

Approved and Issued by:

Iain Critchley

Date: 10th September 2020

Acoustic Report

AM2PM
18-20 Macketts Lane, Liverpool
L25 0LQ

Survey Dates: 1st to 3rd July 2020 and follow-up survey
on 21st August 2020.

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AM2PM acoustic report.lwp



Acoustic Report.

Mr Jalil Ali
AM2PM Ltd
18 to 20 Macketts Lane
Liverpool
L25 0LQ

Investigating Consultant: Iain Critchley MIOA

Date(s) of Investigations: 1st to 3rd July 2020 and 21st August 2020

Investigation of noise from refrigeration condenser units.

1. Introduction.

1.1 Planning conditions.

The purpose of the survey and report is to check for compliance with planning conditions 4 and 8, which relate to recent refurbishment works for the local general store, known as AM2PM, as follows:

Condition 4.

4) No part of the development hereby permitted shall commence until a scheme of noise protection for the dwelling(s) located above the application site has been submitted to and approved in writing by the local planning authority. All works which form part of the scheme shall be completed and retained at all times thereafter.

The scheme shall ensure that noise exposure within living rooms and bedrooms meets the requirements of the relevant standards, as in BS 8233: 2014.

Condition 8.

8) Details of any external air conditioning or ventilation plant to the premises must be provided to, and be approved by the local planning authority prior to installation. Any installation must be in accordance with the approved details.

a) Any fixed plant and machinery associated with the development should be designed to a level that is at least 5dB(A) below the existing LA90 background noise level as measured during the relevant time period. Any tonal, impulsive and/or irregular noise would be addressed by imposing a penalty as per the methodology set out in BS4142:2014, 'Methods for rating and assessing industrial and commercial sound'. Noise limits for fixed plant are to apply at a position 1 metre from the closest affected window of the nearest noise sensitive property.

There are two condenser units located in the rear yard of AM2PM's premises on Macketts Lane. One is a single-fan unit and the other is a twin-fan unit.

PROPOSED GROUND FLOOR PLAN

Labels in the plan include: General Store, Staff Room, Office, Store, Yard/Deliveries, Condenser Units, and various other rooms and areas.

Figure 3 - nearest residential property.



Weather conditions were warm and dry, with clear skies throughout the survey period and a temperature of 19° Celsius, reducing to about 15° overnight. Wind speeds were low with no obvious air movement at or near ground level, suggesting ‘neutral’ sound propagation conditions from the source to the noise-sensitive receptors, and from more distant sources.

The plant was fully operational and probably at maximum duty due to the warm weather (the units supply chilled water to the refrigerators inside the store).

Noise data was gathered by means of two Type 1 sound level meters (Norsonic 140 Ser No. 1402708 and a Norsonic 118 Ser No. 31512), with 1/3 octave filters. Both meters were calibrated to a reference tone of 113.8 dB before and after the monitoring period and no drift was noted. Calibration certificates for the instrumentation (due for renewal in March 2021), are available for inspection if required.

The Norsonic 140 was used for measurements close to the condenser units and the Norsonic 118, fitted with an outdoor microphone and mounted on a pole, was located close to the facade of the 1st floor flat, above the shop.

