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NOISE IMPACT ASSESSMENT REPORT - KITCHEN EXTRACTION SYSTEM

23-24 MARKET PLACE, READING RG1 2DE

FOR

M ACAR



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The preparation of this report by Sound Licensing Ltd. has been undertaken within the terms of the proposal using all reasonable skill and care. Sound Licensing Ltd accepts no responsibility for the data provided by other bodies and no legal liability arising from the use by other persons of data or opinions contained in this report.

1. EXECUTIVE SUMMARY

The Client is seeking to extend their current operating hours as a result of which mechanical plant (Kitchen Extraction System) servicing the premises at 23-24 Market Place, Reading RG1 2DE will operate until the proposed time of 01:00 hours.

Sound Licensing has undertaken an environmental noise survey at the site in order to determine prevailing background noise levels that are representative of the nearest noise sensitive properties. After searching through the planning register it has been assumed that the nearest sensitive premises is the third-floor residential premises at 32 Market Place.

The results of the noise survey are considered reasonable given the location of the measurement position and the existing noise sources in the local vicinity.

Noise measurements and calculations of the mechanical plant have been undertaken using all available details and plans provided by the client and obtaining measurements of the installed plant wherever possible. The data and information form the basis of the assessment.

Noise break-out limits for the mechanical plant have been proposed based on the methodologies of British Standard (BS) 4142:2014+A1:2019 and in accordance to Local Authority policy. A robust, worst-case assessment of the noise levels associated to the proposed mechanical plant has been undertaken.

In accordance with BS 4142:2014+A1:2019 guidance, the predicted noise impact due to the operation of the mechanical plant, with recommended noise mitigation installed, ***“is an indication of the specific sound source having a low impact”***. The predicted noise level of the mechanical plant at the nearest noise sensitive properties is considered to comply with the Reading Borough Council’s policy.

2. INTRODUCTION

The client has installed a kitchen extraction system at the rear of 23-24 Market Place, Reading RG1 2DE, the noise from which could have the potential to affect existing noise sensitive properties nearby.

The purposes of this report are:

- To determine prevailing environmental noise levels affecting surrounding properties due to nearby noise sources (e.g. road traffic, aircraft etc);
- Based on the above, to present noise emission limits in accordance with the requirements of BS 4142:2014+A1:2019 and Local Authority policy, and
- To undertake an assessment to demonstrate compliance with the Local Authority noise requirements.

3. SITE DESCRIPTION

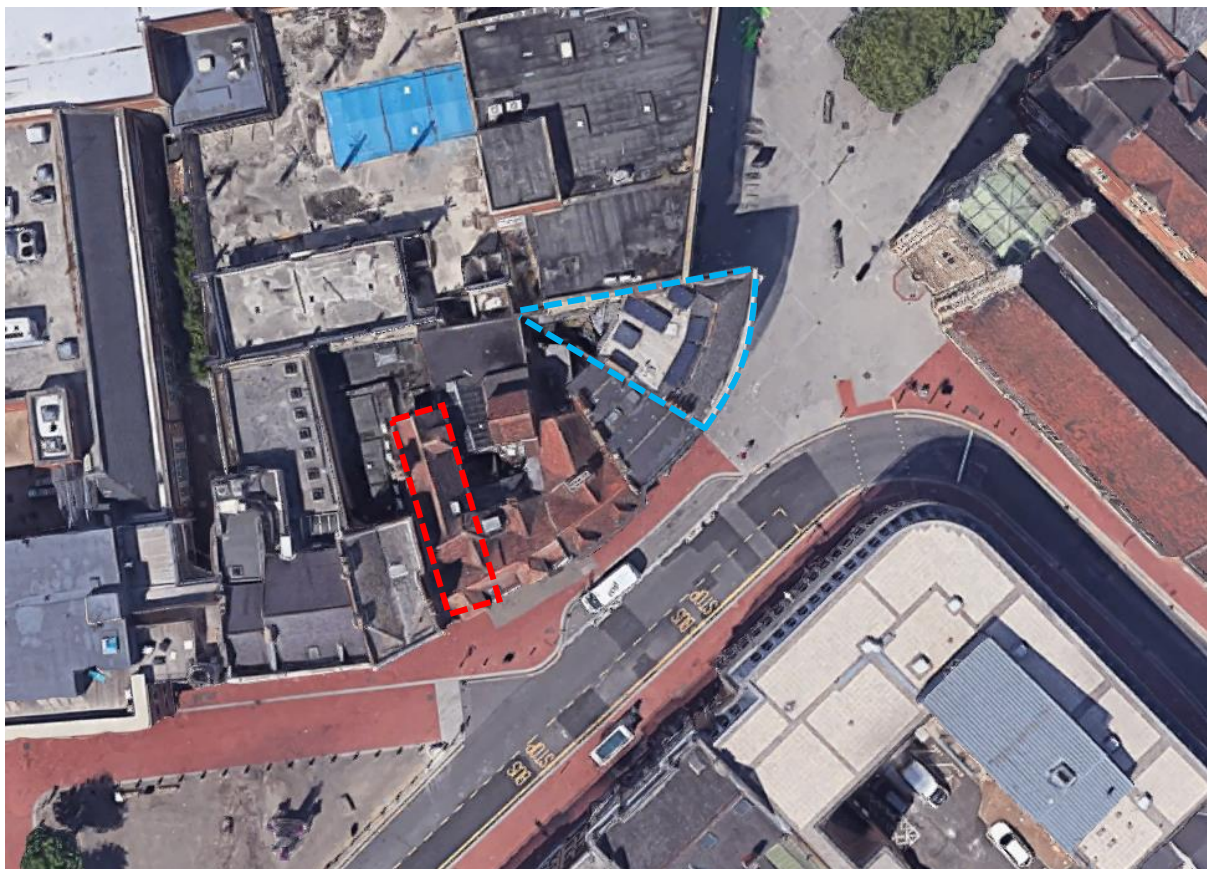
Planning permission is being sought for the extension of hours at 23-24 Market Place, Reading RG1 2DE (hereafter referred to as 'the site'). The property is a traditionally built four-storey terraced building with a basement in Reading. It is located in a mixed area comprising predominantly of commercial units at ground floor level with a mix of offices and limited residential accommodation on the floors above.

