reverberation Time, <i>T</i> , seconds
50	0.4
100	0.5
200	0.6
500	0.7
1,000	0.9
2,000	1.0

BS 8233: 2014 “Guidance on sound insulation and noise reduction for buildings” gives the following guidance:

*‘The design objective for internal ambient noise level is reasonable listening conditions. This requires a low level of background noise and a fairly short reverberation time...The optimum values for reverberation time also vary with frequency (pitch) of the sound. Guide values of *T* for rooms of different volume can be found in standard texts, e.g. Noise control in building services.’ See below.*



Furthermore, BS 8233 2014 also states:

*“Low ceilings and absorbent ceilings can assist in reducing sound transmission between workstations. Where ceilings are higher than 3m, it is more difficult to provide acceptable acoustic conditions in open-plan offices with absorption coverage lower than Class A. Where exposed soffits are used additional absorption might be required. Carpet having good sound-absorbent properties is a desirable floor finish.”*

#### 4.2.4 Noise Control in Building Services Reverberation Criteria

Figure 4.12 of *Noise Control in Building Services*, as referred to in BS8233:2014, gives design target reverberation times for conference rooms, executive offices and open plan offices dependent upon the room volume. This states that a mid-frequency reverberation time of approximately 0.3 seconds is preferable in rooms up to approximately 1,000m<sup>3</sup>, whereas open plan offices between 5,000m<sup>3</sup> and 10,000m<sup>3</sup> should have a mid-frequency reverberation time between 0.3 and 0.4 seconds.

N.B. In our experience these reverberation times are unrealistically short.

### 4.3 Options

#### 4.3.1 South Building

We understand that that within the South Building it is proposed to remove the ceilings and allow for acoustic rafts and baffles;

We outline below some options and have tried to quantify their performance. This is based on an approximate total floor/soffit area of 2650 m<sup>2</sup> as per typical proposed office floor in the south building. We have assumed the office floor areas are covered with carpet.

Ceiling/Soffit Finishes (% of soffit area covered)	Approximate equivalent area of absorption applied to soffit (m <sup>2</sup> Sabines at mid frequencies)	Approximate Predicted mid frequency reverberation time (T <sub>mf</sub> (s))*	BCO Compliant
No acoustic treatment to soffit	0	1.2	Compliant provided BBD clearly states what provisions are made and draws explicit attention to occupiers of the need to consider potential augmentation. See Section 3.1 above.
25% Class A ceiling / 21% Horizontal Acoustic Rafts / 29% Vertical Acoustic Baffles	596	1.0	
50% Class A ceiling / 42% Horizontal Acoustic Rafts / 57% Vertical Acoustic Baffles	1193	1.0	





75% Class A ceiling / 63% Horizontal Acoustic Rafts / 86% Vertical Acoustic Baffles	1789	0.9	
Acoustic Plaster sprayed to all available areas of the soffit (90% coverage assumed)**	2266	0.9	Compliant provided BBD clearly states what provisions are made
90% Class A ceiling / 76% Horizontal Acoustic Rafts	2147	0.9	Yes

\*Measured reverberation times on unoccupied floors may be higher than above due to discrete reflections between distant parallel surfaces.

\*\*The above assessment is based on SonaSpray K13 16mm. Performance may vary depending on selected product and thickness.

We would be happy to provide an audio simulation to better understand the above tables if required.

#### 4.3.2 North Building

We understand that that within the North Building it is proposed to remove the ceilings however, the lower ceiling heights have implications for rafts or baffles.

We outline below some options and have tried to quantify their performance. This is based on an approximate total floor/soffit area of 549 m<sup>2</sup> as per typical proposed office floor in the north building. We have assumed the office floor areas are covered with carpet.

Ceiling/Soffit Finishes (% of soffit area covered)	Approximate equivalent area of absorption applied to soffit (m <sup>2</sup> Sabines at mid frequencies)	Approximate Predicted mid frequency reverberation time (T <sub>mf</sub> (s))*	BCO Compliant
No acoustic treatment to soffit	0	0.9	Compliant provided BBD clearly states what provisions are made and draws explicit attention to occupiers of the need to consider potential augmentation. See Section 3.1 above.
25% Class A ceiling / 21% Horizontal Acoustic Rafts / 29% Vertical Acoustic Baffles	124	0.8	
50% Class A ceiling / 42% Horizontal Acoustic Rafts / 57% Vertical Acoustic Baffles	247	0.7	
75% Class A ceiling / 63% Horizontal Acoustic Rafts / 86% Vertical Acoustic Baffles	371	0.6	
Acoustic Plaster sprayed to all available areas of the soffit (90% coverage assumed)**	469	0.6	Compliant provided BBD clearly states what provisions are made



90% Class A ceiling / 76% Horizontal Acoustic Rafts	445	0.6	Yes
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\*Measured reverberation times on unoccupied floors may be higher than above due to discrete reflections between distant parallel surfaces.

\*\*The above assessment is based on SonaSpray K13 16mm. Performance may vary depending on selected product and thickness.

We would be happy to provide an audio simulation to better understand the above tables if required.

We understand this matter will be further developed at Stage 4 and may result in acoustic baffles to match the south building.

#### 4.4 Summary

With reference to BCO 2019:

*“Where an acoustically absorbent ceiling achieving Absorption Class A, or acoustically equivalent soffit treatment, is not provided, the base-build definition (BBD) should clearly state that what provisions are to be made for sound absorbing finishes in the offices. It is likely that the level of information provided could vary between developments but, as a minimum, it is envisaged that either the total quantity of acoustic absorption ( $m^2$  Sabines in the 500 Hz, 1kHz and 2kHz octave bands) for each treatment type, or the predicted mid-frequency reverberation time ( $T_{mf}$  i.e. the average of the 500 Hz, 1kHz and 2kHz octave band values), should be stated.*

The BBD should draw explicit attention to occupiers to consider potential augmentation of sound absorbing finishes in the offices for the purposes of acoustic privacy and, in certain cases where the evacuation strategy utilises a voice alarm system, any additional sound absorption they need to introduce as part of the fit out works to achieve the speech intelligibility target agreed with the district surveyor/approved inspector. Finally, it is worth noting that if there is no suspended acoustic ceiling then some other acoustic implications include:

- Potential cost uplift for building services noise control because of the additional sound attenuation requirements.
- Potential requirement to enhance vertical sound insulation between floors i.e. across floor slabs and slab edge details.





