

Checked and Issued:

17th March 2022

Acoustic Report.

BS4142:2014 Assessment of noise emitted from external
plant at:

Oaklands House, Wilbraham Road
Fallowfield, Manchester
M14 6JW

Dates of Surveys: 7th October 2021, 19th November 2021
and 9th March 2022.



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A Member of The Association of Noise Consultants

Acoustic Report

Site: Oaklands House
Wilbraham Road
Fallowfield
Manchester
M14 6JW

Client: Whitfield and Brown (Developments) Ltd
Halton House
Gorse Lane
Widnes
WA8 0RP

Date of Survey: 7th October 2021, 19th November 2021 and 9th March 2022.

Acoustic Consultant: *Iain Critchley MIOA MInstSCE for Peninsular Acoustics Ltd*

1. Introduction.

This report was requested by BTP Architects on behalf of Whitfield and Brown to assess noise levels emitted from newly installed external plant and its effect on nearby noise sensitive receptors.

This report updates and replaces the previous report issued on the 21st February, following a further measurement survey and new information concerning the function and operation of the condenser units.

This survey, assessment and report will assist in the discharge of Planning Condition 3 of Planning Conditions issued by Manchester City Council, as follows:

3) Prior to occupation of the building, externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L Aeq) below the typical background (LA90) level at the nearest noise sensitive location.

The scheme shall be submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the site. The approved scheme shall be completed before the premises is occupied.

Upon completion of the development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the noise criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria.

Peninsular Acoustics Ltd were not involved in the design, specification, nor submission of any prior approval assessment. This report therefore only describes the verification survey and assessment procedure, in detail, and concludes with a formal assessment in accordance with British Standard BS4142:2014.

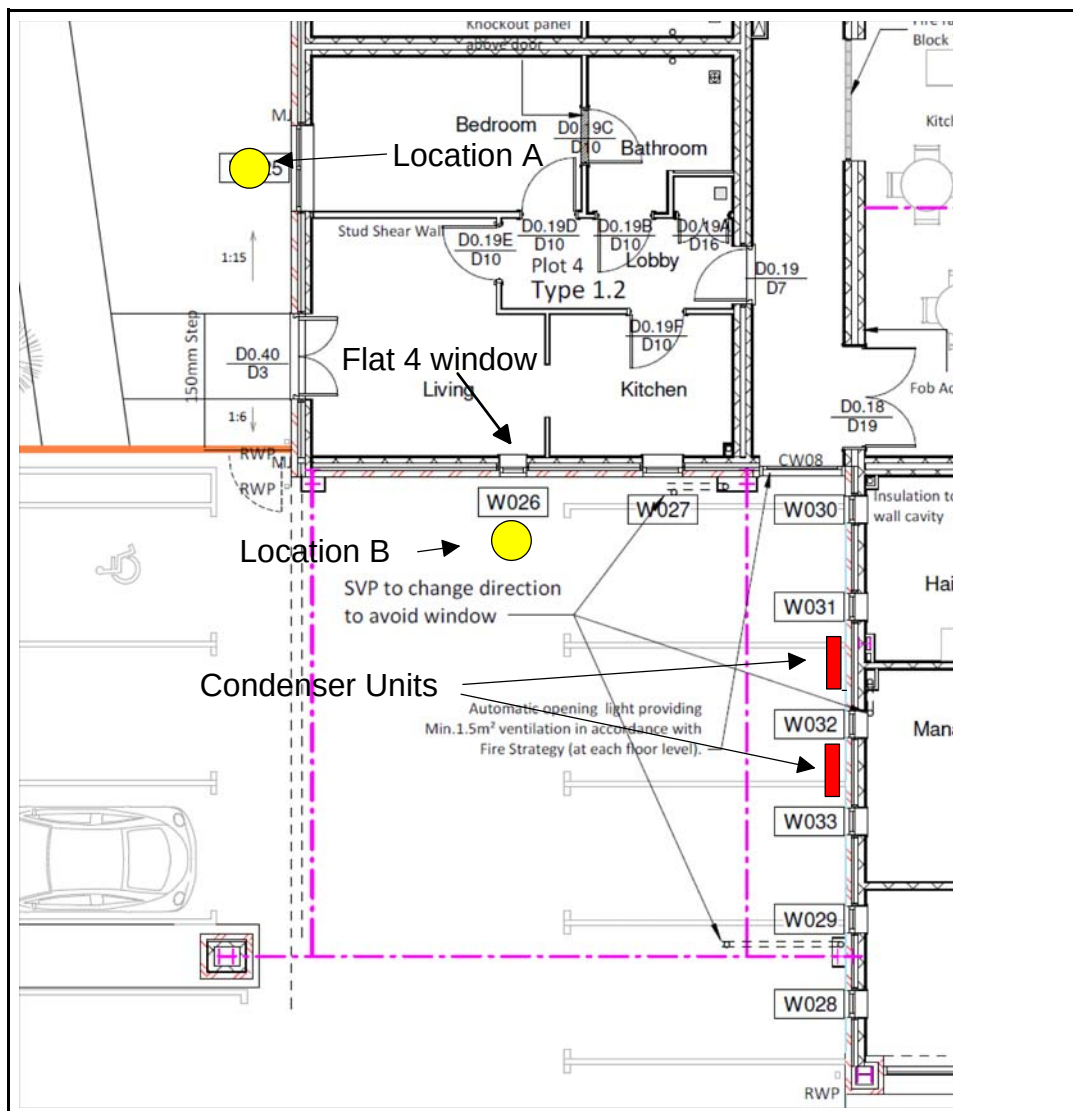
2. Site Description.