The nearest sensitive residential receptors were noted to be the third-floor windows located on the side façade of 32 Market Place at an approximate distance of 13m from the fan motor casing and 12m from the extraction system terminus.

The nearest sensitive receptors are identified in figure 3.1. If the noise impact assessment details that there is an indication of the specific sound source having a low impact at these premises then it can be safely assumed it will be met at other properties of equal distance and/or those further away.

Figure 3.1 shows the site highlighted in **blue** with the nearest noise sensitive premises highlighted in **red**.

Figure 3.1 Site Location and Surrounding Land Use



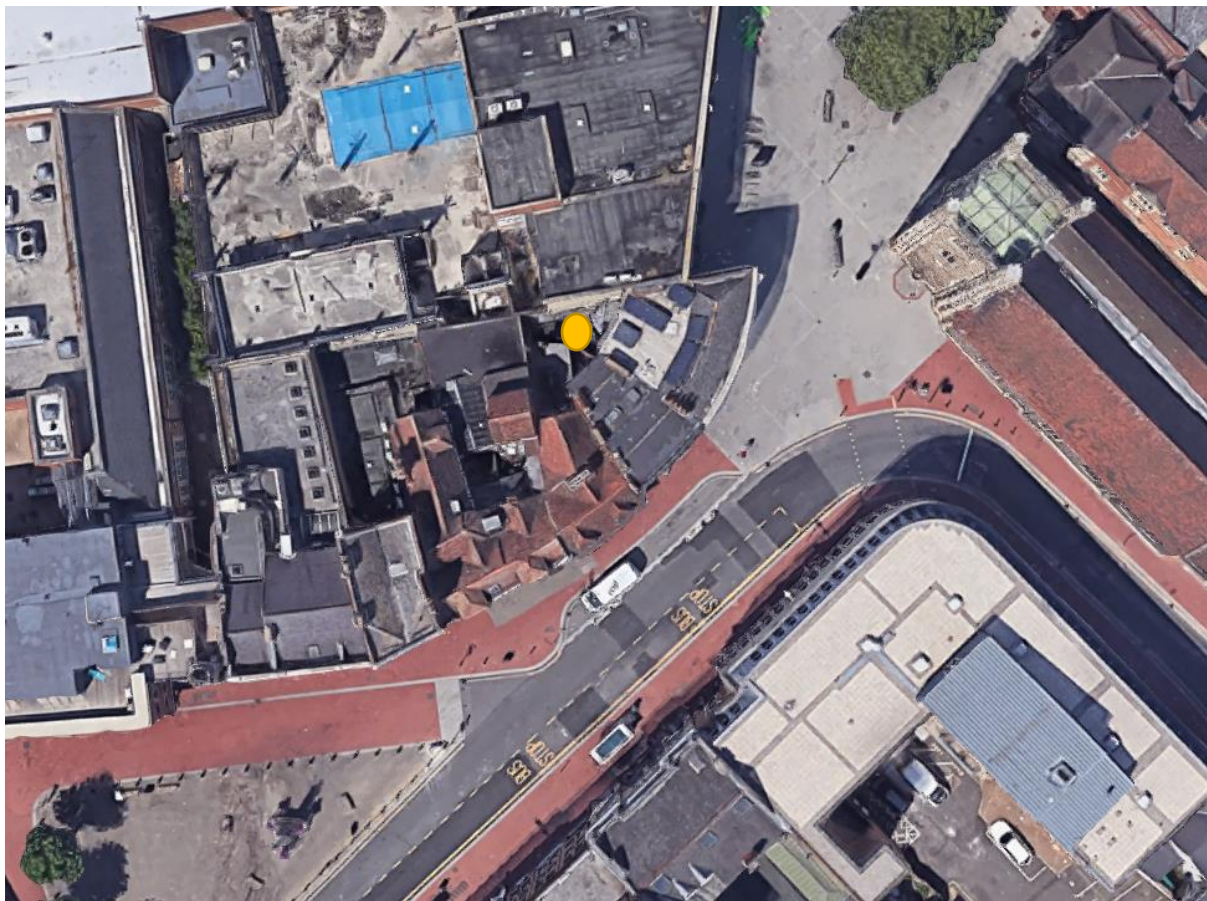
Source: Google Maps

4. ENVIRONMENTAL NOISE SURVEY METHODOLOGY

An unmanned environmental noise survey was undertaken at a single measurement location at ground floor level to the rear of the site. The survey was undertaken between 13:15 hours on the 25th March and 11:45 hours on the 28th March 2022. A survey at this time covers the most sensitive period of time in which the mechanical plant system may be operational.

Ambient, background and maximum noise levels (L_{Aeq} , L_{A90} and L_{Amax} respectively) were measured throughout the noise survey in continuous 15-minute periods. The approximate measurement position is indicated in orange on Figure 4.1 below.

Figure 4.1 Site Plan Showing Approximate Location of Measurement Position



Source: Google Maps

The sound level meter microphone was positioned on a tripod at a height of 2.5 metres, 2 metre from the rear façade of the building at ground floor level. The position is not considered to be in free-field and therefore a 2dB façade correction will be applied. The monitoring position is considered representative of background noise levels at the nearest identified noise sensitive properties. The monitoring position was chosen for equipment security reasons also.

The equipment used for the noise survey is summarised in Table 4.1.

Table 4.1 **Description of Equipment used for Noise Survey**

Equipment	Description	Quantity	Serial Number
Larson Davis Sound Expert LxT	Type 1 automated logging sound level meter	1	0003814
Larson Davis 377B02	½" microphone	1	142503
Larson Davis	Pre-amplifier	1	028032
Larson Davis CAL200	Class 1 Calibrator	1	11706

The noise survey and measurements were conducted in accordance with BS7445-1:2003 '*Description and measurement of environmental noise. Guide to quantities and procedures*'.

