

Acoustic Associates Sussex Ltd

BS4142:2014-A1:2019 Noise Assessment.

Site: Caffè Grey, 26 Felpham Road, Felpham.

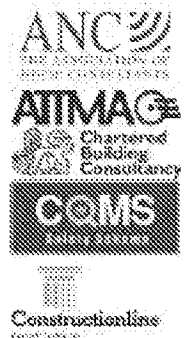
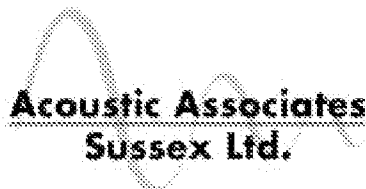
Client: Caffè Grey Limited

Report by: Scott Castle BSc (Hons) CEnvH, MCIEH PGDip: Acoustics MIOA

Date: 01/04/2022

Project: J3336

Issue 2



Sound Insulation Testing - Acoustic Design of Buildings - BS4142 - PPQ24 - Schools Acoustics BS683 -
Vibration - Expert Witness Testimony - Noise at Work - Air Tightness Testing - Auditorium Acoustics

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Issue 1	04/03/2022	Original Issue
Issue 2	01/04/2022	Revised to Account for Issues raised by Arun District Council EHO

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1 Introduction

Acoustic Associates have been appointed to undertake an acoustic assessment to support a planning application for a change of use. Specifically, the application site seeks planning permission to change from retail to a café/restaurant which includes a new kitchen flue.

Standards and guidance referenced for this assessment include:

- ISO9613 (Attenuation of sound during propagation outdoors) 1996
- BS4142:2014-A1:2019- Methods for rating and assessing industrial and commercial sound
- BS8233 (Sound insulation and noise reduction for buildings) 2014
- Noise and vibration control for building services systems CIBSE Guide B4: 2016
- Fläkt Woods Practical Guide to Noise Control (2005)
- BS EN ISO 140-4:1998: Field measurements of airborne sound insulation between rooms
- Approved Document E: Resistance to the Passage of Sound (2003 edition incorporating 2015 amendments).

Background sound pressure levels were measured with a class 1 sound level meter over a number of days (including a weekend) at a position representative of the nearest residential receptor.

The background sound pressure levels were reviewed and calculated as being 40dB $L_{A90,15\text{minutes}}$ for the evening period (18:00-21:30 hours).

With suggested mitigation measures the Rating Level or $L_{Ar,Tr}$ for the external flue on the northern facade at the nearest residential window (window 1) is 3dB below the measured evening background sound pressure level.

Sound insulation testing was also carried out to ensure that the resident in the flat above at 26A Felpham Road remains protected from internally generated patron noise. The $D_{nTw} + C_{tr}$ results of the tests were a minimum of 5dB(A) above the requirements of Approved Document E.

An assessment indicated that the concrete floor/ceiling partition provides good sound insulation properties and based on full capacity of the cafe, noise ingress will be below a reduced BS8233:2014 threshold to account for sounds which may have character, ie people noise.

Based on the assessment undertaken, planning permission should not be withheld on noise grounds.

2 Context, Noise Criteria & Noise Assessment Methodology

2.1 Context and Planning Context

The application site is seen in Figure 1 below located at 26 Felpham Road, Felpham. The front of the premises is orientated West towards Felpham Road. A planning application is currently awaiting determination by Arun District Council (FP/15/22/PL).

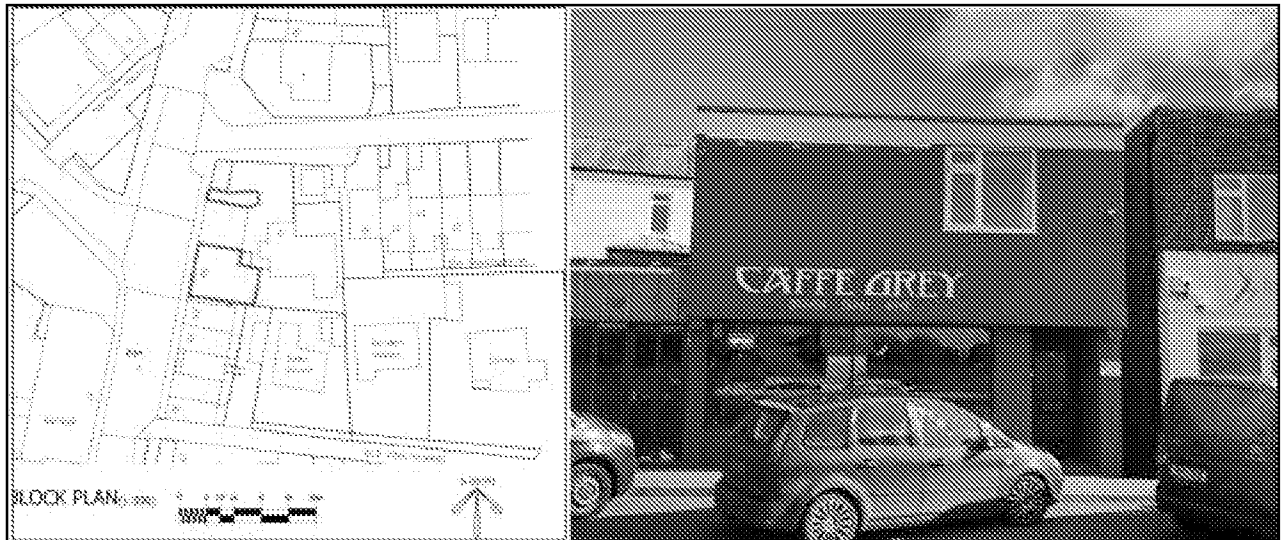


Figure 1. Site Location

To the front of the premises are a number of 1 hour parking bays. Commercial premises are located either side of the site. A dog grooming parlour is located to the immediate North, and an alleyway to the south. A physio studio is located at 24 Felpham Road.

To accommodate the change of use, a kitchen extract is proposed which requires planning permission and an assessment against BS4142:2014-A1:2019. As seen in Figure 2 below, the extract is proposed on the Northern elevation. This layout shows good acoustic design as this facade already is exposed to increased sound pressure levels due to passing road traffic noise.