2.1 General

This is a development of 36 new apartments on four floors.

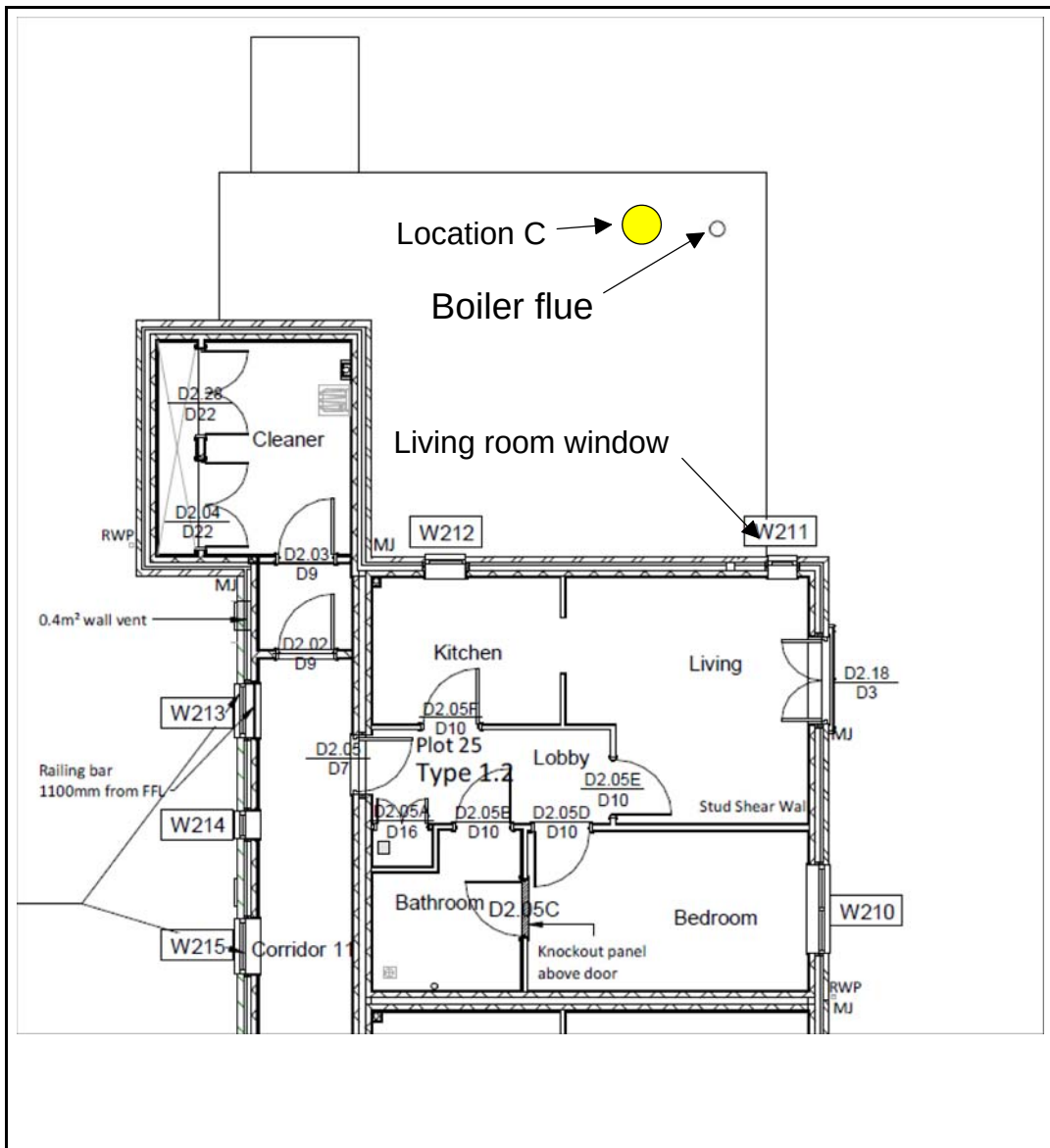
The new external plant consists of a Mitsubishi PUZ M140VKA air conditioning condenser unit and three MUZ AP25VG air-conditioning condenser units. An emergency generator is located at the rear of the building but this is exempt from this assessment as it is for emergency use only. To the rear of the building is a plant room which houses four gas boilers. These extract to a single flue located on a flat roof at second floor level. Although the boilers are not “externally mounted plant”, the flue was subject to a later ‘Variation of Condition’ and is therefore included in this assessment.