Weather conditions throughout the entire noise survey period were noted to be warm (approx. 1-17° Celsius), low clouds (0 to 50% cloud cover approximately) with a light wind (<5m/s). These weather conditions were checked against and confirmed by the use of the Met Office mobile application available on smart phone technology. These conditions were maintained throughout the majority of the survey period and are considered reasonable for undertaking environmental noise measurements.

The noise monitoring equipment was field calibrated before and after the noise survey period. No significant drift was recorded (± 0.3 dB). Equipment calibration certificates can be provided upon request.

5. NOISE SURVEY RESULTS AND OBSERVATIONS

5.1 Results

A summary of the measured ambient and typical background noise levels during the proposed operational hours are shown in Table 5.1.1 below (full monitoring data can be found in Appendix C). The extraction system was not in operation during the surveyed hours.

Table 5.1.1 Measured Ambient and Typical Background Sound Pressure Levels

Date / Period (hours)	Ambient Sound Pressure Level, dB $L_{Aeq,15min}$	Typical Background Sound Pressure Level, dB $L_{A90,15min}$
25/06/2022 – 26/03/2022 (23:00 to 01:00)	37-51*	37*
26/06/2022 – 27/03/2022 (23:00 to 01:00)	38-50*	37*
27/06/2022 – 28/03/2022 (23:00 to 01:00)	37-54*	36*

*Façade correction -2dB

The typical background noise level at the measurement position during the survey, at the time in which the plant could be operational, is **37dB** $L_{A90,15min}$.

Plant Noise Data

In order to assess whether the noise emanating from the mechanical plant has any tonality, 15-minute 1/3 octave measurements were also recorded and are shown in Table 5.1.2 below.

Table 5.1.2 Plant Noise Data

Time	Notes	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
10:00	Off	67.0	65.1	61.3	51.3	45.9	41.2	46.7	41.0
10:15	Off	64.4	65.9	64.3	53.1	47.8	41.1	40.7	36.0
10:30	2m from Motor	69.1	66.6	62.1	50.5	46.5	41.4	45.6	41.5
12:10	2m from Terminus	65.9	69.7	63.3	56.7	51.9	44.8	41.0	34.5

Tonality

BS 4142:2014+A1:2019 (Annex C) states: -

For a prominent, discrete tone to be identified as present, the time-averaged sound pressure level in the one-third-octave band of interest is required to exceed the time-averaged sound pressure levels of both adjacent one-third-octave bands by some constant level difference.

Using the objective assessment method as specified in BS4142:2014+A1:2019 a penalty would be applied to the rated noise level if both adjacent 1/3 octave values;

- Exceeds by 15dB from 25Hz-125Hz
- Exceeds by 8dB from 160-400Hz
- Exceeds by 5dB from 500-10kHz

At no time during the measurement period did the 1/3 octave band measurements with the mechanical plant in operation exceed both adjacent 1/3 octave bands by the BS 4142 objective criteria.

A subjective assessment of the tonality of the extraction system terminus was also completed. There was no audible tonal element to the noise from the extraction system.

5.2 Observations

Given that the noise survey was unmanned, noise sources could not be identified. However, at the beginning and end of the survey background noise was dominated by noise from the vehicles on the local road network and existing mechanical plant. After analysis of the data no significant abnormal noise source(s) were identifiable. It is considered that the measured noise levels are reasonable given the location of the measurement position.

6. EXTERNAL NOISE EMISSION LIMITS

6.1 Local Authority Requirements

The site lies within the jurisdiction of the Reading Borough Council. The following criteria has been provided by the local authority:

'The assessment shall be carried out for in accordance with BS4142:2014+A1:2019 methodology. The predicted specific sound level ($L_{Aeq,Tr}$) (with reference to BS4142) as measured at a point 1 metre external to the nearest noise-sensitive façade shall be at least 10dB below the pre-existing background sound level, $L_{A90,T}$ when all plant/equipment (or any part of it) is in operation. The predicted rating level, $L_{Ar,Tr}$ (specific sound level plus any adjustment for the characteristic features of the sound as measured at a point 1 metre external to the nearest noise-sensitive façade (habitable window of a dwelling) shall not exceed the pre-existing background sound level, $L_{A90,T}$, when all plant/equipment (or any part of it) is in operation.'

For the purposes of this report, an assessment has been undertaken in line with BS 4142:2014+A1:2019. A design criterion of achieving a minimum 10dB(A) below the typical background noise level has been adopted in line with the Local Authorities policy. Taking the noise monitoring data in Section 5 and Local Authority requirements above, the following design target has been adopted for mechanical plant as provided in Table 6.1.

Table 6.1 Maximum Noise Emission Design Target at Residential Premises

Date / Period (hours)	Typical Background Sound Pressure Level, dB $L_{A90,15min}$	Noise Level at Nearest Residential Facade, dB $L_{Aeq,T}$
25/06/2022 – 26/03/2022 (23:00 to 01:00)	37*	27
26/06/2022 – 27/03/2022 (23:00 to 01:00)	37*	
27/06/2022 – 28/03/2022 (23:00 to 01:00)	36*	

* Façade correction -2dB

6.2 BS 4142:2014+A1:2019

BS 4142:2014+A1:2019 “Methods for rating and assessing industrial and commercial sound” presents a method for assessing the significance and possible adverse impact due to an industrial noise source, based on a comparison of the source noise levels and the background noise levels, both of which are measured or predicted at a noise sensitive receiver e.g. a residential property.

The specific noise level due to the source is determined, with a series of corrections for tonality, impulsivity, intermittency or other unusual characteristic. The rating level is then compared to the background noise level and the significance of the new noise source likelihood of any adverse impact is determined in accordance with the following advice:

“The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occur. A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context. A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context. 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 sound level, this is an indication of the specific sound source having a low impact, depending on the context.”

7. KITCHEN EXTRACTION SYSTEM AND ASSOCIATED NOISE LEVELS

The following items of plant are installed at the rear of the premises.

Table 7.0 Proposed Kitchen Extraction Fan Motor

External Plant Item	Make	Model	Reference Noise Level* $L_{w(A)}$
Kitchen Extract Fan Motor	Ventorn	AHF-500/3	Outlet 79dB Breakout 62dB

*Reference sound power levels. Manufacturer's specifications are provided in Appendix B.