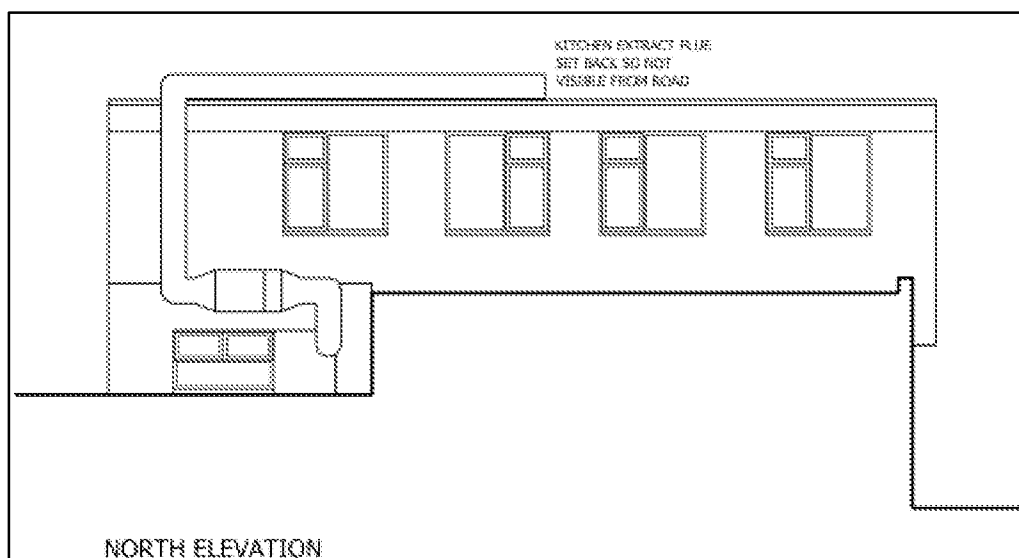


Figure 2. Proposed Extraction Location - Northern Facade

Whilst the applicant in their design and access statement had indicated the use of bi-fold doors, this has no longer been pursued due to the space that these can take up when open.

Given the proximity of the residential flat above, an assessment of noise break in/emissions from the restaurant is also warranted as part of the scope and this has been reflected in the concerns raised by Environmental Health as technical consultees to the application.

It is relevant to note that the local authority (Arun District Council) has already issued a premises licence under the Licensing Act 2003 dated 29th October 2021.

2.2 Site Soundscape

The soundscape is dominated by road traffic noise from Felpham Road which runs North to South at the front of the premises and vehicles coming and going from the temporary parking bays to the front.

2.3 Nearest Residential Receptor Location

The nearest residential receptor is 26A Felpham Road, which is the two-bedroom flat above the premises.

2.4 Proposed Hours of Operation

The hours of use when the kitchen extract will be operational are as follows:

Operational Flue Hours		
Day	From	Until
Monday	08:00	16:00
Tuesday	08:00	16:00
Wednesday	08:00	16:00
Thursday	08:00	21:30
Friday	08:00	21:30
Saturday	08:00	21:30
Sunday	09:00	15:00

The sound from the flue would likely be continuous.

2.5 External Plant

As stated, the plant in question is a flue serving the kitchen extraction system located on the Northern elevation. This is a circular 400mm diameter flue being installed which rises vertically to the flat roof at first floor level, and is then angled parallel with the flat roof. No hats or cowls are proposed at the termination point.

The motor/fan unit and the attenuators are proposed to be inside the property.

2.6 Target Noise Level - Planning Noise Advice Document Sussex (PNADS), March 2021

The Sussex Planning Noise Advice Document dated March 2021, which Arun Council are signed up to, describes that the Rating Level or $L_{Ar,Tr}$ should not exceed measured background sound pressure levels.

“3.2.1 The rating level of the industrial or commercial sound source should, where practicable, achieve a level no greater than the representative background sound, when measured in accordance with BS 4142:2014 + A1: 2019.”

2.7 BS4142: 2014: Methods for rating and assessing industrial and commercial sound

This document provides a means of assessing the impact of industrial or commercial sound upon nearby noise-sensitive receptors, including residential properties.

It does this by comparing the Rating Level of the noise from the industrial or commercial source with the pre-existent L_{90} background noise level affecting the same noise-sensitive premises. The Standard provides guidance that:

- a) Typically, the greater the difference, the greater the magnitude of the impact.
- b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific sound source having a low impact, depending on the context.

3 Methodology and Approach

To ensure that sufficient information is presented to accompany the planning application, the following approach was applied:

1. Visit the commercial premises and measure background sound levels as close as possible to the nearest residential receptor.
2. Extract information from the measured dataset which shows the representative background sound pressure levels for periods when the flue will operate
3. Duct calculations will be undertaken to determine the noise levels arising from the flue.
4. A BS4142:2014-A1:2019 assessment will then be carried out using the worst case predicted results.
5. Context and uncertainty will be discussed in line with BS4142:2014-A1:2019
6. Given the proximity of the residential demise above, a vertical airborne sound insulation test is also proposed to determine the baseline performance of the separating partition. This will guide what, if any additional works might be necessary to protect the upstairs occupants.

4 Background Sound Survey Baseline Conditions & Results

A background noise survey was carried out between the 25th February 2022 and 28th February 2022 to assess the background sound pressure levels at the site and more specifically at the closest location to the upstairs residents. Given the proximity of the adjacent wall, the measured sound pressure levels are considered to be façade levels and will not require any later correction.

4.1 Background and Existing Noise Survey Details

Survey(s) carried out by	Scott Castle BSc(Hons) Env Health, MCIEH CEnvH PGDip Acoustics MIOA
Equipment Used	Norsonic 118- Class 1 Sound Level Meter – Serial No. 31540 (Unattended)
Equipment Used	Castle Acoustic Calibrator – Serial No. 041173
Location	SZ94850/99540 - Pole Mounted at 2.7m above rear ground floor level
Duration	25 th February 2022 to 28 th February 2022

Table 1. Survey Equipment

The sound level meter was calibrated before and after commencing the noise measurements (@114dB with no drift). All measurements were taken with the time base set to 15-minute interval periods. The unattended sound level meter position can be seen below in Figure 3.