3. Results of Measurements.

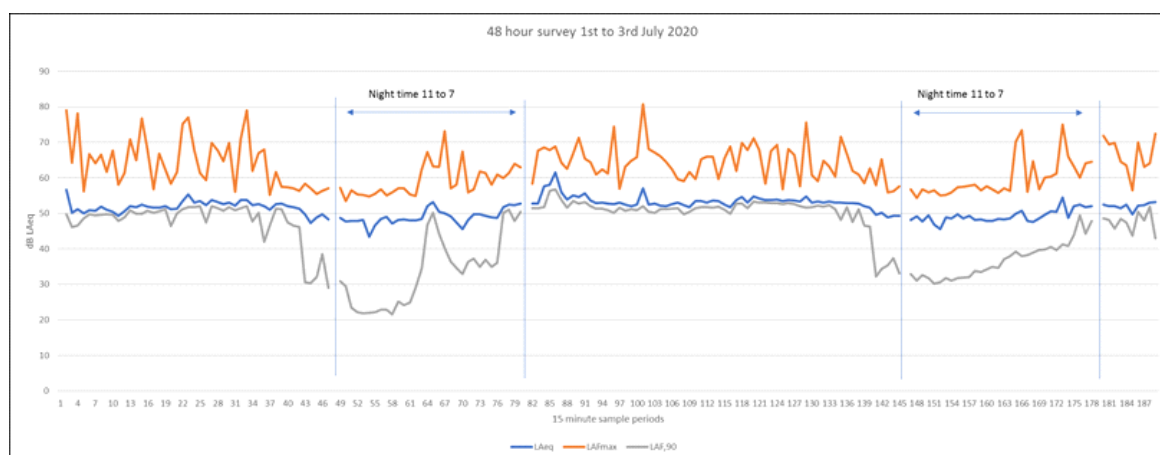
Noise levels were recorded at a distance of 1 metre from each of the two condenser units during their normal duty, while they cycled on and off. Table 1 summarises the data.

Table 1 - summary source data

Source	Distance	LAeq
Unit 1 (single fan)	1 metre	62.2 dBA
Unit 2 (double fan)	1 metre	63.8 dBA
Both units on	1 metre	66.1 dBA
Both units off	1 metre	50.7 dBA

Results of the three-day noise logging measurements at the receptor location are summarised by the graph of Figure 2. The data is recorded in 15 minute periods to enable subsequent analysis in accordance with BS4142:2014.

Figure 2 - recorded data at receptor location 1st to 3rd July.

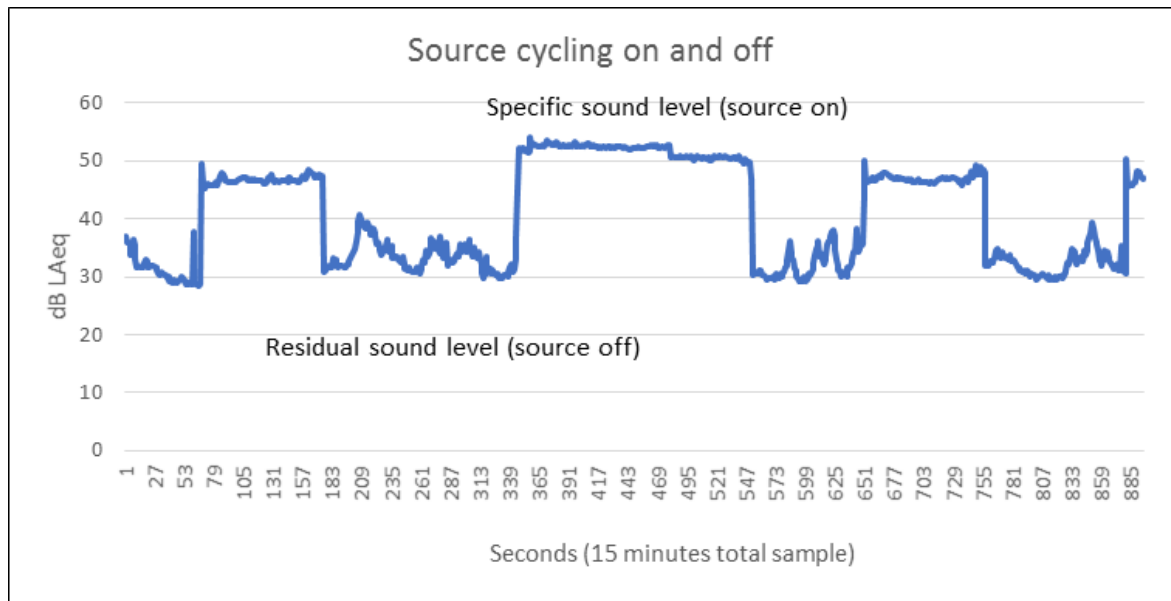


Further analysis of the night-time data, in 1 second periods, shows the two condenser units cycling on and off. The resulting data is summarised as Table 2 and graphically in Figure 3.