The ducting is 300mm standard circular duct work. The extraction fan motor is located externally and therefore breakout noise from the motor and noise from the duct terminus have been considered.

In reference to section 6 of this report, no penalty addition has been applied for intermittency as the system is switched on and remains on throughout the service period. Penalty additions have not been applied for tonality as manufacturers' data shows no significant characteristics, or for impulsiveness as it is considered that these characteristics will not be perceptible sufficient to attract attention at the noise receptors. Penalty additions have not been applied for any other sound characteristics as mechanical plant of this type generally do not demonstrate such features.

7.1 Building Screening

Due to the positioning of the extraction system motor, there will be significant building screening, due to the rear yard wall, from the nearest residential properties so there will be no direct line of sight, therefore attenuation due to barrier loss has also been considered (calculations are provided in Appendix D).

8. NOISE IMPACT ASSESSMENT

This section presents calculations to determine the noise impact of the kitchen extraction system, located at the site, at the nearest noise sensitive properties.

8.1 Proposed Operational Hours and Background Noise Levels

The kitchen extraction system will operate as required during the opening hours of the business. The current opening hours are from 11:30 – 22:30 hours daily. It is proposed to extend the opening hours to 09:00 - 23:00 hours Monday to Thursday, 09:00 - 01:00 hours Friday and Saturday and 09:00 – 23:00 hours on Sunday.

The typical background noise level at the measurement position during the survey is **37dB** $L_{A90,15min}$. The design range is **27dB** $L_{Aeq,T}$ at the façade of the nearest residential premises.

8.2 Nearest Noise Sensitive Properties

The nearest sensitive residential receptors were noted to be the third-floor windows located on the side façade of 32 Market Place at an approximate distance of 13m from the fan motor casing and 12m from the extraction system terminus.

8.3 Description of Determination Process

In accordance with the methodologies of BS 4142:2014+A1:2019, calculations have been undertaken to determine noise levels in which the kitchen extraction system could be operational at its maximum level. Given the distances between the noise sources and the noise sensitive receptors, point source calculations have been used.

Short-term measurements have been completed to determine the specific impact of the kitchen extraction system. Measurements with the system on and off, have been used to determine the specific level of the mechanical plant which has been used to calculate the specific level at the nearest sensitive receptor. Full calculations can be found in Appendix D.

The rating measured noise level at 1m from the nearest sensitive receptor, with the mechanical plant operating, was measured to be **43dB** $L_{Ar,T}$ which is **6dB(A) above** the typical background noise level (37dB $L_{A90,15min}$).

In accordance with BS 4142:2014+A1:2019 guidance, the rating noise ***“is an indication of the specific sound source having an adverse impact”***. *The lower the rating level is relative to the measured background level, the less likely it is that the specific sound source will have an adverse impact.*

In order to meet the required design target, it is recommended that the following mitigation measures are implemented:

8.4 Recommended Noise Mitigation

It is recommended to install a RSD 400/800 and a RSD 400/1200 Helios silencer on the atmosphere side of the fan. The silencers provide the attenuation shown in Table 8.4.1 and Table 8.4.2. All silencers should be Melinex lined.

Table 8.4.1 RSD 400/800 Silencer Attenuation

125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
6	6	12	18	13	12	8

Table 8.4.2 RSD 400/1200 Silencer Attenuation

125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
7	10	14	22	18	13	9

The rating measured noise level at 1m from the nearest sensitive receptor, with the mechanical plant operating, with the recommended noise mitigation installed, is predicted to be **26dB L_{Ar,T}** which is **11dB(A) below** the typical background noise level (37dB L_{A90,15min}).

In accordance with BS 4142:2014+A1:2019 guidance, the rating noise ***“is an indication of the specific sound source having a low impact”***. *The lower the rating level is relative to the measured background level, the less likely it is that the specific sound source will have an adverse impact.*

8.5 Vibration

In addition to the control of airborne noise transfer, it is important to consider the transfer of noise as vibration to adjacent properties as well as any sensitive areas of the same building. Vibration from the system is not expected, however, as a precaution plant should wherever possible be installed on suitable type isolators.

Uncertainty

The levels of uncertainty in the data and calculations are considered to be low/medium given the robust exercise undertaken in noise monitoring and the confidence in the data statistical analysis. Measured data for the plant is considered to be robust. Detailed calculations and resultant noise levels at the residential location are considered to be confidently calculated.

9. CONCLUSION

Sound Licensing has undertaken an environmental noise survey at the site in order to determine prevailing background noise levels that are representative of the nearest noise sensitive properties. Short-term measurements have been completed with and without the mechanical plant in operation in order to determine the specific impact of the mechanical plant. The operation of the kitchen extraction system, in accordance with BS 4142:2014+A1:2019 guidance, with recommended noise mitigation installed, indicates to creating a low impact. All worst-case scenarios have been applied to the assessment. The predicted cumulative operating noise level of the kitchen extraction system, with recommended noise mitigation installed, is demonstrated to comply with the Reading Borough Council's policy.

APPENDIX A – Acoustic Terminology

Parameter	Description
Acoustic environment	Sound from all sound sources as modified by the environment
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far
Ambient sound level, $L_a = LA_{eq,T}$	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T
Background sound level, $LA_{90,T}$	A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels
Decibel (dB)	A logarithmic scale representing the sound pressure or power level relative to the threshold of hearing (20×10^{-6} Pascals).
Equivalent continuous A-weighted sound pressure level, $LA_{eq,T}$	Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time
Measurement time interval, T_m	Total time over which measurements are taken
Rating level, $L_{Ar,Tr}$	Specific sound level plus any adjustment for the characteristic features of the sound
Reference time interval, T_r	Specified interval over which the specific sound level is determined
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound
Residual sound level, $L_r = LA_{eq,T}$	Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T
Specific sound level, $L_s = LA_{eq,Tr}$	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r
Specific sound source	Sound source being assessed

References:

BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound'

APPENDIX B – Data Sheets and Figures

Kitchen Extraction Motor - Ventorn AHF-500/3 Acoustic Data

Sound Data										
Sound pressure level at 3m							54	dB(A)		
Acoustics	Hz	Tot	63	125	250	500	1k	2k	4k	8k
LwA Inlet	dB(A)	77	64	64	70	72	71	68	63	56
LwA Outlet	dB(A)	79	66	68	72	74	73	70	65	58
LwA Surrounding	dB(A)	62	49	51	55	57	56	53	48	41

Helios RSD 400/800 and RSD 400/1200 Silencers Data Sheet

Helios

Flanged circular attenuator RSD

■ Specification – Installation

Casing made of galvanised steel, acoustically lined with high quality mineral wool covered with cloth to prevent erosion. Dimensions and tapped flange holes of all sizes fit fan's nominal diameter (R 20). Tapped holes in accordance to DIN 24155, Pt. 2.

