

MILLER & CARTER, CAVERSHAM

MECHANICAL PLANT NOISE ASSESSMENT

On behalf of:

Mitchells and Butlers Leisure Retail Ltd

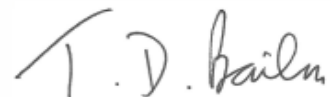
MILLER & CARTER, CAVERSHAM

MECHANICAL PLANT NOISE ASSESSMENT

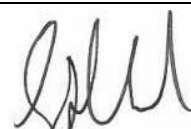
Report prepared by:
Hepworth Acoustics Ltd
Hamilton House
Mabledon Place
London
WC1H 9BB

On behalf of:
Mitchells and Butlers Leisure Retail Ltd

Report prepared by:
Thomas Bailess MEng MIOA – Principal Consultant



Report checked by:
Graham Bowland BSc MIOA – Technical Director



CONTENTS

1.0	INTRODUCTION	1
2.0	ACOUSTIC DESIGN CRITERIA	4
3.0	NOISE SURVEY	5
4.0	ASSESSMENT	7
5.0	CONCLUSIONS	9
	FIGURE 1 – SITE LOCATION	10
	APPENDIX I: NOISE UNITS & INDICES	11

1.0 INTRODUCTION

- 1.1 Hepworth Acoustics Ltd has been commissioned by Mitchells and Butlers Leisure Retail Ltd to carry out a mechanical plant noise assessment in connection with the existing kitchen ventilation plant associated with the Miller & Carter restaurant at 109 Kidmore Road, Caversham, Berkshire RG4 7NH.
- 1.2 The ventilation plant serving the restaurant's kitchen was upgraded during a recent refurbishment. Since then, we understand that noise complaints have been received from local neighbours. The Local Authority, Reading Borough Council, has advised that the client should seek retrospective planning permission for the upgraded kitchen ventilation plant, to include a noise impact assessment. The Senior Environmental Health Officer, Rebecca Moon, made the following comments regarding noise from the new kitchen ventilation plant at the site in her email, dated 8th December 2022:

"I visited the site today and confirmed that the extraction system is (subjectively) very loud. Residents have reported that it has reduced slightly in recent days which they have speculated may be due to reduced fan speeds but this is not verified. We have received complaints from at least 4 separate households about the noise and residents are very concerned about use of their gardens and the impact of the noise when they open their windows when the warmer weather returns.

Advice from planners is that the new system should have been included on the refurb planning application. If it had been, then we would have required a noise and odour assessment to be carried out prior to the installation.

Our planning requirements for a new extraction system are as follows:

"Noise

"No mechanical plant shall be installed until a noise assessment of the proposed mechanical plant has been submitted and approved by the Local Planning Authority. The assessment shall be carried out for in accordance with BS4142:2014+A1:2019 methodology. The predicted specific sound level (LAeq,TR) (with reference to BS:4142) as measured at a point 1 metre external to the nearest noise-sensitive facade shall be at least 10dB below the pre-existing background sound level, LA90,T when all plant/equipment (or any part of it) is in operation. The predicted rating level, LAr,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, LA90,T when all plant/equipment (or any part of it) is in operation.

The plant shall thereafter only be installed in accordance with the assessment and shall thereafter be maintained so that it operates to the same standard.

“In summary we recommend a noise assessment to BS4142 standard, which would then make recommendations for meeting required levels.”

1.3 The purpose of this assessment is therefore to determine the noise impact of the new mechanical plant using the guidance in BS 4142, and to recommend noise mitigation measures where needed to meet the Local Authority’s noise requirements. This assessment has included the following:

- A site inspection;
- A survey of the prevailing environmental noise levels at the site;
- Assessment of noise from the new mechanical plant;
- Recommendations of appropriate noise control measures.

1.4 The site is bounded by Kidmore Road to the northeast. To the southeast of the site is Hornbeam Close, with private houses beyond. To the southwest of the site is the restaurant’s car park and garden, with the private houses on Lymington Gate beyond. To the northwest are further private residences. The house at 89 Kidmore Road is the nearest residence, at around 31 metres away from the new mechanical plant, based on our survey on site. The site location is shown in Figure 1.