Table 2 - summary data at receptor location (night time)

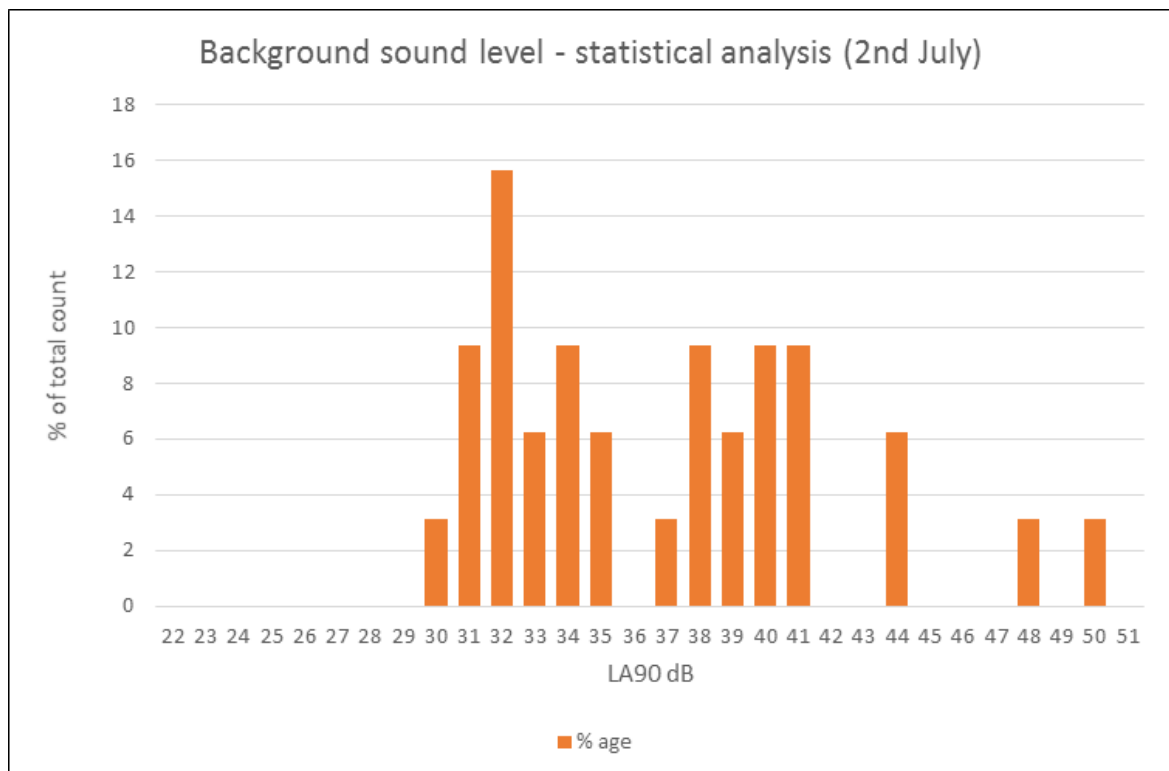
Source	Distance	LAeq
Unit 1 (single fan)	7 metres	47.6 dBA
Unit 2 (double fan)	7 metres	50.4 dBA
Both units on	7 metres	51.9 dBA
Both units off	7 metres	34.2 dBA

Figure 3 - typical duty cycle of both units at receptor location (night time).



Analysis of the data shown in Figure 3 shows a duty cycle (percentage 'on' time) of 48%, from which the specific sound level has been calculated as 48.6 dBA.

Figure 4 - assessment of background sound level



Background sound level.

A daytime background sound level of 46.4 dB LA90 was recorded over a one-hour period during the afternoon of the 1st July, at a proxy location (the rear access road to the property) which was unaffected by noise from the condensers.

The more critical night time background sound level was obtained from the data logs and calculated in accordance with the methodology of BS4142:2014, which is based upon a statistical analysis of 15 minute measurement periods between 11.00 pm and 7.00 am. The graph of Figure 4 shows that a background sound level of 32 dB LA90 was logged for 15.6% of the 8 hour night time measurement period. The night time assessment will therefore be based on a background sound level of 32 dB LA90.