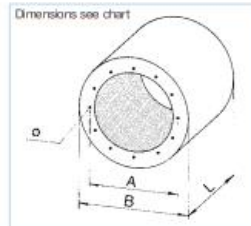
■ Insertion loss

To increase the attenuation, several attenuators can be installed in-line.

■ Pressure drop

The resistance of the RSD attenuators is very low. When designing the system consider twice the pressure drop of rigid ducting.

Dimensions see chart

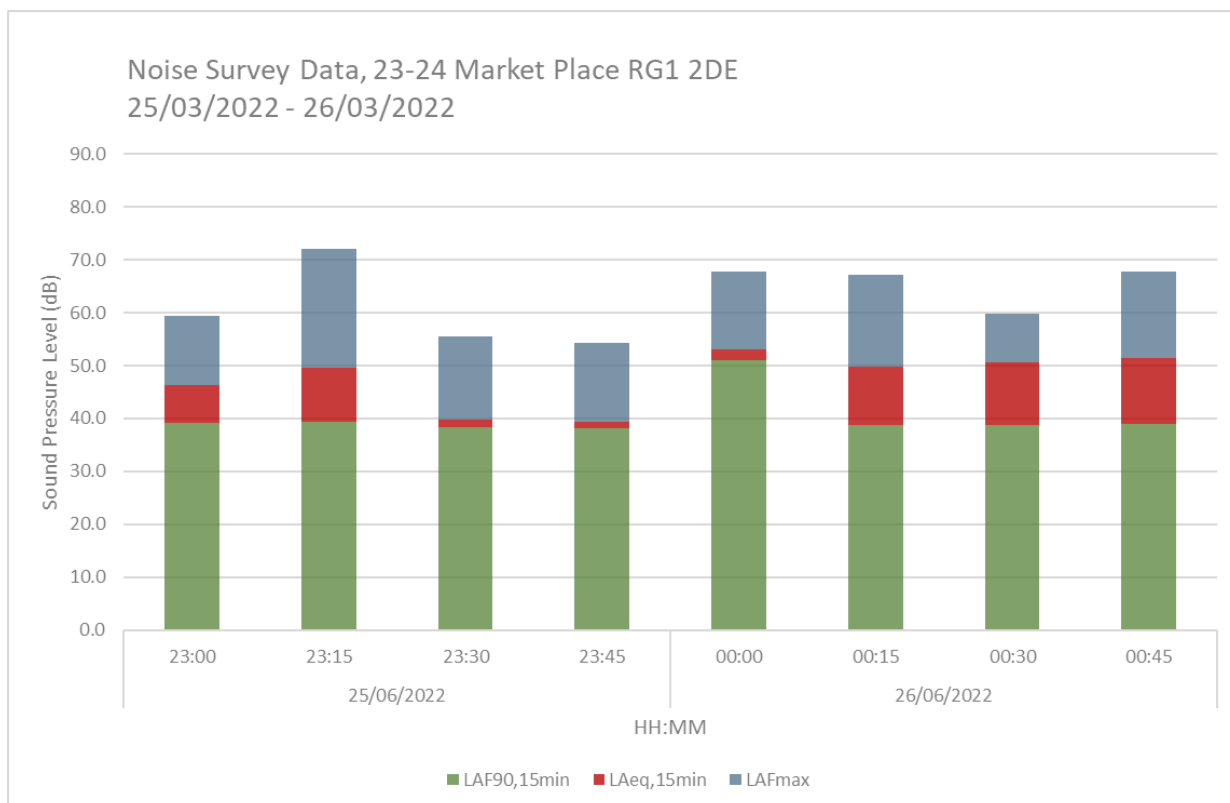


RSD

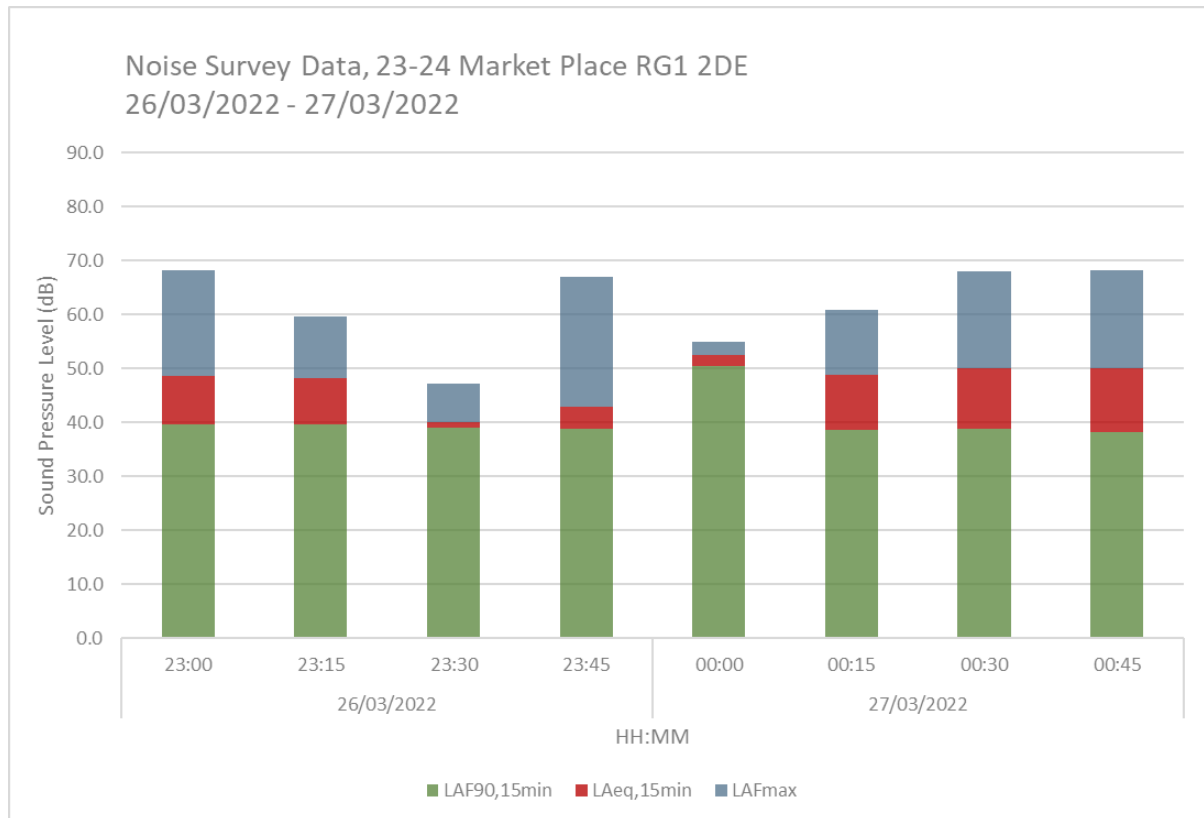


Type	Ref.No.	Basic length	L	Dimensions in mm	Hole ø	Nominal weight kg	125	250	500	1000	2000	4000	8000	Average attenuation
RSD 280/ 400	8740	1	400	322	454	8 x M 8	10	4	5	8	14	9	6	8
RSD 280/ 800	8741	2	800	322	454	8 x M 8	18	7	9	16	28	17	14	14
RSD 280/1200	8742	3	1200	322	454	8 x M 8	25	9	12	23	37	23	16	18
RSD 315/ 400	8743	1	400	356	504	8 x M 8	11	3	3	7	13	8	5	5
RSD 315/ 800	8744	2	800	356	504	8 x M 8	19	6	8	14	26	16	12	12
RSD 315/1200	8745	3	1200	356	504	8 x M 8	28	9	12	21	36	18	17	18
RSD 355/ 400	8746	1	400	395	564	8 x M 8	13	3	4	7	11	7	6	6
RSD 355/ 800	8747	2	800	395	564	8 x M 8	23	6	7	13	22	14	12	11
RSD 355/1200	8748	3	1200	395	564	8 x M 8	33	8	11	17	29	18	15	17
RSD 400/ 400	8749	1	400	438	564	12 x M 8	12	3	4	6	9	7	5	6
RSD 400/ 800	8750	2	800	438	564	12 x M 8	21	6	6	12	18	13	12	9
RSD 400/1200	8751	3	1200	438	564	12 x M 8	30	7	10	14	22	18	13	15
RSD 450/ 400	8752	1	400	487	634	12 x M 8	17	4	5	8	10	8	7	8