- Where phased evacuation involving a voice alarm (VA) system is proposed, early discussion with the district surveyor/approved inspector are essential to ensure that the required levels of audibility and intelligibility are achieved.

## 5.0 Building Services Noise

### 5.1 Building Services Noise in Internal Areas

Noise generated by building services alone should not be more than the NR levels (ref BS 8233: 2014 Guidance on sound insulation and noise reduction for buildings, Annex B) when measured under Cat A standards in accordance with the Association of Noise Consultants Guidelines: Measurement of Sound Levels in Buildings (June 2020):

Area	Noise Rating Level
Speculative offices*:	NR38
Reception Areas	NR40
Retail/Restaurant	NR40
Lift lobbies	NR40
Circulation spaces	NR40
Toilets	NR45
Loading bays	NR55
Underground car parks	NR55

Note\*: The speculative office criterion is a compromise between that for open plan and cellular rooms

These criteria are based on building services noise being constant - for example as with the noise typically generated from fan coil units (FCUs) with constant fan speed. For variable air volume (VAV) systems some relaxation may be appropriate for worst case conditions (to +5 dB relaxation at maximum design duty) to avoid overdesign, provided these criteria are achieved under typical conditions. The Association of Noise Consultants Guidelines Part 1: Noise from Building Services 2011 says: "The typical duty may be taken to be that which is not exceeded for more than, say, 10 days of the year or 5 per cent of the operating time."

These criteria are also based on building services noise without a specific character. Where individual noise sources are impulsive or tonal, they shall be at least 5 dB lower (10 dB lower where the noise are both impulsive and tonal)".

Where noise levels are likely to be significantly below these NR levels, localised noise sources e.g. extract stub ducts, duct noise breakout, risers and plantrooms, should also be at least 5dB lower than indicated above and 10dB lower where the noise is both localised and either tonal or intermittent. This is an issue where building services noise sources are not enclosed by a suspended ceiling.



## 5.2 Building Services Noise to External Areas

Building services plant external noise emission levels will need to comply with the Local Authority's requirements and statutory noise nuisance legislation. Planning Condition Number 14 states:

- a) *The level of noise emitted from any new plant shall be lower than the existing background level by at least 10 dBA. Noise levels shall be determined at one metre from the window of the nearest noise sensitive premises. The background noise level shall be expressed as the lowest LA90 (10 minutes) during which plant is or may be in operation.*
- b) *Following installation but before the new plant comes into operation measurements of noise from the new plant must be taken and a report demonstrating that the plant as installed meets the design requirements shall be submitted to and approved in writing by the Local Planning Authority.*
- c) *All constituent parts of the new plant shall be maintained and replaced in whole or in part as often is required to ensure compliance with the noise levels approved by the Local Planning Authority.*

*REASON: To protect the amenities of neighbouring residential/commercial occupiers in accordance with the following policies of the Local Plan: DM15.7, DM21.3.*

BREEAM credit Pol 05 requires the following regarding noise emission from fixed items of plant at the development:

*"where the building does have noise-sensitive areas or buildings within 800m radius of the site, one credit can be awarded as follows:*

*Where a noise impact assessment in compliance with BS 7445 has been carried out and the following noise levels measured/determined:*

*Existing background noise levels at the nearest or most exposed noise-sensitive development to the proposed development or at a location where background conditions can be argued to be similar.*

*The rating noise level resulting from the new noise source (see CN4).*



*The noise level from the proposed site/building, as measured in the locality of the nearest or most exposed noise-sensitive development, is a difference no greater than +5dB during the day (07:00 to 23:00) and +3dB at night (23:00 to 07:00) compared to the background noise level.”*

The Local Authority's requirements are more onerous and therefore by achieving them the requirements for the BREEAM Pol 05 criteria will also be met.

#### External Amenity Spaces

With regard to external amenity spaces, BS8233:2014 advises that:

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

Therefore, we would recommend that the noise from the proposed building services plant does not exceed 55 dBA at such amenity spaces.

### 5.3 Standby Plant

For standby plant, e.g. smoke extract fans and emergency generators - relaxations of the internal and external criteria are normally acceptable but should comply with the Local Authority's requirements and must not interfere with internal audible emergency alarms.

The Local Authority normally advise the following in relation to emergency plant:

*“Any generator on the site shall be used solely on intermittent and exceptional occasions when required in response to a life threatening emergency or an exceptional event requiring business continuity and for the testing necessary to meet that purpose and shall not be used at any other time. At all times the generator shall be operated to minimise noise impacts and emissions of air pollutants and a log of its use shall be maintained and be available for inspection by the Local Planning Authority.*

*REASON: To minimise adverse air quality in accordance with policies DM15.6 and DM 21.3 of the Local Plan and policies 7.14 B a and c of the London Plan.”*

It is proposed to install a standby generator in the basement. This generator has fresh air inlet ducts within the building and the associated fresh air exhaust ducts terminate at ground



floor level on Whitefriars Street. The combustion air flues terminate at roof level on the South Building.

Both sets of fresh air ducts shall be installed with atmospheric attenuators to control the noise in order to achieve a maximum cumulative noise level of 70dBA at 1m from the fresh air inlet duct and 60dBA at 1m from the fresh air outlet duct. The exhaust flues terminate at roof level on the South Building and shall be installed with atmospheric attenuators to control the noise in order to achieve a maximum cumulative noise level of 60dBA at 1m from the flue outlets.

The standby generator shall also be designed so as not to exceed NR45 in the worst affected office areas. Testing shall be undertaken outside normal office working hours.

Smoke extract systems shall be designed so as not to exceed NR55, in order that emergency announcements may be clearly audible.

## **5.4 Building Services Noise Control**

Plant will be selected, located and attenuated such that the aforementioned building services noise criteria are achieved. Further advice will be provided during the next RIBA Stage.