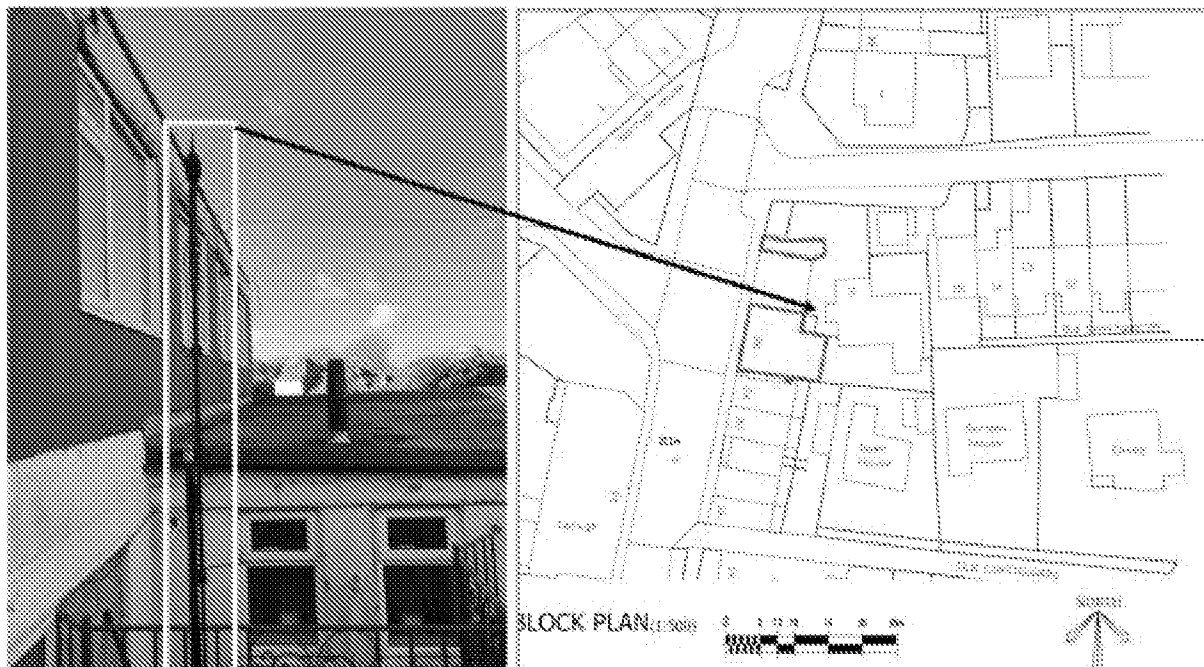


Figure 3. Survey Location

4.2 Representative Background Sound Levels

The survey monitoring position was chosen to represent an “area” background sound level representative to the site. BS4142 states the following on page 11 (Note 1):

To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum/modal value.

Background sound pressure levels have been derived for three situations to exploit the soundscape and ensure that third party residents remain protected against adverse noise elements. These are as follows:

1. Operational hours (Friday, 13:00-21:30, Sat, 08:00-21:30 and Monday 08:00-16:00)
2. Sunday Hours (Sunday, 09:00-15:00 hours)
3. Evening Hours (Friday and Saturday 18:00-21:30 (closed on Sunday evenings)).