4. BS4142 :2014 impact assessment (pre-remediation).

4.1 Daytime assessment

1. Specific sound from condenser units = 52 dB LAeq (measured 1 metre from facade)
2. Residual sound level = 49 dB
3. % on-time correction = 0 dB (one or both units operate more or less continuously during the day)
4. Facade correction = -3 dB
5. Character correction = +3 dB (source is intermittent but is not noticeably tonal)
6. Corrected source level = 49 dB_{1 hour} (rating level)
7. Background sound level = 46 dB

The daytime rating level is 3 dB above background level so is considered a “low impact” according to BS4142:2014.

Planning condition 8, however, suggests that the rating level from fixed plant and machinery should be at least 5 dB below background. This suggests that at least 8 dB of noise reduction, at source, may be required in order to fully comply with this part of condition 8.

4.2 Night time assessment

1. Specific sound from condenser units = 52 dB (measured 1 metre from facade)
2. Residual sound level = 34 dB
3. % on-time correction = -3 dB (one or both units operate more or less continuously during the day)
4. Facade correction = -3 dB
5. Character correction = +3 dB (source is intermittent but is not noticeably tonal)
6. Corrected source level = 49 dB _{15 minutes} (rating level)
7. Background sound level = 32 dB

The daytime rating level is 17 dB above background level so is considered a “significant adverse impact” according to BS4142:2014.

Planning condition 8, however, suggests that the rating level from fixed plant and machinery should be at least 5 dB below background. This suggests that at least 22 dB of noise reduction, at source, may be required in order to fully comply with this part of condition 8.

5. Noise reduction works (August 2020).

The client and owner of the AM2PM premises has implemented some noise reduction measures in an attempt to reduce the noise emitted by the condenser units. It is understood that this work has involved re-mounting of the units on anti-vibration mountings and lining the main enclosure with sound-absorbing material.

The acoustic consultant was called in to carry out further measurement and assessment on the 21st August 2020.

In order to simplify the assessment, measurements were repeated at 1 metre from the front of the condenser units and the results compared with the measurements recorded on the 1st July.

The repeated measurements show that about 6 dB noise reduction has been achieved overall. Comparative measurements are summarised in Table 3.

Table 3 - summary source data (pre and post-remedial compared)

Source	Distance	LAeq (1st July)	LAeq 21st August	Reduction
Unit 1 (single fan)	1 metre	62.2 dBA	54.6 dBA	7.6 dB
Unit 2 (double fan)	1 metre	63.8 dBA	58.2 dBA	5.6 dB
Both units on	1 metre	66.1 dBA	60.1 dBA	6.0 dB
Both units off	1 metre	50.7 dBA	49.0 dBA	1.7 dB

The data suggests that at least 6 dB sound level reduction has been achieved.

Subsequent assessments according to BS4142:2014 will apply the reduced sound levels on a pro-rata basis but will assume the same background conditions.

6. BS4142 :2014 impact assessment (post-remediation).

6.1 Daytime assessment

1. Specific sound from condenser units = 46 dB LAeq (predicted at 1 metre from facade)
2. Residual sound level = n/a (not applicable as source level is calculated)
3. % on-time correction = 0 dB (one or both units operate more or less continuously during the day)
4. Facade correction = -3 dB
5. Character correction = +3 dB (source is intermittent but is not noticeably tonal)
6. Corrected source level = 46 dB_{1 hour} (rating level)
7. Background sound level = 46 dB

The daytime rating level is the same as the background level so is considered a “low impact” according to BS4142:2014.

6.2 Night time assessment

1. Specific sound from condenser units = 46 dB LAeq (predicted at 1 metre from facade)
2. Residual sound level = n/a (not applicable as source level is calculated)
3. % on-time correction = -3 dB (one or both units operate more or less continuously during the day)
4. Facade correction = -3 dB
5. Character correction = +3 dB (source is intermittent but is not noticeably tonal)
6. Corrected source level = 43 dB _{15 minutes} (rating level)
7. Background sound level = 32 dB

The night time rating level is 11 dB above background level so is considered a “significant adverse impact” according to BS4142:2014.

6.3 Uncertainty.

At the measurement distances involved and the fact that several repeated measurements were recorded of each operating condition, the measurement uncertainty of the sound sources will be very low, estimated at +/- 0.5 dB.