We would offer the following as general advice at this stage:

### **5.4.1 Attenuators**

Attenuators shall be selected such that the aforementioned criteria are achieved.

A preliminary attenuator schedule 27804/AS is enclosed. It is essential that all attenuators are manufactured in accordance with our "General Specification for Acoustic and Vibration Isolation Materials and Products" which is enclosed with this Report. This will ensure that attenuators are both mechanically and aerodynamically suitable.

The ideal location of attenuators is inside the plantroom, adjacent to the penetration of the plantroom structure. This ensures that noise breaking into the duct between the fan and the penetration is attenuated, and also that noise levels in the ductwork outside the plantroom are at a minimum so that noise breakout is controlled. Where fans are not situated within a plantroom, attenuators should be fitted as close to the fan as possible, whilst allowing a suitable plenum space, in order to minimise noise breakout from the ductwork.



## 5.4.2 System Generated Noise

### Volume Control Dampers

Volume control dampers near duct terminations should only be used to provide fine trimming of the air flow. If the dampers are likely to be used beyond fine trimming purposes (20% closed for 5m/s face velocity), 'damper silencers' may be required between the damper and duct terminal.

The level of noise generated by airflow across an opposed blade volume control damper is proportional to the airflow through the damper and the pressure drop across it. Listed below are recommended guideline maximum values for the product of airflow velocity through the fitting and the pressure drop across the fitting, for various damper locations.

VCD Location	Maximum Recommended Values Airflow Velocity (m/s) x Pressure Drop (Pa)
Extract Stub Duct	TBA
Supply Duct in Main Branch	600
Supply Duct in Terminal Branch	60

If for any damper its specific duty is such that the maximum values above are exceeded, then a silencer will be required on the "roomside" of the damper.

In order to reduce the possibility of any dampers causing excessive noise, we recommend that they are located as far from terminals as is practicable. If this approach is followed, the requirements for damper silencers will often be negated.

Any dampers located at terminals must be used strictly for fine trimming only.

Manufacturers shall specify the insertion losses expected from the silencers offered, under the operating conditions, with the data derived from tests carried out in accordance with BS 4718:1971.

### Ductwork

The general parameters for ductwork or pipework design, fabrication and installation are laid down in the relevant codes of practice (HVCA and CIBSE). In order to alleviate the most commonly occurring problems with duct services, the following items represent a list of good acoustic practices:



- i) Bends and bifurcations – 90° bends shall either be radiused type, or be fitted with equally short-cord turning vanes.
- ii) All branches shall be fitted with boots or coned as a standard practice.
- iii) Transitions shall be as gradual as possible within the physical limitations and it is preferred that one pair of sides remain parallel.
- iv) Duct velocities shall be limited to those specified in Table 21180/DV1.
- v) The aspect ratio in all main and branch duct runs for rectangular and flat oval ductwork should ideally not exceed 3:1. We would recommend that ductwork having higher aspect ratios be stiffened and we would be pleased to advise further on this matter if required.
- vi) All duct penetrations should be resiliently sleeved to prevent vibrational energy in duct transmitted to structures.

### **Pipework**

It is unlikely that the piped services associated with the building services plant will, if designed in accordance with HVCA/CIBSE recommendations produce any flow generated noise problems. It is worth noting, however, that the overall friction loss in pipework should be limited to 280 Pa/m across the range of pipes to be used.

#### **5.4.3 Plantroom Enclosures**

##### **Wall/Soffit Junctions**

It is imperative that the sound reduction afforded by plantroom walls is not compromised by leakage at the junction to the soffit. This can be done by making good with mortar to full depth. Alternative methods may also be acceptable but must be referred to, and agreed by ourselves.

##### **Masonry Walls**

All masonry walls shall:

- have full depth mortar joints
- be pointed to a good standard
- have interlaced junctions/corners
- be imperforate
- be laid “frogs” up (in the case of brickwork)

##### **Plaster/Render Finishes**

To ensure masonry walls are truly homogeneous in nature it is good acoustic practice to



apply a plaster or render finish to masonry walls. Provided walls have full depth mortar joints and are pointed to a good standard a plaster or render finish to one side only (slab to slab) is generally acceptable unless otherwise specified.

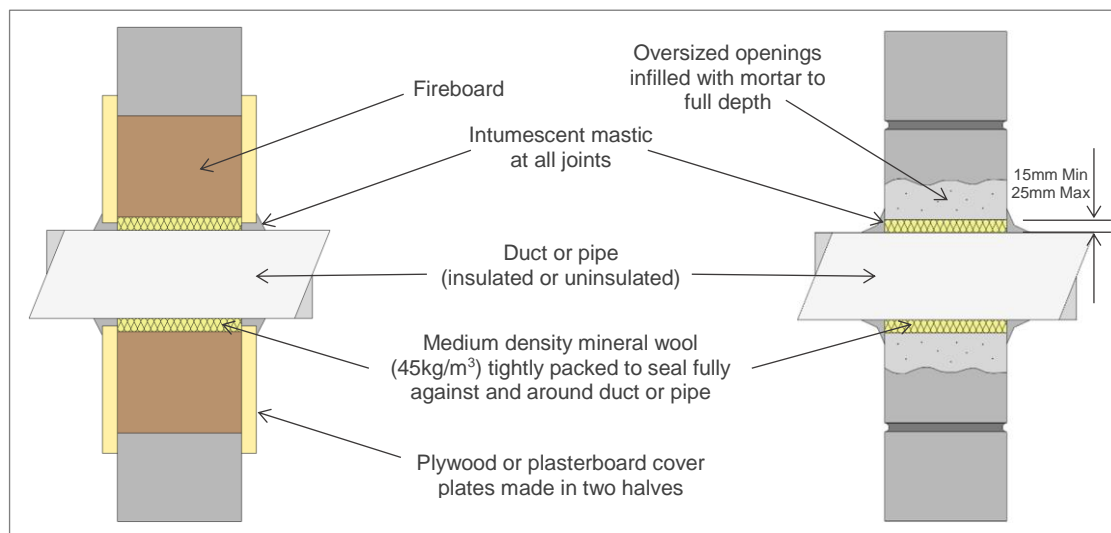
#### 5.4.4 Penetrations

All penetrations of plantroom structures by ducts, pipework, electrical cables etc should be adequately sealed acoustically.