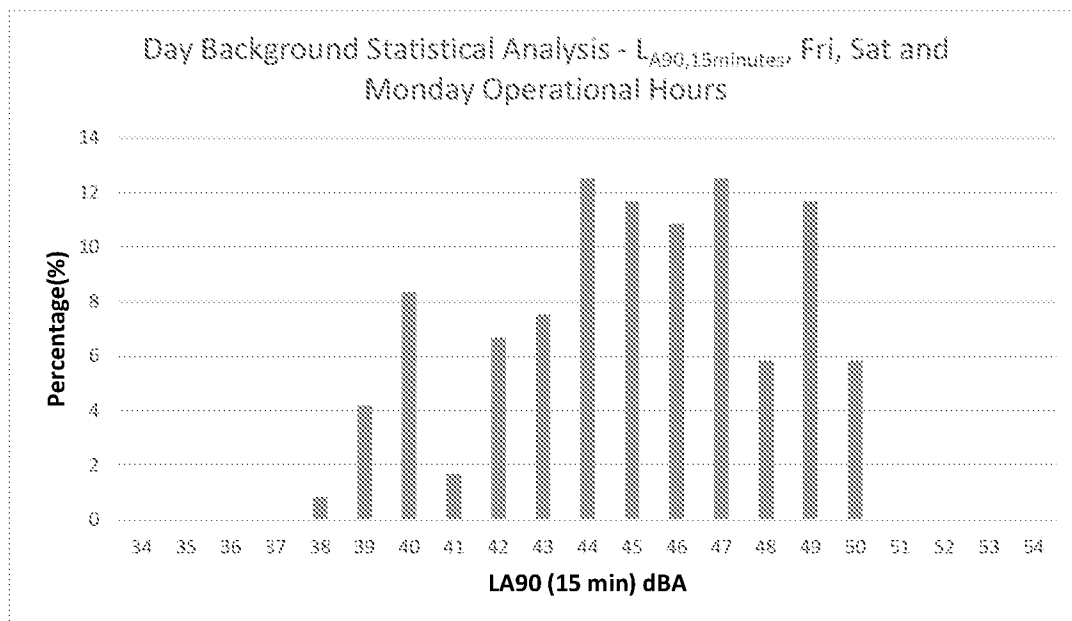


Figure 4. Measured Daytime Background - Fri, Sat, Mon

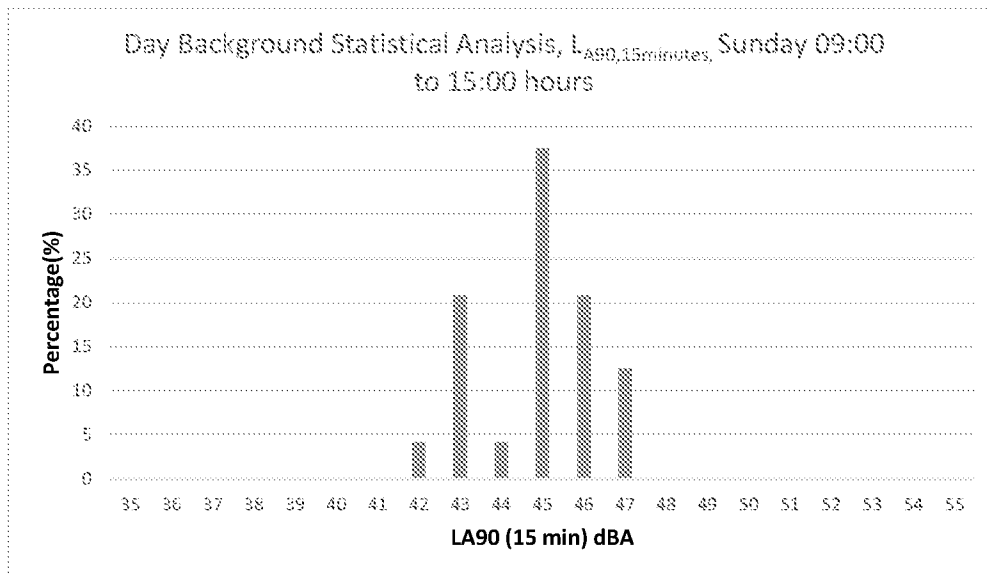


Figure 5. Measured Daytime Background - Sunday

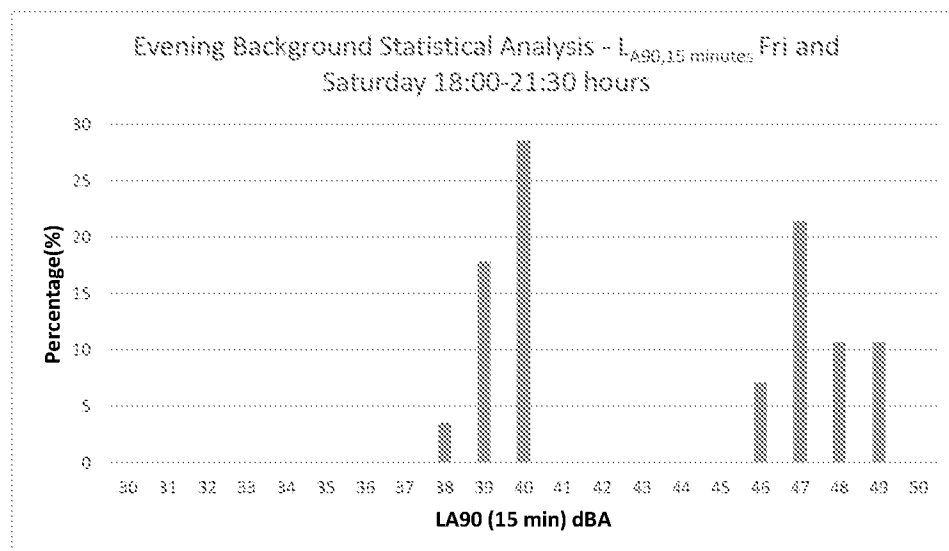


Figure 6. Measured Evening Background - Fri and Sat 18:00-21:30

The representative background sound pressure levels were measured as follows:

- Operational Hours, Fri, Sat and Monday – 44dB $L_{A90,15\text{minutes}}$
- Sunday Hours, 45dB $L_{A90,15\text{minutes}}$
- Evening Hours (Fri and Sat) – 40dB $L_{A90,15\text{minutes}}$.

To ensure that the third-party residential property above remains protected from adverse sound pressure levels, it is relevant to apply the background sound levels for the evening period as 40dB $L_{A90,15\text{minutes}}$. It is however noted that the evening calculation was only made up of data from Friday and Saturday night as it was evident that the equipment was subject to an unauthorised move.

5 Duct Calculations

The ductwork is 0.8g galvanised steel and circular with a 400mm diameter. The motor unit for the fan to drive air through the ductwork is a system air AR 400E4-L Sileo Axial Fan.

The induct sound power levels provided by the client's duct work installer are detailed below in Figure 7.

Sound power level	Acoustic filter	63	125	250	500	1k	2k	4k	8k	Total
Inlet	dB(A)	44	54	59	60	64	65	59	51	68
Outlet	dB(A)	43	55	60	61	65	64	58	49	70

Figure 7. In Duct Sound Power Levels

It is relevant to note that the motor unit is to be housed inside the property and has two silencers proposed, one on the inlet to the fan (ie room side) and one in the outlet of the fan (environmental side). All attenuators are located within the building to minimise the external impact.

The silencers are two 400mm diameter, 600mm long and are circular straight silencers. For the purposes of the duct work calculation, only one atmospheric attenuator is present.

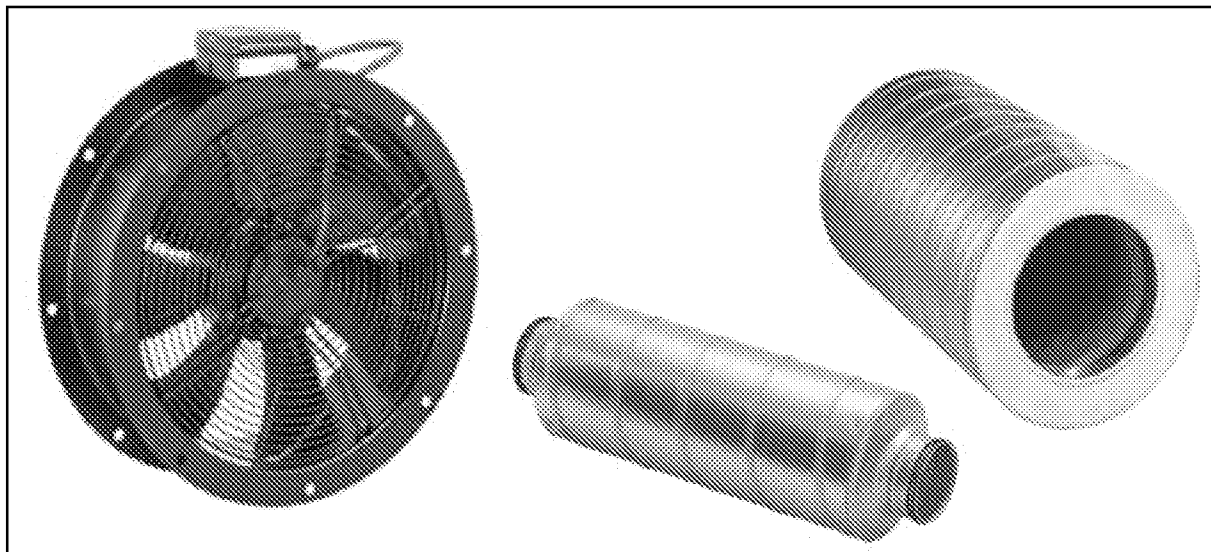


Figure 8. Inline Fan/Motor Unit and Silencers

$\text{Ø}_{\text{duct}} [\text{mm}]$	$\text{L}_{\text{noise}} [\text{mm}]$	63	125	250	500	1k	2k	4k	8k	Ø_{dy}	l	m
400	300	0	1	2	3	3	2	3	1	508	300	12,0
400	600	0	2	4	8	10	5	4	4	508	600	16,0
400	900	0	2	5	12	16	7	5	6	508	900	22,0
400	1200	0	2	7	16	20	9	6	7	508	1200	32,0

Figure 9. Silencer Details for 400mm Diameter and 600mm Length

Given that the sound pressure within the flue will be approximately the same in the external sections of the duct, due to the attenuators fitted internally (inside the premises), it may be treated as the same sound source for the closest window to the flue and the closest window to the termination point.