Similarly, the logging survey at the receptor location was repeated over two, consecutive 24 hour periods so uncertainty will also be low, estimated at +/- 2 dB depending on day to day variations in the duty cycle of the two condenser units.

Greater uncertainty can occur when measuring background sound as this is dependent on atmospheric conditions as well as variable levels of road and rail traffic. It is not possible to quantify such uncertainty but it is worth noting that the initial survey was carried out during the latter stages of the Covid-19 lockdown so traffic conditions etc may have been lighter than ‘normal’. The BS4142 assessments are therefore likely to be ‘worst case’.

7. Context and discussion.

The 2014 edition of BS4142 allows the consultant and the enforcing authority to take account of the ‘context’ in which the measurement and assessment of sound occurs.

The context in this case is that the nearest residential property is a first floor flat over the shop where the plant and external equipment are being assessed. The affected rooms which overlook the rear yard are a kitchen (which has a small balcony overlooking the yard) and a bathroom. The primary habitable rooms, the living room and bedroom, are located on the front elevation of the property, where noise from the rear service yard will be virtually inaudible.

The mitigation works have achieved a commendable 6 dBA of noise reduction. However, the night time assessment suggests that a further 11 dB noise reduction would be required in order to meet the “rating level not exceeding background” criterion of BS4142 and that 16 dB noise reduction would be required in order to meet the letter of planning condition 8 which requires a rating level of 5 dB below background.

With no habitable rooms overlooking the rear yard, there would be little or no practical benefit achieved by further (and much more costly) noise reduction measures.

Regarding the daytime assessment, the BS4142 calculation shows that the “rating level not exceeding background” criterion has been achieved by the mitigation works, with a rating of “low impact” although again, a further 5 dB reduction would be needed in order to meet the strict requirements of planning condition 8.

8. Planning Condition 4.

Planning condition 4 requires that there is a scheme of noise insulation in place to ensure that noise levels within living rooms and bedrooms meet the requirements of BS8233:2014.

The guideline noise levels in BS8233:2014, are ‘average’ internal noise levels in bedrooms, dining rooms and living rooms, in dwellings, as summarised by the table below.

Indoor ambient noise levels for dwellings (BS8233:2014)			
Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hour}$	
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

In summary, this means that living rooms must be no more than 35 dBA during the day and that bedrooms must be no more than 30 dBA at night.

Noise ingress to habitable rooms in this case can be a) an internal sound path via the separating floor/ceiling above the shop and b) the external sound path via the windows which open onto the rear service yard (as previously covered under planning condition 8).

Internal sound path via separating floor.

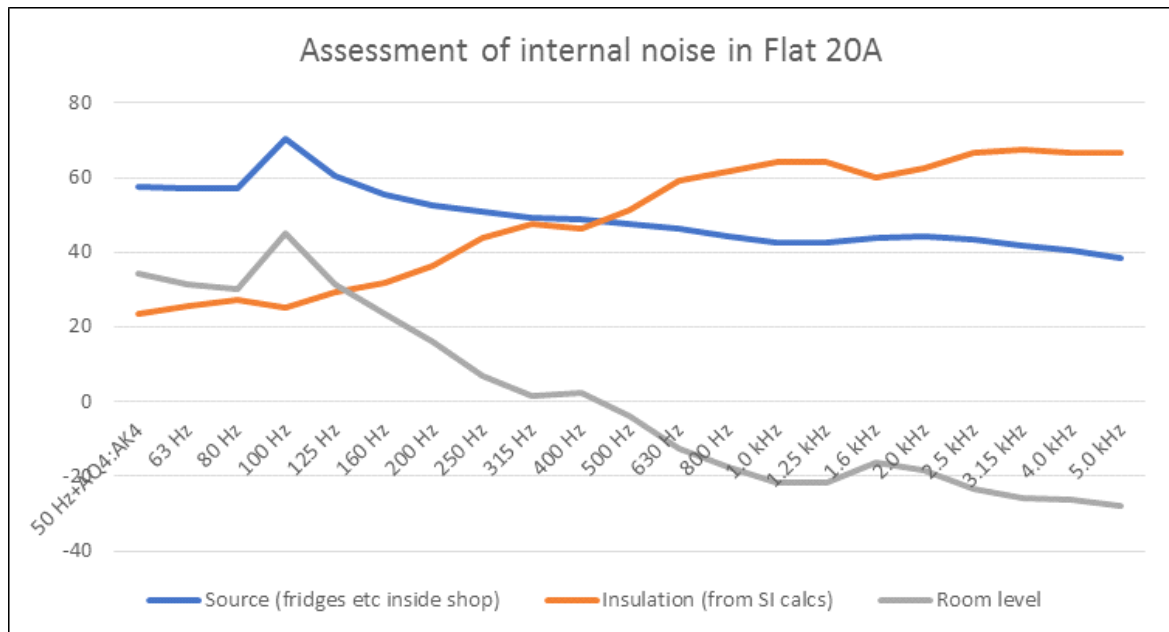
A sound insulation test was carried out between the shop and Flat 20A on the 1st July 2020. The test chart is attached to this report in Annex B.