Building services penetration of non-acoustically critical walls (i.e. between plantrooms) can be sealed using fire stopping material.

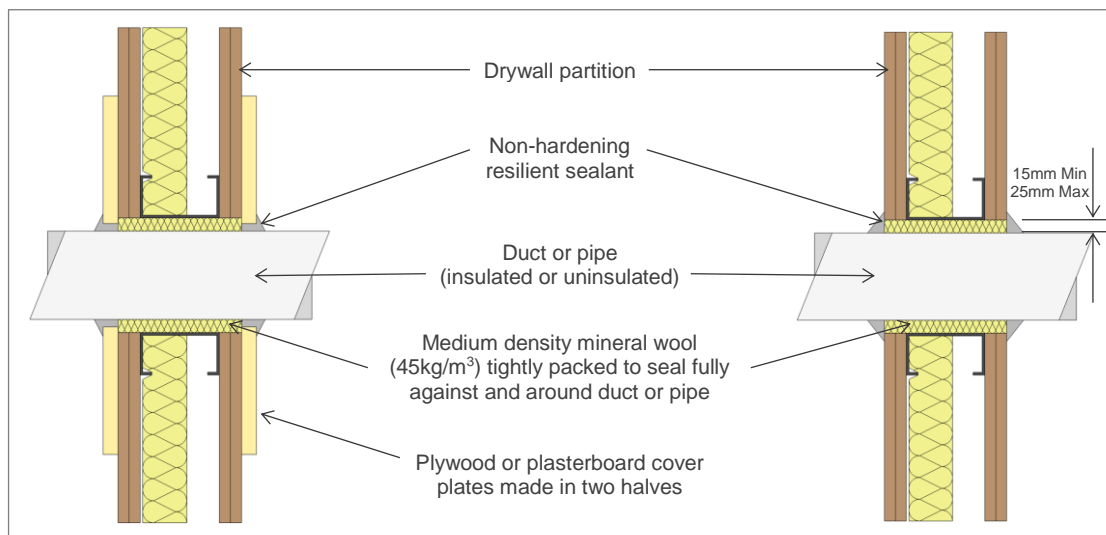
Where live ducts or pipes penetrate acoustically critical walls (i.e. walls with an acoustic specification), it is essential to acoustically sleeve the penetrations to prevent transmission of noise and vibration. This should be done by sleeving penetrations with a 25mm thickness of mineral wool having a density of at least  $80\text{kg/m}^3$ . Care should be taken to seal any gaps by means of heavy grout, and the whole should be finished with a liberal application of dense, soft, non-hardening mastic.

The following sketches show suitable details for duct and pipe penetrations through masonry constructions.



Sketch 1. Methods of sealing service penetrations through masonry constructions

The following sketches show suitable details for duct and pipe penetrations through drywall partitions.



Sketch 2. Methods of sealing service penetrations through drywall partitions

## 6.0 Building Services Vibration

Vibration transfer from building services plant to office floors should not exceed  $0.01 \text{ m/s}^2$  peak acceleration, based on  $W_b$  weighting as defined in Clause 3.3 of BS 6472-1: 2008 Guide to evaluation of human exposure to vibration in buildings.

All items of building services plant should be fitted with vibration isolators to control the transmission of vibration to the building structure. A preliminary vibration isolation schedule 27804/VIS is enclosed.

It is important that all AVM's are manufactured in accordance with our "General Specification for Acoustic and Vibration Isolation Materials and Products".

The following provides a general description of isolator requirements and installation procedures.

### i) Site Installation of Vibration Isolators

In order to provide trouble-free site installation, two single considerations will eliminate the most commonly occurring faults.

### ii) Isolator Adjustment

When raising equipment to its final position on vibration isolators, the isolators must be adjusted progressively.





Each isolator should be adjusted several turns at a time in sequence. The continued adjustment of a single mount will result only in the unit becoming coil bound and failure to lift the equipment.

### **iii) Pipework to Pumps, Chillers etc.**

Where isolated equipment is piped-up after installation, it is imperative that associated pipework is independently supported (with appropriate vibration isolators – see below) and does not transfer any load to the isolated equipment. Pipework should also not cause any shearing force to be transmitted to the isolated equipment.

### **iv) Pipework Isolation**

The use of flexible connectors as an interface between plant and associated pipework cannot be considered as adequate vibration isolation. Their use as thermal and shock compensators are well known, but even under nominal line pressures the connectors become acoustically rigid. It is, therefore, recommended that all active pipework should be isolated on resilient mountings/hangers up to the structural penetration adjacent to the service shaft, the first 100 pipe diameters or the first 10m of pipe run whichever is the greatest.

Thereafter oversized brackets having neoprene inserts would be advisable, generally for larger “live” pipework, but also for smaller “live” pipework where friction losses exceed 280Pa/m.

If flexible connectors are also required they should be located in the horizontal plane and be of the double arched type.

### **v) Ductwork Flexible Connections**

All ductwork connections to fans and air handling units should be flexible and at least 75mm long. These should be constructed from sound barrier mat having a minimum superficial density of at least 5kg/m<sup>2</sup>. These connections should be straight but not rigid, with no offset, in order to prevent turbulence.

### **vi) Electrical Connections**

It is important that isolated equipment is not mechanically shorted by the installation of



conduit or cable trays, etc., which are rigidly connected to the structure. Electrical connections to plant should, therefore, be made via a looped flexible conduit. The loop should form a diameter of 300mm or more.

## **7.0 Lifts**

Lift noise and vibration criteria, including within the lift car, lift lobbies and adjacent office areas, should be controlled to meet the enclosed Acoustic Specification for Lifts.

## **8.0 Tenant's Handbook**

Tenants shall be responsible for controlling noise and vibration from their plant and activities. A draft form of words for inclusion in the tenant's handbook regarding acoustics is enclosed. This should be a live document throughout the design and construction phases. We enclose a draft form of words below.