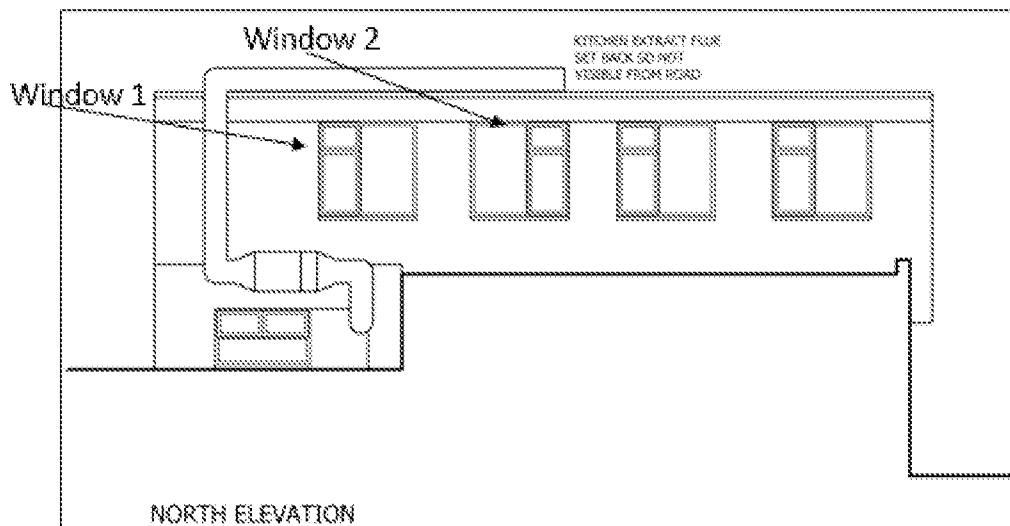


Figure 10. Illustration to detail reception points

The sum total at the 1st window from both duct breakout as well as the termination point will be 45.7 dB $L_{Aeq,T}$. This is comprised as 45.7dB $L_{Aeq,T}$ from the ductwork and 23dB $L_{Aeq,T}$ from the termination point.

The sum total at the 2nd window from both duct breakout as well as the termination point will be 39.9 dB $L_{Aeq,T}$. This was comprised pf duct breakout (35.3dB $L_{Aeq,T}$) and the duct termination point (38.1 dB $L_{Aeq,T}$).

The detailed calculations can be seen in Appendix A.

6 BS4142:2014-A1:2019 Assessment

A BS4142:2014-A1:2019 assessment has been carried out of the worst-case window of 26A, as the flat above the property. This would be an assessment of window 1 using a specific sound pressure level of 45.7dB $L_{Aeq,T}$.

Caffè Grey - Evening - 18:00-21:30 hours			
Results	Measurement Parameter		Relevant Clause
Specific sound level	$L_{Aeq(T)}$	45.7	7.3.4
On time corrected value	Not Applicable	0	
Acoustic feature correction	4dB for Tonality	4	9.2
Rating level	$L_{Ar,Tr}$	49.7	9.2
Background sound level	$L_{A90(T)}$	40	8
Excess of rating level over background sound level		9.7	11
Assessment indicates a	Likely Adverse-Significant Adverse Effect - Depending on Context		11
Uncertainty of the assessment	Discussed		10

Figure 11. BS4142:2014-A1:2019 Assessment

It should be noted that the EHO at Arun District Council (Craig Milligan) has requested that a character correction of 4dB for tonality be applied for the assessment. This would suggest that a tone is clearly perceptible, despite the system being brand new and fitted with room side silencers in the kitchen and atmospheric side silencers, also within the kitchen. Notwithstanding this, the 4dB character correction has been applied.

The outcome of the assessment details that the noise impact of the flue is likely to be above (ie 9.7dB) the measured background sound pressure levels.

- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

Context is always relevant when considering an assessment outcome. The flue operates during the daytime hours only and will only operate three evenings in a week. As new equipment it is unlikely to be tonal. The noisier elements of the flue are the motor/fan unit and these have been deliberately housed internally inside the restaurant. It is relevant to note that only the worst-case window has been considered using BS4142:2014, as window 2 was already at least 10dB below the measured background. Notwithstanding this, there is a requirement to bring the $L_{Ar,Tr}$ or Rating level down further to achieve parity with background.

7 Suggested Mitigation Measures

To reduce the sound pressure levels incident on the closest window, the priority is to reduce the sound at source and consider a higher performance silencer than already calculated above and this uses 100mm of insulation.

Additionally, a second air side silencer (also 100mm) will assist in reducing the induct sound pressure levels and the resultant breakout through the duct wall. Lagging of the external ductwork using a CMS Danskin Superlag (5/25mm) around the flue will also assist in reducing sound energy breaking out from the flue walls. A PIB (Poly Iso Butylene) sheeting layer is strongly advised to ensure that the lagging/damping material remains protected against the environment and specifically from being degraded by birds. The silencer specification and the CMS Danskin wrapping/lagging are shown in Figures 12 and 13 respectively.

		Insertion loss [dB] for centre frequency [Hz]							
$\varnothing d_1$ nom. [mm]	l_{nom} [mm]	63	125	250	500	1k	2k	4k	8k
315	* 600	2	5	9	14	12	6	4	5
315	* 900	3	6	13	20	19	10	6	7
315	* 1200	4	8	16	27	25	15	9	10
400	600	4	5	8	10	7	4	4	6

Figure 12. Enhanced 100mm Silencer. Two Atmosphere Side Silencers (100mm) are required



Figure 13. CMS Danskin Superlag 5/25mm

The flue fixings to the wall must also incorporate suitable anti vibration mounts to prevent sound energy being transmitted into the building structure and being re-radiated as airborne sound.

Care needs to be taken to ensure that access to the fan and motor areas, are considered for accessibility for servicing, cleaning and replacing filters. This also applies for any specific operational elements which are outside of the building structure.

It is recommended that the extract system be fitted with a time clock to stop it being used after 21:30 so that it isn't accidentally left on over its permitted hours.

The modified performance allows for the following attenuation with window references as per Figure 10 above.