1.5 The new mechanical plant has been installed outside on the first-floor flat roof at the rear of the premises, which includes a new kitchen extract fan, new kitchen supply fan, and associated ductwork. To summarise, the new mechanical plant is as follows:

Table 1: Mechanical Equipment

Equipment	Type	Location
Kitchen Extract Fan	SystemAir MUB T 062 630D4	Rear flat roof
Kitchen Supply Fan	SystemAir MUB T 062 630D4	Rear flat roof

1.6 This assessment is based on the following documents:

- Drawing MACCR-01 Revision 1, dated 29th June 2022, prepared by Concept CCF UK Ltd
- Statement of Design Intent for Kitchen Ventilation System Ref: B3829 Rev A (22/12/2022), prepared by Building Management Technology Ltd

- 1.7 The kitchen supply fan is shown on the above drawing with duct attenuators ('silencers') on the inlet and outlet. The kitchen extract fan is shown without any duct attenuators. Our site inspection confirmed this is how it is constructed on site.
- 1.8 All recommendations in this report are given for acoustics reasons only. Compliance with other requirements (e.g. fire, structural, thermal, etc.) must be checked by others.
- 1.9 The various noise units and indices referred to in this report are described in Appendix I. All noise levels mentioned in the text have been rounded to the nearest decibel, as fractions of decibels are imperceptible.

2.0 ACOUSTIC DESIGN CRITERIA

- 2.1 The Local Authority refers to the current version of British Standard 4142, which is BS 4142: 2014 + A1: 2019 '*Methods for rating and assessing industrial and commercial sound*'. The standard will be referred to as BS 4142 for the rest of this report for brevity.
- 2.2 BS 4142 requires the noise 'rating level' for the plant/operation to be compared with the background (L_{A90}) sound level in the absence of the operational noise being assessed, outside the nearest residential location.
- 2.3 The 'rating level' is derived based on the 'specific sound level' (in L_{Aeq}) attributable to the plant with an '*acoustic feature*' penalty added for any noise sources which give rise to tonal, impulsive, intermittent, or other characteristics that are readily distinctive against the residual acoustic environment, outside the residential location.
- 2.4 The impact of the plant noise at the nearest residential location is determined by subtracting the background sound level from the rating level. The Local Authority has requested for the 'specific sound level' to be at least 10 dB(A) below the background sound level, and the 'rating level' to be below the background sound level, when determined outside the nearest residence.

3.0 NOISE SURVEY

- 3.1 To determine the noise impact of the existing kitchen ventilation plant, noise measurements were made at 22:30 on Thursday 12th January 2023 outside the nearest residence at the location marked on Figure 1 with a) the kitchen ventilation plant running at normal speed and b) with all equipment switched off. The late-evening measurement time was selected to reduce interference from extraneous noise such as road traffic.
- 3.2 The measurement microphone was mounted on a tripod, around 1.5 metres above ground level with the microphone in 'free-field' conditions. Each of measurements a) and b) described above were taken for five-minute sample durations. Measurements were made using the L_{A90} metric. For constant noise sources, including fixed plant such as this, L_{A90} can be considered equivalent to L_{Aeq} for assessment purposes, but with the advantage of excluding intermittent noise from external environmental sources that would otherwise interfere with the source noise measurements.
- 3.3 The weather conditions throughout the noise survey were cool, dry, and overcast, with wind speeds below 5 m/s. Wind was from the south-west. These were considered suitable conditions for the survey.
- 3.4 The results of the noise measurements are summarised in Table 2.

Table 2: Measured noise levels summary (dB)

Description	Octave Band Centre Frequency (Hz)								A
	63	125	250	500	1k	2k	4k	8k	
All equipment on at normal speed, dB $L_{90,5mins}$	50	54	49	44	41	34	25	16	47
All equipment off (background), dB $L_{90,5mins}$	49	50	45	42	40	32	22	15	44

- 3.5 The background noise levels, in the absence of the equipment noise, were predominantly due to road traffic on Kidmore Road.
- 3.6 The source noise was neither tonal, intermittent, nor impulsive, therefore no BS 4142 acoustic feature penalty is required.
- 3.7 In addition to the noise measurements described above, close-up visual inspection of the equipment was carried out, along with subjective listening to the source and character of the equipment noise. This confirmed that the equipment appears to be installed correctly and is running normally.
- 3.8 All noise measurements were carried out using a Brüel & Kjær Type 2250 sound level meter (serial no. 3011626) fitted with a windshield.