RSD 450/ 800	8753	2	800	487	634	12 x M 8	27	6	7	13	18	13	12	11
RSD 450/1200	8754	3	1200	487	634	12 x M 8	38	8	10	18	23	17	14	15
RSD 500/ 600	8755	1	600	541	714	12 x M 8	27	4	5	9	11	9	9	8
RSD 500/ 900	8756	2	900	541	714	12 x M 8	36	6	8	14	16	13	13	12
RSD 500/1200	8757	3	1200	541	714	12 x M 8	45	8	11	22	24	17	16	17
RSD 560/ 600	8758	1	600	605	804	8 x M 10	32	3	5	9	9	8	8	8
RSD 560/1200	8759	2	1200	605	804	8 x M 10	52	6	10	19	19	16	13	15
RSD 630/ 600	8760	1	600	674	900	8 x M 10	44	3	5	8	8	8	7	8
RSD 630/1200	8761	2	1200	674	900	8 x M 10	68	5	10	16	15	15	11	15
RSD 710/ 600	8762	1	600	751	1000	8 x M 10	51	3	5	7	7	7	6	8
RSD 710/1200	8763	2	1200	751	1000	8 x M 10	80	5	10	14	13	13	10	15
RSD 800/ 600	8764	1	600	837	1100	12 x M 10	57	2	5	7	6	6	5	8
RSD 800/1200	8765	2	1200	837	1100	12 x M 10	88	5	9	13	11	11	9	14
RSD 900/ 900	8766	1	900	934	1220	12 x M 10	82	2	4	10	9	6	5	6
RSD 900/1800	8767	2	1800	934	1220	12 x M 10	135	4	9	21	17	13	9	14
RSD 1000/ 900	8768	1	900	1043	1350	12 x M 10	96	2	4	8	7	5	4	6
RSD 1000/1800	8769	2	1800	1043	1350	12 x M 10	157	4	7	16	14	10	7	11
RSD 1120/ 900	8770	1	900	1174	1350	12 x M 10	81	2	3	7	6	4	3	5
RSD 1120/1800	8771	2	1800	1174	1350	12 x M 10	136	3	6	14	11	8	6	9
RSD 1250/ 900	8772	1	900	1311	1460	12 x M 10	86	1	2	5	4	3	2	3
RSD 1250/1800	8773	2	1800	1311	1460	12 x M 10	146	2	4	11	9	7	5	6