## DRAFT FORM OF WORDS FOR INCLUSION IN TENANT'S HANDBOOK REGARDING ACOUSTICS

### X ACOUSTICS

All designs, works, materials, installations and tolerances are to be fully in accordance with the following:

- Building Regulations
- British Standard BS 8233 "*Guidance on sound insulation and noise reduction for buildings*".
- British Standard BS 4142 "*Methods for rating and assessing industrial and commercial sound*".

CIBSE Guides issued by the Chartered Institution of Building Services Engineers.

- Planning Conditions and other requirements of the Local Authority, including Planning Condition Number 9 which states "*The proposed office development sharing a party element with non-office premises shall be designed and constructed to provide resistance to the transmission of sound. The sound insulation shall be sufficient to ensure that NR40 is not exceeded in the proposed office premises due to noise from the neighbouring non-office premises and shall be permanently maintained thereafter. A test shall be carried out after completion but prior to occupation to show the criterion above have been met and the results shall submitted to and approved in writing by the Local Planning Authority.*"
- Statutory noise nuisance legislation.
- Manufacturer's installation instructions, particularly those relating to acoustic matters.
- Other relevant British Standards and Codes of Practice.

Where more than one standard is applicable, the more onerous shall be achieved.

Any relaxation of the acoustic criteria described herein must be agreed in writing by the Landlord or his Acoustic Consultant.

Tenants are warned that in some cases the acoustic criteria contained herein will be difficult to achieve. Tenants are advised to engage an acoustic consultant at an early stage to identify and address the implications of these acoustic criteria.

## X.2 Atmospheric Noise Emissions

Tenants shall control noise from all of their sources (including mechanical services, amplified speech/music and activities) such that the total noise emissions from the development:

- a) Do not cause a statutory noise nuisance.
- b) Comply with the planning conditions and other requirements of the Local Authority.
- c) When measured in terms of  $L_{Aeq(5minutes)}$  they are at least the following amount below the prevailing background  $L_{A90(15minutes)}$  noise level at any time:

Description		Criterion $L_{Aeq(5minutes)}$		
Location	Assessment Location	All Plant (i.e. combined)	Individual Tonal or Intermittent mechanical service, amplified speech/music and activities.	Emergency Plant Tested up to 1hour/week between 09:00 and 17:00 hours Monday to Friday or 09:00 to 13:00 Saturday
Residential	1m outside any openable noise sensitive window	$L_{A90} -5dB$	$L_{A90} -10dB$	As per statutory requirements. See above
Office	1m outside any openable noise sensitive window	52dB or $L_{A90} -3dB$ , whichever is higher	50dB or $L_{A90} -5dB$ , whichever is higher	60dB or $L_{A90} +5dB$ , whichever is higher
Pavement	1m from façade, 1.8m above ground level	55dB or $L_{A90} +5dB$ , whichever is higher		60dB or $L_{A90} +10dB$ , whichever is higher

Note: Planning condition may be more onerous than above criteria.

All of the above criteria relate to the total noise levels from all sources within the development. Tenants shall therefore make appropriate allowances for contributing noise from all sources within the development. In the case of noise from amplified music and

activities this shall be calculated according to the tenant's demise area relative to the total relevant tenant areas, unless otherwise agreed. In the case of mechanical services this shall be calculated on a pro-rata basis according to the tenant's plant/louvre area relative to the total plant/louvre area, unless otherwise agreed.

The tenant shall employ an acoustic consultant to assess their design and shall make a full submittal of the acoustic performance of the proposed installation for landlord approval prior to commencing installation.

### **X.3 Noise and Vibration Transfer to Internal Areas**

Tenants shall control noise and vibration transfer from all of their sources (including mechanical services, amplified speech/music and activities) to internal areas beyond their demise such that:

- a) It does not cause a nuisance, disturbance or annoyance.
- b) It complies with Planning Condition Number 9 (see above)
- c) It does not exceed any acoustic criteria specifically agreed between the Landlord and other Tenants.
- d) It does not exceed the following Noise Rating (NR) levels.

Area	Criteria	Criteria for Music & Activities $L_{max(fast)}$
Offices/Management Suite	NR40	NR35
Retail Units, A3 Units, Circulation Areas, Landlord's Areas and Other Occupied Areas	NR40	NR40
Car Park ,service yards/Loading bays	NR50	NR55

- e) It does not give rise to audible tones or rattles.

- f) Vibration transfer from M&E services to internal occupied areas shall not exceed  $0.01\text{m.s}^{-2}$  peak based on the  $W_b$  weighting as defined within BS 6472-1: 2008 "Guide to Evaluation of Human Exposure to Vibration in Buildings".

Criterion (a) is ultimately the overriding requirement. Provided (a) is complied with in full, some relaxation of (b) (c) (d) and (e) may be permissible, but only at the Landlord's discretion. Compliance with (b) (c) (d) and (e) would however, in most cases, be considered as evidence tending to demonstrate compliance with a).

#### **X.4 Emergency Plant**

Relaxation of the above criteria may be permissible for emergency or standby plant, subject to agreement in writing with the Landlord or his Acoustic Consultant.

#### **X.5 Construction Noise & Vibration**

Construction work shall not cause unacceptable nuisance to other occupants of the building or nearby buildings.

Construction work which is likely to cause nuisance to local residents should not take place outside Monday to Friday 08:00 to 18:00 hours except with the approval of the Local Authority and the Landlord.

Construction work which is likely to cause nuisance to other tenants should not take place during weekday working hours except with the approved of the Local Authority and the landlord.

All works should be undertaken in full accordance with:

- BS 5228-1:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Noise*';
- BS 5228-2:2009+A1:2014 '*Code of practice for noise and vibration control on construction and open sites. Vibration*';
- Best Practicable Means (BPM), as defined within Section 72 of the Control of Pollution Act 1974.

The contractor's programme and Method Statement shall account for there being a need to limit on noise and vibration generated by the works that are undertaken during certain times.