- 3.9 The calibration level of the meter was checked before and after the survey with a Brüel & Kjær Type 4231 sound calibrator (serial no. 2412667). No significant calibration deviation was observed.

4.0 ASSESSMENT

4.1 Based on the results in Table 2, it is apparent that noise from the kitchen ventilation system currently exceeds the limits required by the Local Authority. If the specific sound level was at least 10 dB(A) below the background noise levels, we would expect no significant increase in the A-weighted level. However, the levels increased by 3 dB(A), showing that the plant noise is around 44 dB(A), i.e. at the same level as the background noise. Noise mitigation measures will therefore be required.

4.2 Based on the noise measurements results and our equipment inspections on site, our recommended noise mitigation measures are summarised as follows:

- Inlet and outlet duct attenuators for the kitchen extract fan.
- Additional inlet duct attenuator for the kitchen supply fan.
- Duct wrapping for all external ductwork.

4.3 We recommend that a duct attenuator is installed on the atmosphere side (outlet) of the kitchen extract fan with the insertion loss values shown in Table 4, or greater.

Table 4: Kitchen Extract Fan Atmosphere-Side Attenuator Minimum Insertion Loss Values (dB)

Description	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Insertion loss	-5	-11	-20	-25	-26	-27	-23	-18

4.4 We recommend that a duct attenuator is installed on the room side (inlet) of the kitchen extract fan with the insertion loss values shown in Table 5, or greater.

Table 5: Kitchen Extract Fan Room-Side Attenuator Minimum Insertion Loss Values (dB)

Description	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Insertion loss	-3	-8	-11	-12	-12	-12	-11	-10

4.5 We recommend that an additional duct attenuator is installed on the atmosphere side (inlet) of the kitchen supply fan (i.e. in addition to the existing duct attenuator) with the insertion loss values shown in Table 6, or greater.

Table 6: Kitchen Supply Fan Atmosphere-Side Attenuator Minimum Insertion Loss Values (dB)