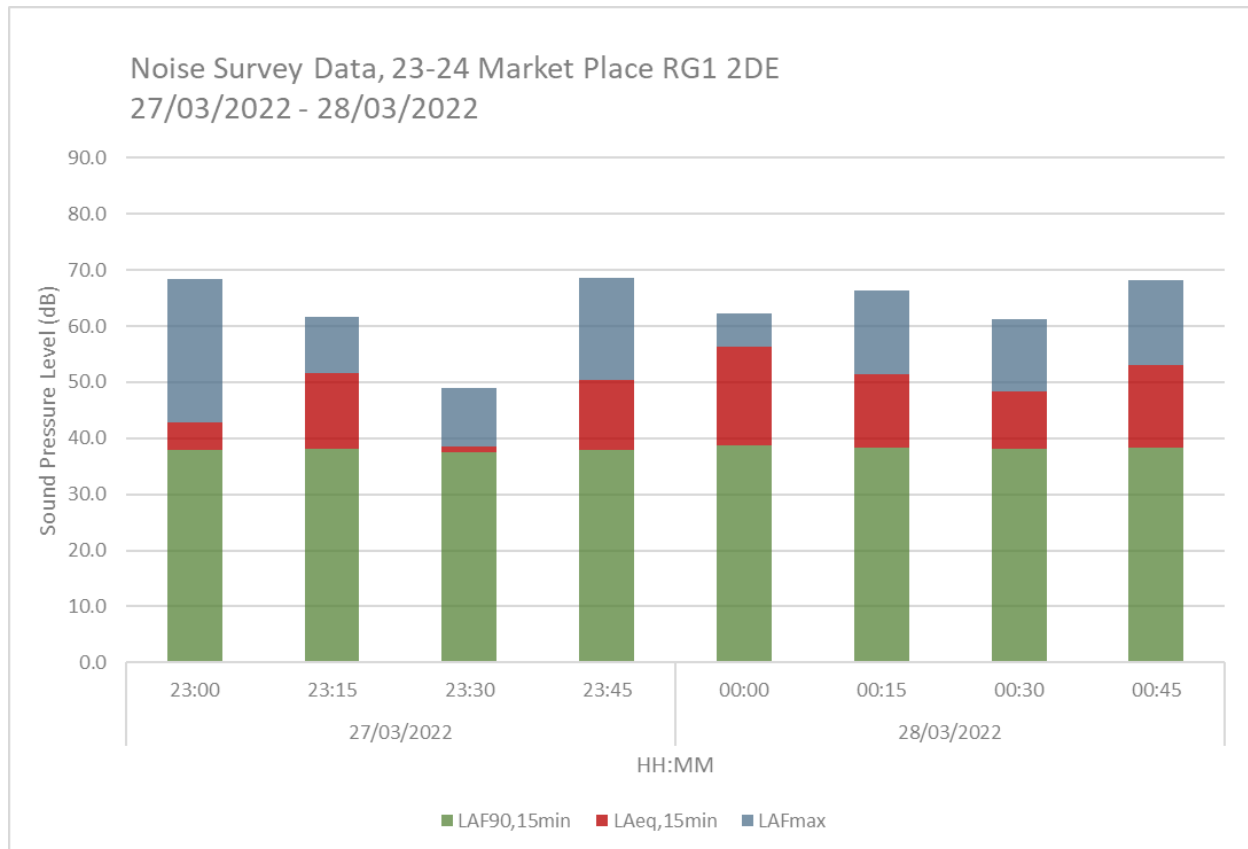
APPENDIX C – Noise monitoring Data



Date	Time	L _{Aeq,15min}	L _{AFmax}	L _{AF90,15min}
25/06/2022	23:00	46.3	59.4	39.1
	23:15	49.5	72.1	39.3
	23:30	39.7	55.5	38.3
	23:45	39.4	54.2	38.2
26/06/2022	00:00	53.1	67.8	51.0
	00:15	49.8	67.1	38.7
	00:30	50.6	59.8	38.7
	00:45	51.4	67.7	39.0



Date	Time	L _{Aeq,15min}	L _{AFmax}	L _{AF90,15min}
26/03/2022	23:00	48.6	68.3	39.6
	23:15	48.1	59.6	39.5
	23:30	40.0	47.2	39.0
	23:45	42.8	66.9	38.7
27/03/2022	00:00	52.4	54.9	50.5
	00:15	48.7	60.8	38.5
	00:30	50.1	68.0	38.7
	00:45	49.9	68.3	38.2



Date	Time	L _{Aeq,15min}	L _{AFmax}	L _{AF90,15min}
27/03/2022	23:00	42.8	68.3	38.0
	23:15	51.7	61.7	38.1
	23:30	38.5	49.1	37.6
	23:45	50.4	68.6	37.9
28/03/2022	00:00	56.3	62.3	38.8
	00:15	51.5	66.3	38.3
	00:30	48.3	61.2	38.2
	00:45	53.0	68.1	38.4

APPENDIX D – Calculations

Determination of Mechanical Plant Noise

Where:

L_1 = Measured $L_{A90,1\text{hour}}$ With the Mechanical Plant Operating

L_2 = Measured $L_{A90,1\text{hour}}$ Without the Mechanical Plant Operating

L_P = Sound Pressure Level of Mechanical Plant at Nearest Sensitive Receptor

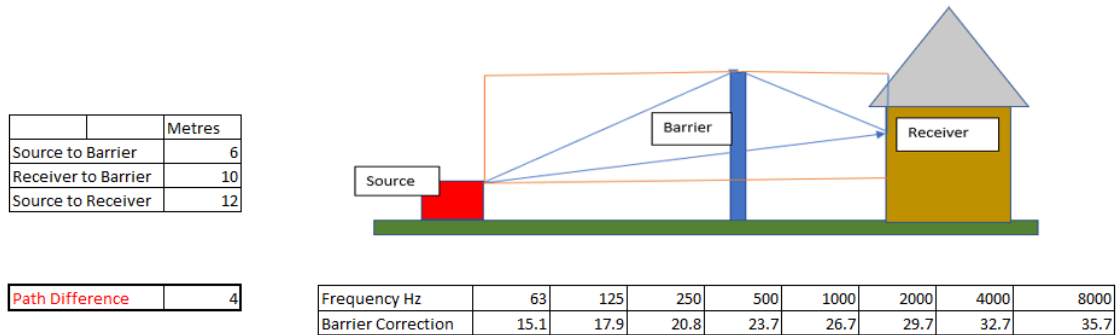
$$L_P = 10 \log \left(10^{\left(\frac{L_1}{10}\right)} - 10^{\left(\frac{L_2}{10}\right)} \right)$$