A detailed project specific noise and vibration management plan should be produced to address:

- The likely sources of noise and vibration during works;
- The selection of the most appropriate procedures and methodologies in accordance with BPM/BS5228 (ie. to minimise noise and vibration impact) including a specific focus on using non-percussive works. Percussive works must only be used where it can be demonstrated that non-percussive works will not be appropriate;
- The selection of the most appropriate plant and equipment in accordance with BPM/BS5228 (ie. to minimise noise and vibration impact);
- The consideration of working hours including the timing of activities likely to cause disturbance;
- Details of the considerations taken to minimise the impact of activities likely to cause disturbance;
- Management procedures to address on-going compliance, correction, and response;
- Nominated personnel and their qualifications to ensure full implementation of the above.

A detailed noise and vibration impact assessment should be undertaken by appropriately qualified personnel. This should predict the impact of noise and vibration for the various activities.

**65 FLEET STREET**

**ACOUSTIC SPECIFICATION FOR**

**INTERNAL / ATRIUM GLAZING**

**SOUND REDUCTION PERFORMANCE**

The complete glazing system shall achieve a minimum Weighted Sound Reduction Index of  $R_w$  42dB when tested in accordance with BS EN ISO 10140-2:2010.

It is the responsibility of the glazing system supplier to ensure that this performance is maintained as installed on site, and that the system proposed for this project is selected in order to achieve this.

**FLANKING PERFORMANCE**

**Sound Insulation Across Floors**

Vertical sound level difference between individual office floors should be at least  $D_{nT,w}$  45 dB at shell and core stage or at least  $D_{nT,w}$  48 dB if fitted to Cat A standards. This is when tested in accordance with BS EN ISO 16283-1:2014 Acoustics - Field measurement of sound insulation in buildings and of building elements - Part 1: Airborne sound insulation and rated in accordance with BS EN ISO 717-1: 2013 Acoustics. Rating of sound insulation in buildings and of building elements. Where mock-up rooms are used for testing, they should have a floor area of no more than 20 m<sup>2</sup> to ensure that the sound field is uniform and ideally include a section of façade. The façade design and specification should include this requirement. Where it is envisaged that the fit-out may not include a ceiling, the shell and core shall achieve  $D_{nT,w}$  48 dB without the need for further enhancement later - which may necessitate enhancing some elements -e.g. the slab edge detail.

**Sound Insulation Across Demise Walls Between Different Occupiers**

Demise walls, separating different office occupiers, should give a sound level difference of at least  $D_{nT,w}$  48 dB when tested in accordance with BS EN ISO 16283-1:2014 and rated in accordance with BS EN ISO 717-1: 2013.

Where mock-up rooms are used for testing, they should have a floor area of no more than 20 m<sup>2</sup> - to ensure that the sound field is uniform - and ideally include a section of external facade. Demise walls separating offices from non-office uses may require enhancement depending on the non-office use.



## **Mullions Within Occupier Spaces**

The sound insulation requirement for internal partitions within individual occupier office areas will depend on the desired degree of privacy and the levels of background masking noise. (See BCO Guide to Fit Out.)

Flanking transmission horizontally across cladding mullions at potential partitions locations should achieve a weighted normalised flanking level difference of at least  $D_{nf,w}$  45 dB when tested in a laboratory in general accordance with BS EN ISO 10848-2: 2017 Acoustics. Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms. and rated in accordance with BS EN ISO 717-1: 2013.

Flanking constructions should be capable of being upgraded in the occupier (Cat B) fit out to at least  $D_{nf,w}$  53 dB to accommodate high performance partitions required for special areas. This may necessitate over-cladding mullions with a dense material such as steel to either side. The façade design and specification should include this requirement.

The supplier must demonstrate through developed design details that vulnerable areas subjected to the passage of unwanted sound (i.e. flanking transmission) have been so developed along with trades immediately adjoining the cladding to produce sound reduction figures as prescribed by the Acoustic Engineer.

## **TEST DATA**

The supplier shall allow for the cost for supplying and testing a representative test sample in accordance with BS EN ISO 10848-1:2006 in an independent UKAS accredited or international equivalent acoustic test laboratory.

Fully detailed test reports shall be supplied. All test reports shall be in English or, a full English translation.

Test data should include the  $\frac{1}{3}$  octave band results from 100Hz to 3150Hz inclusive, together with the corresponding octave band results from 125Hz to 4000Hz inclusive.

The test report shall be provided for test samples which are representation of the complete system for the relevant facades - including frames, joints, seals, spandrel panels and opening lights and trickle vents (as appropriate). The samples proposed should be approved by Hann Tucker Associates.

**65 FLEET STREET**

**ACOUSTIC SPECIFICATION FOR**

**LIFT INSTALLATIONS**

Lift ride quality and performance characteristics shall not exceed the following levels:

	Ride Quality and Noise Criteria for Lifts
	BCO 2019
Noise in lift car <sup>1</sup>	55dB L <sub>Amax</sub> (fast)
Acceleration <sup>1</sup>	1.0m/sec <sup>2</sup>
Jerk <sup>1</sup>	1.2m/sec <sup>3</sup>
Horizontal peak to peak vibration <sup>1</sup>	0.10m/sec <sup>2</sup> (10mg)
Vertical peak to peak vibration <sup>1</sup>	0.12m/sec <sup>2</sup> (12mg)
Vertical vibration in occupied areas <sup>2</sup>	0.01 m/sec <sup>2</sup> (1mg)
Noise in lift lobby <sup>3</sup>	55dB L <sub>Amax</sub> (fast)
Noise from in car announcement and arrival gongs <sup>3</sup>	65dB L <sub>Amax</sub> (fast)
Noise into offices through lift shaft walls <sup>3</sup>	35dB L <sub>Amax</sub> (fast)
Noise directly into offices without lift lobbies <sup>3</sup>	50dB L <sub>Amax</sub> (fast)

- <sup>1</sup> Lift ride quality and performance characteristics shall be measured and presented in accordance with BS ISO 18738-1:2012 'Measurement of ride quality Part 1: Lifts'. N.B. The measurement parameter for vibration is peak to peak, not peak.
- <sup>2</sup> Vibration levels shall be measured in terms of peak acceleration on the floor slabs in occupied areas based on the Wb weighting, as defined in Clause 3.3 of BS 6472-1:2008.
- <sup>3</sup> Lifts shall be operated as per Section 6.4 of BS ISO 18738-1:2012. Noise levels shall be measured at 1m from the Lift Door or Shaft Wall, as appropriate, in accordance with the Association of Noise Consultants Guidelines titled "Noise Measurements in Buildings Part 1: Noise from Building Services".