- Window 1, a total sound pressure level of **33.2dB $L_{Aeq,T}$** comprised of duct breakout **33.1 dB $L_{Aeq,T}$** and from the termination point, **15.1 dB $L_{Aeq,T}$**
- Window 2, a total sound pressure level of **29.7dB $L_{Aeq,T}$** comprised of duct breakout **22.3 dB $L_{Aeq,T}$** and from the termination point, **28.8 dB $L_{Aeq,T}$**

A revised BS4142:2014-A1:2019 assessment of window 1 would be as follows and provides the direction as requested by the EHO in terms of a 4dB character correction for tonality. The revised assessment shows that the Rating Level or $L_{Ar,Tr}$ is 3dB below the measured background for the evening periods, for the Thursday, Friday and Saturday evening period when the flue would operate until 21:30 hours. The resultant impact is low/no impact as the rating level is below the measured background sound pressure levels.

Caffè Grey - Evening - 18:00-21:30 hours			
Results	Measurement Parameter		Relevant Clause
Specific sound level	$L_{Aeq(T)}$	33.2	7.3.4
On time corrected value	Not Applicable	0	
Acoustic feature correction	4dB for Tonality	4	9.2
Rating level	$L_{Ar,Tr}$	37.2	9.2
Background sound level	$L_{A90(T)}$	40	8
Excess of rating level over background sound level		-2.8	11
Assessment indicates a	Below Measured Background - Low/No Impact		11
Uncertainty of the assessment	Discussed		10

Figure 14. Revised BS4142:2014-A1:2019 Assessment - Improvements to Flue

8 Assessment of Flue against Open Windows/Internal Environment

Whilst BS4142:2014 states that it is not to be used for deriving internal measurements (section 1.3 of the British Standard), the proximity of the flue to the window and the calculations already undertaken allow for this to be assessed. Whilst not appropriate under BS4142:2014, a lowered criteria using BS8233:2014 would apply due to the tonal element referenced by the EHO.

Given that the flue operates during daytime hours, ie 07:00-23:00 hours the Table 4 value for a habitable room may be applied of 35dB $L_{Aeq, 16 \text{ hour}}$. It is noted that BS8233:2014 provides for continuous and anonymous sound sources, so, it is relevant to consider a reduction of the internal criterion by 5dB to 30dB $L_{Aeq, 16 \text{ hour}}$ to account for character such as tonality.

With Window 1 being 33.2dB $L_{Aeq,T}$, this would likely be reduced by 13dB to account for sound energy passing through a partially open window. This would account for an internal sound pressure level of 20.2dB $L_{Aeq,T}$ which is approximately 10dB below the lowered criterion.

The operation of the flue would not therefore present any adverse concerns to the third-party residential demise above and specifically, not with windows open either.

9 Post Installation Flue Testing

Providing the specifications referenced are applied by the installers and workmanship is of a high standard, the operational flue should be capable of operating below measured background sound pressure levels.

It is noted that due to the predicted sound pressure levels being below measured background sound pressure levels, it will therefore be impossible to validate the predictions via measurements alone. An L_{Aeq} sound pressure level will be louder than the L_{A90} sound level in the same location, as one is comparing the sound level which is occurring 100% of the time with that which is occurring only 90% of the time. Therefore the $L_{Aeq,T}$ when measured will always be above the measured background sound pressure level ($L_{A90,T}$).

It is strongly advised that the local planning authority do not apply a condition which is not consistent with the six planning tests in the NPPF, 2021, namely necessary, relevant to the planning and the development being permitted, enforceable, precise and reasonable.

It is however recommended that regular inspection, maintenance and servicing occurs to ensure that the unit remains in optimal performance.

10 Sound Insulation Testing – Ground floor to First Floor

The building is concrete frame with a concrete floor, 6-8 inches thick, with a 6-8 inch void and subsequent plasterboard finish in the café area.

On 13th January 2022, an Approved Document E sound insulation test was carried out to determine the performance of the separating partition between the commercial and residential demise above. A vertical airborne test was carried out from the larger space (ie the ground floor café element) to the bedroom and lounge room areas representing habitable spaces of 26A above.

The testing process followed the guidance of BS EN ISO 140-4:1998. This involves exciting the ground floor café area with very high sound pressure levels (105dB(A)) using pink noise and then testing in the rooms above, testing without the sound source present (background) and then reverberation times being undertaken in the two receive rooms (Bedroom and Lounge)

The results of the sound insulation testing were as follows:

- Café to Bedroom = 50dB $D_{nTw} + C_{tr}$
- Café to Lounge Area = 48dB $D_{nTw} + C_{tr}$

It should be noted these results are 5dB better than the Approved Document E $D_{nTw} + C_{tr}$ requirements for conversions.

11 Predicted Internal Sound Pressure Levels (Generated in Caffè Grey)

11.1 People Noise

As a café/restaurant, background music is proposed and in addition to this people noise will be generated inside the premises. The table layout is already known from the site set up, so it is fair to assume at least one individual customer/patron talking from each table, as clearly not all customers would speak at the same time.

Table A.1 of BS: 9921:2003 states that a normal human voice is 60dB(A) at 1m and a raised human voice level is 66dB(A) at 1m. It is likely that due to alcohol consumption, some of patrons may be talking with raised voices, however it would be unrepresentative to expect everyone in the premises would be talking at a raised level.

Therefore, for the following calculation, half of the individuals talking will be projected to be speaking at a raised level and half at a normal level.

It should be remembered that this represents a robust scenario with the premises at full capacity. From the current table layout, it is estimated that there could be 29 persons sat and

as discussed, not all individuals would speak at once and it would be an over estimate to use 3 people speaking in a table of six, when at most, two might be speaking with the remainder of the table listening.

It is therefore estimated that of 13 persons (including staff) speaking, 6 would be at a normal level and 6 at an increased vocal effort.

$$60+10\log(7) = 68.5\text{dB}$$

$$66+10\log(6) = 73.8\text{ dB}$$

$$\text{Combined people noise} = 10\log(10^{6.85}+10\log 10^{7.38}) = 74.9\text{dB(A)}$$

11.2 Background Music/Noise Level

For a setting such as Caffè Grey, background music would not normally exceed 70dB(A) measured at 1m, otherwise patrons would likely complain about speech intelligibility and not being able to hear one another.

11.3 Combined Internal Noise Level inside Café Grey

The background music (70dB(A)) and the people noise (74.9dB(A)) are therefore logarithmically combined to determine the overall internal noise level. This is calculated as $10\log(10^{7.0}+10^{7.49}) = 76.1\text{dB(A)}$ and presents a robust scenario of full capacity.