Without Recommended Mitigation

Building Screening Attenuation Calculation – Extraction Fan Motor Casing

Applicable where barrier breaks line of sight between source and receiver

Example Illustration of Barrier Attenuation



Attenuation per double distance required =
(6dB for LpA recommended)

ion per double distance required = 6dB for LpA recommended)				6	dB			Metres	Ref Dist'
					Enter Distance =				12
	Frequency Hz								
	63	125	250	500	1000	2000	4000	8000	Total
	65.1	61.3	54.7	41.3	37.5	28.4	36.7	31.8	66.88
'A' Weight	26.2	16.1	8.6	3.2	0	-1.2	-1	1.1	
LPA	38.9	45.2	46.1	38.1	37.5	29.6	37.7	30.7	50.06
LPA at New Dist'	23.3	29.6	30.5	22.5	22.0	14.1	22.1	15.1	34.50
BARRIER	15.1	17.9	20.8	23.7	26.7	29.7	32.7	35.7	
LPA After Insert	8.20	11.75	9.75	-1.22	-4.73	-15.65	-10.61	-20.62	15.08

Fan Motor Casing Breakout @ 12m = 15dB L_{Aeq,T}

Attenuation per double distance required =
(6dB for LpA recommended)

ion per double distance required = 6dB for LpA recommended)				6	dB			Metres	Ref Dist'
				Enter Distance =				11	2
	Frequency Hz								
	63	125	250	500	1000	2000	4000	8000	Total
	57.0	67.8	59.0	55.3	50.7	42.3	36.7	31.0	68.92
'A' Weight	26.2	16.1	8.6	3.2	0	-1.2	-1	1.1	
LPA	30.8	51.7	50.4	52.1	50.7	43.5	37.7	29.9	57.53
LPA at New Dist'	16.0	36.9	35.6	37.3	35.9	28.6	22.9	15.1	42.72
LPA After Insert	15.97	36.90	35.57	37.28	35.88	28.65	22.86	15.12	42.72

Extraction System Terminus @ 11m = 43dB L_{Aeq,T}

Adding dB								
Levels to be added (Max. of eight)								
Enter values	15	43	0	0	0	0	0	0
Total = 43.0 dB								

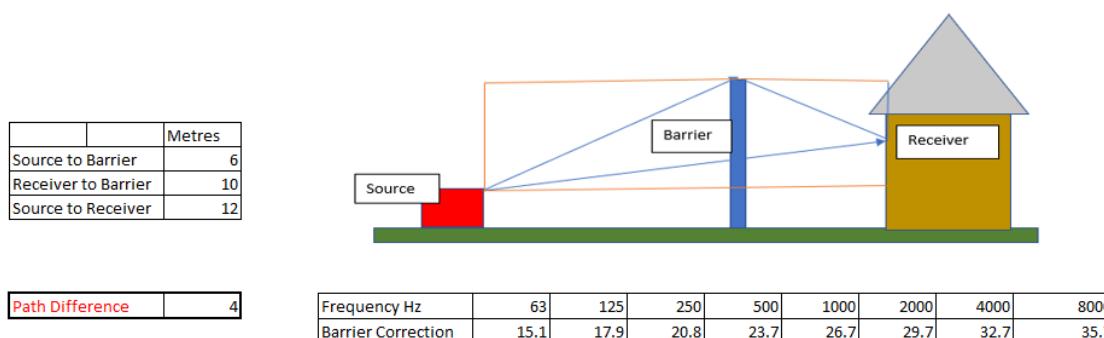
Cumulative Rating Level @ Nearest Sensitive Receptor = 43dB $L_{Ar,T}$

With Recommended Mitigation

Building Screening Attenuation Calculation – Extraction Fan Motor Casing

Applicable where barrier breaks line of sight between source and receiver

Example Illustration of Barrier Attenuation



Attenuation per double distance required =
(6dB for L_{pA} recommended)

ion per double distance required = 5dB for LpA recommended)				6	dB			Metres	Ref Dist'
					Enter Distance =			12	2
	Frequency Hz								
	63	125	250	500	1000	2000	4000	8000	Total
	65.1	61.3	54.7	41.3	37.5	28.4	36.7	31.8	66.88
'A' Weight	26.2	16.1	8.6	3.2	0	-1.2	-1	1.1	
LPA	38.9	45.2	46.1	38.1	37.5	29.6	37.7	30.7	50.06
LPA at New Dist'	23.3	29.6	30.5	22.5	22.0	14.1	22.1	15.1	34.50
BARRIER	15.1	17.9	20.8	23.7	26.7	29.7	32.7	35.7	
LPA After Insert	8.20	11.75	9.75	-1.22	-4.73	-15.65	-10.61	-20.62	15.08

Fan Motor Casing Breakout @ 13m = 14dB $L_{Aeq,T}$

Attenuation per double distance required =
(6dB for LpA recommended)

ion per double distance required = 6dB for LpA recommended)				6	dB			Metres	Ref Dist'
				Enter Distance =				11	2
	Frequency Hz								
	63	125	250	500	1000	2000	4000	8000	Total
	57.0	67.8	59.0	55.3	50.7	42.3	36.7	31.0	68.92
'A' Weight	26.2	16.1	8.6	3.2	0	-1.2	-1	1.1	
LPA	30.8	51.7	50.4	52.1	50.7	43.5	37.7	29.9	57.53
LPA at New Dist'	16.0	36.9	35.6	37.3	35.9	28.6	22.9	15.1	42.72
SILENCER	0	7	10	14	22	18	13	9	
SILENCER	0	6	6	12	18	13	12	8	
LPA After Insert	15.97	23.90	19.57	11.28	-4.12	-2.35	-2.14	-1.88	25.92

Extraction System Terminus @ 12m = 26dB L_{Aeq,T}

Adding dB								
<u>Levels to be added</u> (Max. of eight)								
<u>Enter values</u>	15	26	0	0	0	0	0	0
Total = 26.4 dB								

Cumulative Rating Level @ Nearest Sensitive Receptor = 26dB L_{Ar,T}