The result of the sound test was a sound insulation level of 43 dB $D_{nTw}+C_{tr}$. Which is the minimum level required under UK building regulations Approved Document E.

Sound levels were recorded in the shop premises which gave an averaged level of about 60 dBA near the fridges, with no background music.

A detailed calculation, based on the one-third octave data, gave an estimated noise level in the bedroom of Flat 22A of 26.4 dBA. See the graph of Figure 5.

Figure 5 - sound insulation calculation from shop to Flat 20A



External sound path via open windows.

Section 6 of this report has demonstrated that the ambient noise level at the rear elevation of the building, due to the condenser units, is 46 dBA during the day and 43 dBA during the night.

The sound attenuation through a partially opened window is widely accepted to be about 15 dB so that internal daytime noise levels, due to plant and equipment, will be 31 dB (day) and 28 dB (night).

The internal noise and external noise should be added, on an energy basis, to give an overall value. See Table 4.

Table 4 - internal noise levels in flat 20A over the shop

Sound path	Sound level (day)	Sound level (night)
Internal via separating floor	26 dBA	26 dBA
External via windows	31 dBA	28 dBA
Combined	32 dBA	30 dBA

The requirements of BS8233:2014 have been achieved, meaning that planning condition 4 can be discharged.

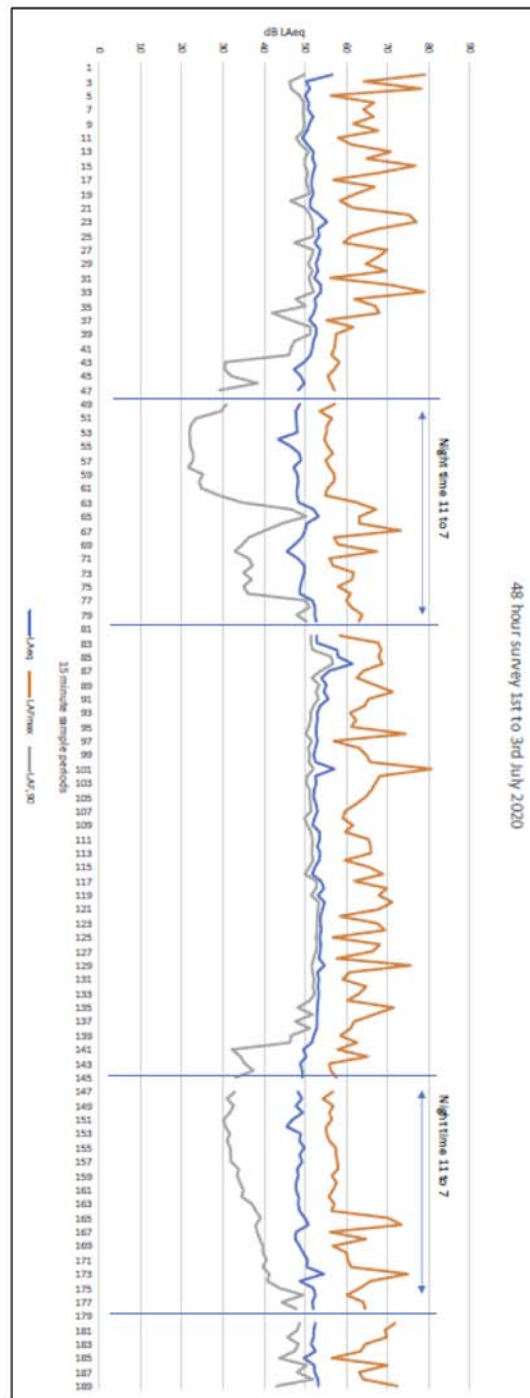
9. Conclusions.