For goods/vehicles/cycle lifts relaxation of the criteria for ride quality within the lift car may be acceptable, but shall be agreed by the developer or acoustic consultant in writing. No relaxation is normally acceptable within occupied areas.

In order to meet the above criteria it is suggested that consideration be given to the following items.

- a) All lift equipment (including the lift motor, starter electrical cabinet, car controllers, reactors and motors generators) should be suitably vibration isolated as appropriate. All connections, such as electrical grounding, shall be formed from flexible cable/conduit.
- b) In the case of hydraulic lift installations, pipework shall be fitted with in-line silencers in order to effectively control noise transmission to areas outside the lift motor room via hydraulic fluid pipes.
- c) All support steelwork for the installation is to be selected to avoid any resonances forced by the lift motor and the natural frequencies of steelwork should therefore fall between the dominant system frequencies. The steelwork, in particular beams supporting diverter sheaves and pulleys, should be as stiff as possible and suitably vibration isolated from the main structural building elements. The mounting arrangements for the beams should be carefully considered to ensure that the beams are not less stiff than the proposed method of isolation. To this end, long span beams should be avoided and beams should terminate as closely as possible to columns rather than other horizontal beams. The stiffness of the beam support member should be at least 3 times greater than the stiffness of the beam.
- d) Rope hole penetrations shall be acoustically treated (if required) so as to ensure lift motor room noise breakout is controlled to ensure acceptable noise levels in the 'lift lobby' area as defined above.
- e) The car and counterweight guides shall be so joined and fixed to their brackets that they do not deflect by more than 1.0mm under normal operating conditions, and for all panoramic passenger and goods lifts the fixings shall be at floor level only.

65 Fleet Street

Revision: 0	Date: 14 May 2021	Prepared by: Nick Russell	Comments: Stage 3 Issue											
Plant Ref.	Location	Plant Type	Duty		Data		Sound Level (dB) at Octave Band Centre Frequency (Hz)							
			m³/s	Pa	mfr/empir	Lw/Lp	63	125	250	500	1k	2k	4k	8k
AHU-05-01	North Building Roof	Air Handling Unit	2.8	300	mfr	Intake Lw	63	76	66	62	56	55	49	44
					mfr	Supply Lw	74	86	79	79	77	75	67	63
			2.5	250	mfr	Extract Lw	61	75	64	61	53	52	47	42
					mfr	Exhaust Lw	71	85	77	77	75	70	65	61
EF-05-01	North Building Roof	Extract Fan	0.25		mfr	Inlet Lw	89	85	72	63	59	55	53	46
					mfr	Outlet Lw	89	85	76	63	59	54	50	43
EF-05-02	North Building Roof	Extract Fan	0.05		mfr	Inlet Lw	67	63	56	54	47	45	46	45
					mfr	Outlet Lw	72	64	62	53	50	51	47	46
SF-05-01	North Building Roof	Smoke Pressurisation Fan			mfr	Inlet Lw	101	94	102	101	98	98	94	89
					mfr	Outlet Lw	102	96	100	98	97	97	94	90
SF-GR-01	North Building Reception	Supply Fan	0.17	150			To be advised in Stage 4							
DHR-01	North Building Reception	Overdoor Heater					To be advised in Stage 4							
CON 1-4	5th Floor Plantroom North Building	REYQ40			mfr	Lp at 1m	67dBA							
CON 5	5th Floor Plantroom North Building	REYQ10			mfr	Lp at 1m	60dBA							

The above data represent 'maximum' noise levels which should therefore not be exceeded. It is essential that Hann Tucker Associates are apprised of any alterations or additions to this list

65 Fleet Street

Revision: 0	Date: 14 May 2021	Prepared by: Nick Russell			Comments: Stage 3 Issue									
Plant Ref.	Location	Plant Type	Duty		Data		Sound Level (dB) at Octave Band Centre Frequency (Hz)							
			m³/s	Pa	mfr/empir	Lw/Lp	63	125	250	500	1k	2k	4k	8k
GEN/01	South Building Basement	Life Safety Generator			mfr	Limiting Lp at 1m	See Specification							
CHILLER 1	South Building Roof	Chiller 2 No.			mfr	Limiting Lp at 1m	76dBA							
CHILLER 2	South Building Roof	Chiller 1 No.			mfr	Limiting Lp at 1m	74 dBA							
AHU-B1-01 to AHU-B1-08	South Building Basement	Air Handling Unit			mfr	Intake Lw	To be advised in Stage 4							
					mfr	Supply Lw								
					mfr	Extract Lw								
					mfr	Exhaust Lw								
SEF-B1-01a/b	South Building Basement	Smoke Extract Fan	5	400	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
SEF-RF-01	South Building Roof	Smoke Extract Fan	TBC	TBC	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
SEF-07-01	South Building Roof	Smoke Extract Fan	TBC	TBC	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
EF-B1-01	South Building Basement	Extract Fan	1.5	300	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
EF-LG-01	South Building Lower Ground	Extract Fan	0.2	150	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
EF-00-01	South Building Ground	Extract Fan	0.22	150	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
EF-01-01 To EF-06-01 + EF-07-02	South Building Toilets	Extract Fan	Various	Various	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
EF-07-01	South Building 7th Floor Plantroom	Extract Fan	1.5	300	mfr	Inlet/Outlet Lw	To be advised in Stage 4							

The above data represent 'maximum' noise levels which should therefore not be exceeded. It is essential that Hann Tucker Associates are appraised of any alterations or additions to this list