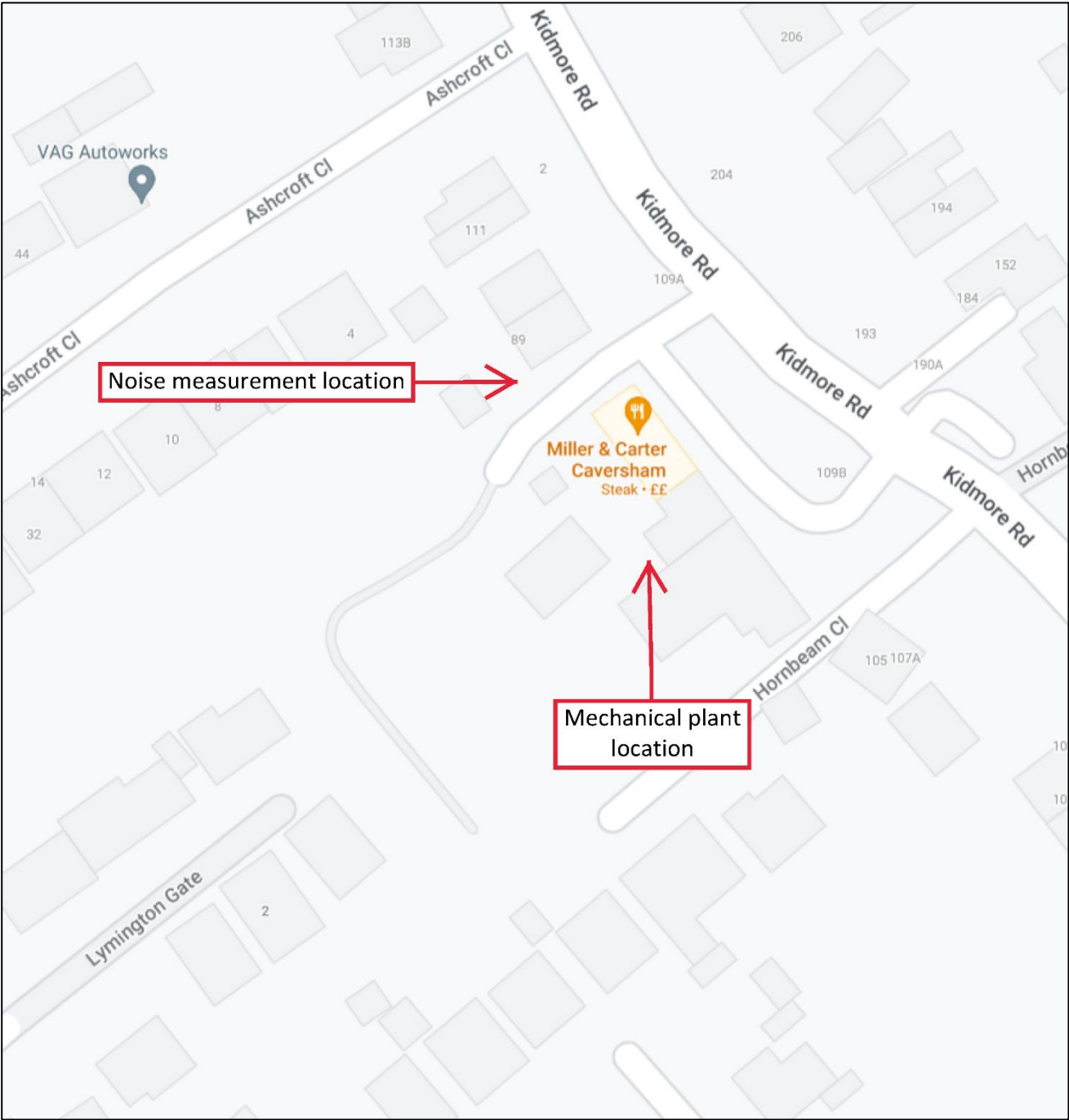
Description	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Insertion loss	-4	-11	-15	-18	-20	-20	-19	-17

- 4.6 We recommend that all ventilation ductwork on the flat roof is replaced with minimum 22g steel sheet, where it is not already.
- 4.7 All outdoor ductwork should be wrapped with minimum 50 mm thick Muftilag P (10 kg/m²), or approved equal.
- 4.8 To avoid creating excessive regenerated noise, we recommend that the air flow velocity does not exceed 15 m/s through the kitchen extract or supply ducts.
- 4.9 Where they are not already, the supply and extract fans should be mounted on suitable vibration isolators, with isolation efficiency of 0.95 @ 20 Hz. There should be no rigid connections between the fan and the building structure. The ductwork should be connected to the fans using flexible connectors.
- 4.10 With the above measures, we predict that the resultant sound pressure levels outside the nearest residences due to the kitchen ventilation system will be reduced by at least 12 dB(A). This will bring the noise level of the equipment noise to more than 10 dB(A) below the measured background noise levels at the nearest residence. This will therefore comply with the noise requirements of Reading Borough Council.
- 4.11 This assessment is based on the kitchen ventilation system being switched off between 23.00 and 09.00. We recommend installing a timer on the fans to ensure this.
- 4.12 In addition to the above measures, consideration can be given to installing a variable speed controller that will enable the speed of the fans, and therefore the noise emitted, to be reduced during less busy times in the kitchen. This doesn't change the recommendations above, as for assessment purposes we have considered the worst-case scenario when both fans are running at full speed, but it could potentially reduce the length of time that this scenario occurs.
- 4.13 For general good practice, we recommend that the equipment is inspected periodically to confirm whether maintenance is needed. This should include checks that all equipment is running smoothly, without any unusual noise or excessive vibration. The fan speed should also be checked to ensure it has not been altered to run faster than the design speeds noted in the Statement of Design Intent for Kitchen Ventilation System prepared by Building Management Technology Ltd.