11.4 Noise Break In to 26A Felpham Road (Flat Above)

The purpose of the sound insulation testing was to determine the sound insulation performance of the current concrete separation between the ground floor commercial premises and the residential demise above. Importantly, an assessment of how much sound is likely to enter the residential flat above is required. This was an area of concern flagged by Environmental Health.

With 76.1dB(A) generated internally inside the café, a test sound source which used speech, laughter as well as background music data was used to replicate the spectral frequency at 76.1dB(A) inside the café.

The Dnt values obtained from the sound testing were then applied to determine how much sound would enter the residential flat above (24A).

The calculations are shown in Figure 15 below and indicate 26dB(A) inside the bedroom and 27dB(A) rounded for the lounge area.

Café to Bedroom						Café to Lounge					
Frequency Hz	Adjusted music spectrum (-13dB)	Dnt	Linear level in NSR	A weighting	A weighted level in NSR	Frequency Hz	Adjusted music spectrum (-13dB)	Dnt	Linear level in NSR	A weighting	A weighted level in NSR
50	61.7	33.2	28.5	-30.2	-1.7	50	61.7	36.1	25.6	-30.2	-4.6
63	60.3	42.4	17.9	-26.2	-8.3	63	60.3	35.9	24.4	-26.2	-1.8
80	63.1	36.9	26.2	-22.5	3.7	80	63.1	35.2	27.9	-22.5	5.4
100	66.0	40.4	25.6	-19.1	6.5	100	66.0	35.2	30.8	-19.1	11.7
125	62.5	42	20.5	-16.1	4.4	125	62.5	40.8	21.7	-16.1	5.6
160	65.9	40.2	25.7	-13.4	12.3	160	65.9	37.7	28.2	-13.4	14.8
200	67.9	43.2	24.7	-10.9	13.8	200	67.9	43	24.9	-10.9	14.0
250	68.9	43	25.9	-8.6	17.3	250	68.9	42.2	26.7	-8.6	18.1
315	70.0	43.4	26.6	-6.6	20.0	315	70.0	44.3	25.7	-6.6	19.1
400	69.3	47.8	21.5	-4.8	16.7	400	69.3	46.7	22.6	-4.8	17.8
500	71.6	49.5	22.1	-3.2	18.9	500	71.6	49.1	22.5	-3.2	19.3
630	71.8	53.3	18.5	-1.9	16.6	630	71.8	51.3	20.5	-1.9	18.6
800	68.4	55.3	13.1	-0.8	12.3	800	68.4	53.8	14.6	-0.8	13.8
1000	62.3	56.9	5.4	0	5.4	1000	62.3	57.7	4.6	0	4.6
1250	61.7	58.6	3.1	0.6	3.7	1250	61.7	60.5	1.2	0.6	1.8
1600	61.5	59.3	2.2	1	3.2	1600	61.5	63.9	-2.4	1	-1.4
2000	63.4	60.9	2.5	1.2	3.7	2000	63.4	65.3	-1.9	1.2	-0.7
2500	62.4	65	-2.6	1.3	-1.3	2500	62.4	67.3	-4.9	1.3	-3.6
3150	58.8	68.9	-10.1	1.2	-8.9	3150	58.8	71.3	-12.5	1.2	-11.3
4000	53.5	72.8	-19.3	1	-18.3	4000	53.5	73.7	-20.2	1	-19.2
5000	52.0	75.2	-23.2	0.6	-22.6	5000	52.0	76.2	-24.2	0.6	-23.6
Broadband A weighted level in NSR					26.0	Broadband A weighted level in NSR					26.7

Figure 15. Assessment of Predicted Noise Ingress to 26A Felpham Road

Whilst BS8233:2014 Table 4 values provide for daytime noise levels of 35dB $L_{Aeq,16 \text{ hour}}$ internally, these relate to continuous and anonymous sounds, without character. Given the changeable pitch, intermittency and range of human speech and laughter etc, it is relevant to consider a lower noise level internally to protect the residential apartment and therefore 30dB $L_{Aeq,16 \text{ hour}}$ is relevant for the daytime period when the café premises will be open.

The measured sound insulation performance shows that the predicted internal noise levels inside the habitable rooms of 26A Felpham Road are below the reduced criterion for daytime values ie 30dB $L_{Aeq, 16 \text{ hour}}$.

12 Uncertainty

The sound level meter used in the site survey work and sound testing was calibrated before and after the survey in situ, without any significant drift having occurred, to ensure that the information and data being obtained was representative and that the sound level meter was operating correctly.

Background sound pressure levels have been measured over a number of days and deliberately included a weekend to properly understand the soundscape.

Spectral data was also obtained from the plant manufacturers to ensure that the ductwork calculations were as accurate as possible.

Environmental Health comments as Technical Consultees to the planning process were also reviewed and from this, site measurements were taken to ensure that the resident of 26A above remains protected from unwanted sound. Liaison with the upstairs resident of 26A meant that such testing could be carried out rather than reliance on modelling or suggested performance which further reduced uncertainty.

The BS4142:2014 assessment was also made for a worst-case assessment at Window 1. In reality, the closer the windows to Felpham Road, the higher the contribution of sound from passing traffic.

13 Conclusion

Background sound pressure levels were measured with a class 1 sound level meter over a number of days (including a weekend) at a position representative of the nearest residential receptor.

The background sound pressure levels were reviewed and calculated as being 40dB $L_{A90,15\text{minutes}}$ for the evening period (18:00-21:30 hours).

With suggested mitigation measures the Rating Level or $L_{Ar,Tr}$ for the external flue on the northern facade at the nearest residential window (window 1) is 3dB below the measured evening background sound pressure level.

Sound insulation testing was also carried out to ensure that the resident in the flat above at 26A Felpham Road remains protected from internally generated patron noise. The $D_{nTw} + C_{tr}$ results of the tests were a minimum of 5dB(A) above the requirements of Approved Document E.

An assessment indicated that the concrete floor/ceiling partition provides good sound insulation properties and based on full capacity of the cafe, noise ingress will be below a reduced BS8233:2014 threshold to account for sounds which may have character, ie people noise.

Based on the assessment undertaken, planning permission should not be withheld on noise grounds.