65 Fleet Street

Revision: 0	Date: 14 May 2021	Prepared by: Nick Russell	Comments: Stage 3 Issue											
Plant Ref.	Location	Plant Type	Duty		Data		Sound Level (dB) at Octave Band Centre Frequency (Hz)							
			m <sup>3</sup> /s	Pa	mfr/empir	Lw/Lp	63	125	250	500	1k	2k	4k	8k
SF-XX-XX	South Building Toilet Cores	Supply Fan	TBC	TBC	mfr	Inlet/Outlet Lw	To be advised in Stage 4							
FCU-4 Pipe Types 1-4	South Building Offices	Fan Coil Unit			mfr	Inlet/Case Radiated Lw	To be advised in Stage 4							
FCU-4 Pipe Types 1-4	South Building Offices	Fan Coil Unit			mfr	Discharge Radiated Lw	To be advised in Stage 4							
ASHP-08-01	South Building 8th Floor	Air Source Heat Pump			mfr	Lp at 1m	76dBA							
ASHP-08-02	South Building 8th Floor	Air Source Heat Pump			mfr	Lp at 1m	76dBA							
ASHP-08-03	South Building 8th Floor	Air Source Heat Pump			mfr	Lp at 1m	74dBA							

The above data represent 'maximum' noise levels which should therefore not be exceeded. It is essential that Hann Tucker Associates are appraised of any alterations or additions to this list

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Revision: 0	Date: 14/05/2021	Prepared by: Nick Russell				Comments: Stage 3 Issue									
Attenuator Ref.	Description	No. Off	Dimensions (mm)			Vol m <sup>3</sup> /s	Max PD Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
			W	H	L			63	125	250	500	1k	2k	4k	8k
	AHU-05-01 Inlet							No Attenuator Required							
	AHU-05-01 Supply	1						To be Advised in Stage 4							
	AHU-05-01 Extract	1						To be Advised in Stage 4							
	AHU-05-01 Exhaust							No Attenuator Required							
	EF-05-01 Extract	1						To be Advised in Stage 4							
	EF-05-01 Exhaust							No Attenuator Required							
	EF-05-02 Extract	1						To be Advised in Stage 4							
	EF-05-02 Exhaust							No Attenuator Required							
	SF-GR-01 Inlet							No Attenuator Required							
	SF-GR-01 Supply	1						To be Advised in Stage 4							
AT1	Smoke Pressurisation Fan Inlet	1	1500	1500	1200			4	9	17	26	31	30	23	16
	AHU-B1-01 to 08 Inlet	8						To be Advised in Stage 4							
	AHU-B1-01 to 08 Supply	8						To be Advised in Stage 4							
	AHU-B1-01 to 08 Extract	8						To be Advised in Stage 4							
	AHU-B1-01 to 081 Exhaust	8						To be Advised in Stage 4							

65 Fleet Street

Revision: 0	Date: 14/05/2021	Prepared by: Nick Russell				Comments: Stage 3 Issue									
Attenuator Ref.	Description	No. Off	Dimensions (mm)			Vol m <sup>3</sup> /s	Max PD Pa	Minimum Insertion Loss (dB) at Octave Band Centre Frequency (Hz)							
			W	H	L			63	125	250	500	1k	2k	4k	8k
	SEF-B1-01a/b Inlet	1						To be Advised in Stage 4							
	SEF-B1-01a/b Supply	1						To be Advised in Stage 4							
	SEF-R1-01 Inlet	1						To be Advised in Stage 4							
	SEF-R1-01 Supply	1						To be Advised in Stage 4							
	SEF-07-01 Inlet	1						To be Advised in Stage 4							
	SEF-07-01 Supply	1						To be Advised in Stage 4							
	EF-B1-01 Extract	1						To be Advised in Stage 4							
	EF-B1-01 Exhaust	1						To be Advised in Stage 4							
	EF-LG-01 Extract	1						To be Advised in Stage 4							
	EF-LG-01 Exhaust	1						To be Advised in Stage 4							
	EF-(00-07)-01 Extract	7						To be Advised in Stage 4							
	EF-(00-07)01 Exhaust	7						To be Advised in Stage 4							
	SF-XX-XX Inlet	17						To be Advised in Stage 4							
	SF-XX-XX Supply	17						To be Advised in Stage 4							



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Revision: 1		Date: 14/05/2021		Prepared by: Nick Russell		Comments: Preliminary Issue		
Plant Ref.	AVM Ref.	Plant Description		Location	Power (kW)	Base Code	Isolator Code	Static Deflection (mm)
Generators	AV1	Generators		Basement		SFB	CSS	50
AHU	AV2	Air Handling Units		Basement/Roof			OSS	25
EF	AV3	Extract Fans		Basement			OSS/HSS	25
Chillers	AV4	Chillers		Roof		SFB	CSS/R	50
SF	AV5	Supply Fans		Basement			OSS/HSS	25
BOIL	AV6	Boilers		Basement			NP	3
PUMP	AV7	Pumps		Basement		CIB	OSS	25
PRESS	AV8	Pressurisation Units		Basement			OSS/HSS	25
FCU	AV9	Fan Coil Units		Various		Manufacturers Internal Mounts		
Base Code	Description	HTA Spec. Ref.	Isolator Code	Description	HTA Spec. Ref.	Isolator Code	Description	HTA Spec. Ref.
AVR	AV Rails	4.7.1	NP	Neoprene Pads	-	HSS	Hangers with steel springs	4.5
SFB	Steel frame base	4.7.2	CSS	Caged steel spring	4.2	HNT	Hangers with neoprene	4.6
CIB	Concrete inertia base	4.7.2	OSS	Open steel spring	4.3	_/R	Restraining or positioning	4.1.1
CSP	Concrete split plinth	4.7.4	NIS	Neoprene-in-shear	4.4			
Note 1	To be read in conjunction with HTA's General Specification for Acoustic & Vibration Isolation Materials and Products (available upon request if not supplied)							
Note 2	All cased fans shall have the above specified isolators internally beneath fan/motor frame, and be additionally isolated externally with neoprene pads having 2mm (min) deflection							
Note 3	All pipework to be isolated between the plant and the first structural penetration using AV hangers/mounts with the above specified static deflection, and thereafter with brackets having neoprene inserts. CW booster pipework to be isolated on AV hangers throughout.							