1. A detailed and thorough noise survey has been undertaken at the Macketts Lane premises of AM2PM Ltd in order to assess compliance with planning conditions 4 and 8, which relate to the recent refurbishment works to the shop.
2. The survey concludes that the recent noise reduction measures applied to the two condenser units in the rear yard have achieved a reduction in noise of approximately 6 dBA overall, compared to the original survey in July 2020.
3. The result of this, as confirmed by a detailed assessment in accordance with BS4142:2014 shows that the daytime assessment is of “low impact”, i.e. the rating level is the same as the background level.
4. The BS4142:2014 night time assessment, however, is of “significant adverse impact”, because the rating level is 11 dBA above the background level.
5. In consideration of ‘context’ however, the stated noise levels are probably reasonable and acceptable. The ‘context’ in this case being that there are no habitable rooms on the rear elevation. While further noise reduction measures are possible, these would be radical and costly, so of limited benefit.
6. A separate sound test and calculation, described in Section 8 of this report, demonstrates compliance with planning condition 4.

This concludes the report.

Annex A

Graph of 3-day noise survey at receptor location.

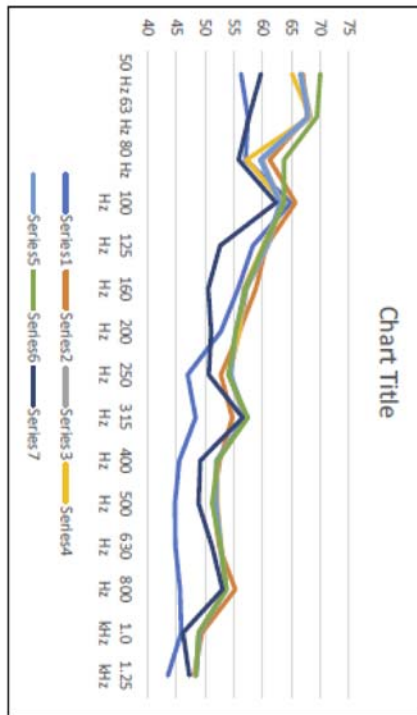


Annex B.

Measurements of plant following noise reduction works..

Directory: C:\Acoustic data 2020\Nor 140 (2728)\200821 File version v1.0/6.1.0.27

File	Date	Duration	Status	LAeq	LA _{Fmax}	LAF ₉₀
NOR140_1662400_200821_0001.NBF	Small one on @ 1 m	(0:0:47.0)	N/A	54.6	70.3	53.2
NOR140_1662400_200821_0002.NBF	Both on @ 1 m	(0:0:49.0)	N/A	60.4	64.6	59.5
NOR140_1662400_200821_0003.NBF	Both on @ 1 m	(0:1:17.0)	N/A	60.1	68.3	59.6
NOR140_1662400_200821_0004.NBF	Both on @ 1 m	(0:0:16.0)	N/A	60.1	60.8	59.7
NOR140_1662400_200821_0005.NBF	Both on @ 1 m	(0:0:28.0)	N/A	60	62.2	59.6
NOR140_1662400_200821_0006.NBF	Both on @ 1 m	(0:0:28.0)	N/A	60.1	67.7	58.6
NOR140_1662400_200821_0007.NBF	Big one on	(0:1:21.0)	N/A	58.2	60.8	57.8
NOR140_1662400_200821_0008.NBF	Both on @ 1 m	(0:0:29.0)	N/A	60.1	60.7	59.8
NOR140_1662400_200821_0009.NBF	Both on ambient	(0:0:38.0)	N/A	53	54.7	52.5
NOR140_1662400_200821_0010.NBF	Both on ambient	(0:0:39.0)	N/A	53.3	54.7	52.8
NOR140_1662400_200821_0011.NBF	Both on ambient	(0:0:35.0)	N/A	52.8	54.4	52.3
NOR140_1662400_200821_0012.NBF	Both on ambient	(0:1:24.0)	N/A	52.4	54.8	51.7
NOR140_1662400_200821_0013.NBF	Big one on	(0:0:13.0)	N/A	55.9	58	55.5



Annex C.