14 Appendix A – Duct Calculations

	63	125	250	500	1000	2000	4000	8000		distance to reception = r
Enter Fan sound power (linear) or chose fan type:										
Fan outlet	43	55	60	61	65	64	58	49		r=
Silencer details	19952.62	316227.8	1000000	1258925	3162278	2511886	630957.3	79432.82	69.5	2.47
Silencers	8	10	16	20	14	8	8	12		
Insertion loss per bend < 900 diameter circular duct width(mm) x Frequency(khz)	25.2	50	100	200	400	800	1600	3200		TABLE 4.24
Number of bends	5	1	1	2	3	3	3	3		TABLE 4.24 Calc
Insertion loss all bends	5	5	10	15	15	15	15	15		TABLE 4.23
Diameter	400									
Insertion loss per bend < 900 diameter circular duct	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06		TABLE 4.19 cbse
number of metres duct run	12.5									
insertion loss for duct length	0.375	0.375	0.375	0.375	0.75	0.75	0.75	0.75		
Termination reflections	13	9	5	4	0	0	0	0		TABLE 4.26
SWL radiated from discharge	16.6	30.6	28.6	21.6	35.3	40.3	34.3	21.3		30.10299957
Directivity	3	3	3	3	3	3	3	3		13.01029996
Radiating Free space Hih level discharge at dist r	-2	12	10	3	16	21	15	2		
Barrier Calcs	0.0	0.0	22.93188	17.51442	25.17092	26.32378	24.89648	16.89497		
A w	0	0	0	0	0	0	0	0		
A-Weighted SPL	1	15	-10	-12	-6	-2	-7	-11		Total SPL
	1.19428	29.99895	0.096365	0.066937	0.264554	0.641547	0.223748	0.070812		15.12647
										32.55719
Vert section										
Insertion loss per bend < 900 diameter circular duct	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06		
Number of bends	2	1	2	3	3	3	3	3		
Insertion loss all bends	2	2	4	6	6	6	6	6		W
Directivity										L
insertion loss per m of duct	0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06		H
number of metres duct run	2.7									
insertion loss for duct length	0.081	0.081	0.081	0.081	0.162	0.162	0.162	0.162		5 Sd (cross section of Duct)
										10.32 Sw Surface area of Duct
Sw/Sd	3.147097	3.147097	3.147097	3.147097	3.147097	3.147097	3.147097	3.147097		
	2.064	2.064	2.064	2.064	2.064	2.064	2.064	2.064		
Lw Duct (SWLo)	32.919	42.919	39.919	34.919	44.838	49.838	43.838	30.838		
Duct SRI (R)	16	15	14	28	44	50	58	49		
swlb = swld-R+10log(Sw/Sd)	20.1	31.1	29.1	10.1	4.0	3.0	-11.0	-15.0		
swlb never greater than swld-3	29.919	39.919	36.919	31.919	41.838	46.838	40.838	27.838		
Pick SWLo or SWLo-3 which ever is lower	29.9	31.1	29.1	31.9	4.0	3.0	-11.0	0.0		Total SPL
	26	28	26	28	0	-1	-15	-4		33.09038
barrier	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		2037.223
Aw	0	0	0	0	0	0	0	0		Duct distance to receptor
	26	28	26	28	0	-1	-15	-4		0.6
	432.1132	562.7392	355.0645	684.8532	1.102065	0.875401	0.03485	0.440248		

		63	125	250	500	1000	2000	4000	8000	distance to reception = r	
Enter Fan sound power (linear) or chose fan type:											
Fan outlet		43	55	60	61	65	64	58	49	r=	0.7
Silencer details		19952.62	316227.8	1000000	1258925	3162278	2511886	630957.3	79432.82	69.5	
Silencers		8	10	16	20	14	8	8	12		
Insertion loss per bend < 900 diamter circular duct width(mm) x frequency(khz)		25.2	50	100	200	400	800	1600	3200		
Number of bends	5	1	1	2	3	3	3	3	3	TABLE 4.24	
Insertion loss all bends		5	5	10	15	15	15	15	15	TABLE 4.24 Calc	
Diameter	400									TABLE 4.23	
Insertion loss per bend < 900 diamter circular duct		0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	TABLE 4.19 cbse	
number of metres duct run	12.5										
insertion loss for duct length		0.375	0.375	0.375	0.375	0.75	0.75	0.75	0.75		
Termination reflections		13	9	5	4	0	0	0	0	TABLE 4.26	
SWL radiated from discharge		16.6	30.6	28.6	21.6	35.3	40.3	34.3	21.3		
Directivity		3	3	3	3	3	3	3	3		
Radiating Free space Hih level discharge at dist r	SPL	9	23	21	14	27	32	26	13		
Barrier Calcs		0.0	0.0	0.0	11.02496	13.86028	16.78038	19.74486	22.73207		
A w		0	0	0	0	0	0	0	0		
A-Weighted SPL		12	26	24	6	16	19	10	-6	Total SPL	
		14.86976	373.5115	235.6698	3.713712	44.54262	71.90619	9.126783	0.229931	28.77124	
										753.5702	
Vert section											
Insertion loss per bend < 900 diamter circular duct		0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06		
Number of bends	2	1	1	2	3	3	3	3	3		
Insertion Loss all bends		2	2	4	6	6	6	6	6	W	0.4
Directivity										L	12.5
insertion loss per m of duct		0.03	0.03	0.03	0.03	0.06	0.06	0.06	0.06	H	0.4
number of metres duct run	2.7										
insertion loss for duct length		0.081	0.081	0.081	0.081	0.162	0.162	0.162	0.162		
										5 Sd (cross se	
										10.32 Sw Surface	
		3.147097	3.147097	3.147097	3.147097	3.147097	3.147097	3.147097	3.147097		
Sw/Sd		2.064	2.064	2.064	2.064	2.064	2.064	2.064	2.064		
Lw Duct (SWLo)		32.919	42.919	39.919	34.919	44.838	49.838	43.838	30.838		
Duct SRI (R)		16	15	14	28	44	50	58	49		
swlb = swld-R+10log(Sw/Sd)		20.1	31.1	29.1	10.1	4.0	3.0	-11.0	-15.0		
swlb never greater thanswld-3		29.919	39.919	36.919	31.919	41.838	46.838	40.838	27.838		
Pick SWLa or SWLo -3 which ever is lower		29.9	31.1	29.1	10.1	4.0	3.0	-11.0	0.0	Total SPL	
										22.27933	
barrier		17	18	16	-3	-9	-10	-24	-13	169.0181	
Aw		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Duct distance to recpetor	1.7
		0	0	0	0	0	0	0	0		
		17	18	16	-3	-9	-10	-24	-13		
		53.82725	70.099	44.22948	0.556816	0.137281	0.109047	0.004341	0.054841		