5.0 CONCLUSIONS

- 5.1 A noise assessment of the existing kitchen ventilation plant associated with the Miller & Carter restaurant at 109 Kidmore Road, Caversham, Berkshire RG4 7NH has been carried out.
- 5.2 A noise survey has been undertaken at the site and the noise from the kitchen ventilation system and the background noise levels at the nearest noise-sensitive premises have been determined.
- 5.3 Using the results of the noise survey, the specific sound level and the rating level for the kitchen ventilation system outside the nearest noise-sensitive premises has been determined using the guidance in British Standard 4142.
- 5.4 Based on our assessment, the measured level of noise emitted from the kitchen ventilation system exceeds the Local Authority's noise limits. This therefore requires noise mitigation measures.
- 5.5 Suitable noise mitigation measures have been recommended that will reduce the plant noise levels to within the Local Authority's noise limits.
- 5.6 The recommended noise mitigation measures include the following:
- Inlet and outlet duct attenuators for the kitchen extract fan.
 - Additional inlet duct attenuator for the kitchen supply fan.
 - Duct wrapping for all external ductwork.
 - General good practice noise control measures.
- 5.7 By following the recommendations in this report, we predict that the noise impact of the new mechanical plant will comply with the noise requirements of the Local Authority.

Figure 1 – Site Location



Appendix I: Noise Units & Indices

Sound and the decibel

A sound wave is a small fluctuation of atmospheric pressure. The human ear responds to these variations in pressure, producing the sensation of hearing. The ear can detect a very wide range of pressure variations. In order to cope with this wide range of pressure variations, a logarithmic scale is used to convert the values into manageable numbers. Although it might seem unusual to use a logarithmic scale to measure a physical phenomenon, it has been found that human hearing also responds to sound in an approximately logarithmic fashion. The dB (decibel) is the logarithmic unit used to describe sound (or noise) levels. The usual range of sound pressure levels is from 0 dB (threshold of hearing) to 120 dB (threshold of pain).

Due to the logarithmic nature of decibels, when two noises of the same level are combined together, the total noise level is (under normal circumstances) 3 dB(A) higher than each of the individual noise levels e.g. 60 dB(A) plus 60 dB(A) = 63 dB(A). In terms of perceived 'loudness', a 3 dB(A) variation in noise level is a relatively small (but nevertheless just noticeable) change. An increase in noise level of 10 dB(A) generally corresponds to a doubling of perceived loudness. Likewise, a reduction in noise level of 10 dB(A) generally corresponds to a halving of perceived loudness.

The ear is not equally sensitive to sound at all frequencies. It is less sensitive to sound at low and very high frequencies, compared with the frequencies in between. Therefore, when measuring a sound made up of different frequencies, it is often useful to 'weight' each frequency appropriately, so that the measurement correlates better with what a person would actually hear. This is usually achieved by using an electronic filter called the 'A' weighting, which is built into sound level meters. Noise levels measured using the 'A' weighting are denoted dB(A) or dBA.

Frequency and Hertz (Hz)

As well as the loudness of a sound, the frequency content of a sound is also very important. Frequency is a measure of the rate of fluctuation of a sound wave. The unit used is cycles per second, or hertz (Hz). Sometimes large frequency values are written as kiloHertz (kHz), where 1 kHz = 1000 Hz.

Young people with normal hearing can hear frequencies in the range 20 Hz to 20 kHz. However, the upper frequency limit gradually reduces as a person gets older.

Glossary of Terms

- $L_{Aeq,T}$ This is the A-weighted 'equivalent continuous noise level' which is an average of the total sound energy measured over a specified time period, T. In other words, L_{Aeq} is the level of a continuous noise which has the same total (A-weighted) energy as the real fluctuating noise, measured over the same time period, T. It is increasingly being used as the preferred parameter for all forms of environmental noise.
- $L_{Amax,f}$ This is the maximum A-weighted noise level that was recorded during a sample duration, with the sound level meter on the 'fast' setting.
- $L_{A90,T}$ This is the A-weighted noise level exceeded for 90% of the time period, T. L_{A90} is used as a measure of background noise.
- $L_{Ar,T}$ This is the BS 4142 rating level for the time period, T.
- L_W This is the sound power level of a sound source, in decibels, which is 10 times the logarithm to the base 10 of the ratio of sound power radiated by the source to a reference power. The reference power is 1 picowatt (1×10^{-12} watt). The sound power level is the fundamental measure of the total sound energy radiated by a source per unit time.