Results of sound insulation test between shop and Flat 20A.

Standardized level difference according to BS EN ISO 140-4

Field measurements of airborne sound insulation between rooms

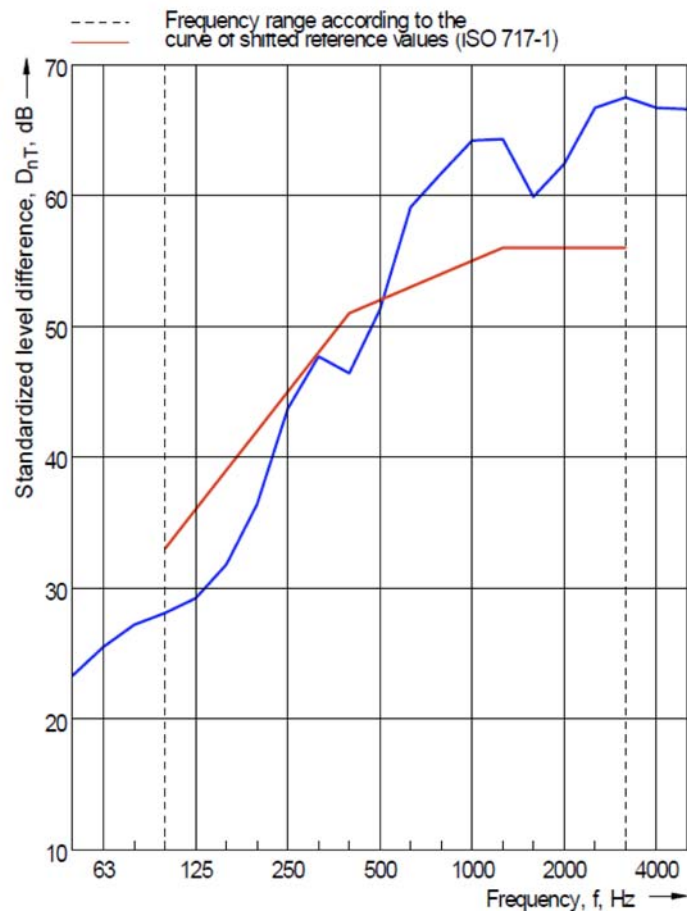
Client: Jimal at AM2PM, 18 to 20 Mackett's Lane
 Description: Retail unit (general area) to Flat 22A bedroom

Date of test: 1st July 2020

Object: Timber joist separating floor with suspended ceiling (exact construction unknown)

Source room volume: 220.0 m³
 Receiving room volume: 25.0 m³

Frequency f [Hz]	D _{nT} 1/3 octave [dB]
50	23.3
63	25.5
80	27.2
100	28.1
125	29.2
160	31.8
200	36.4
250	43.7
315	47.7
400	46.4
500	51.3
630	59.1
800	61.7
1,000	64.2
1,250	64.3
1,600	59.9
2,000	62.4
2,500	66.7
3,150	67.5
4,000	66.7
5,000	66.6



Rating according to ISO 717-1

 $D_{nT,w}(C;C_{tr}) = 52$ (-3; -9) dB

Evaluation based on field measurement results
 obtained
 in one-third-octave bands by an engineering method.

 $C_{50-3150} = -4$ dB $C_{50-5000} = -3$ dB $C_{100-5000} = -2$ dB $C_{tr,50-3150} = -12$ dB $C_{tr,50-5000} = -12$ dB $C_{tr,100-5000} = -9$ dB

Company: Peninsular Acoustics Ltd

No. of test report: Test 1

Date: 02/07/2020

Signature: I.C.