Figure 1 - site plan showing condenser units and monitoring positions A and B.



The nearest off-site noise sensitive premises are located at a neighbouring building, approximately 30 metres from the condenser units. The nearest on-site receptors are the apartment of Oaklands House. Apartment No.4 has a living room window which overlooks the condenser location and Apartment No.25 has a living room window which overlooks the boiler flue.

Figure 2 - site plan showing boiler flue and monitoring location C



2.2 Noise Sources.

These are a Mitsubishi PUZ M140VKA air source heat pump and three MUZ AP25VG air-conditioning condenser units. An emergency generator is located at the rear of the building but this is exempt from a noise impact assessment as it will be for emergency use only.

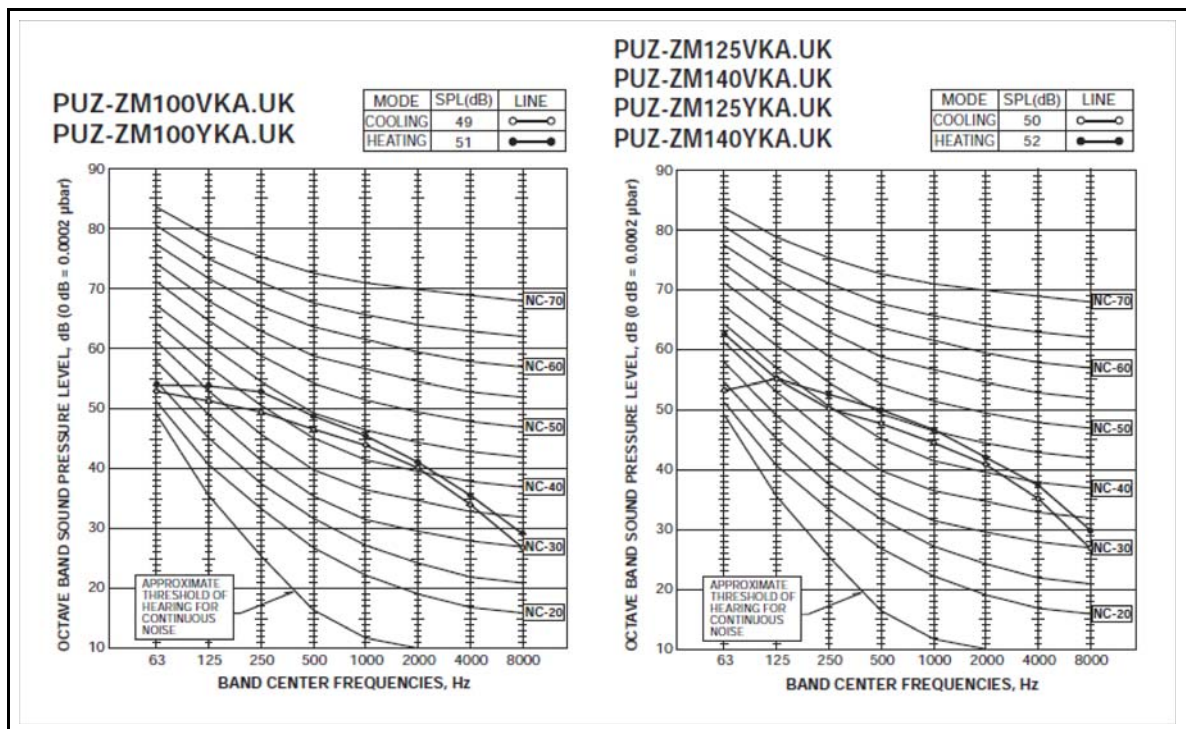
The condenser units are located in the undercroft parking area and are therefore partially shielded from the other Oaklands apartments and from neighbouring properties.

The three smaller air-conditioning condenser units have a noise rating of 48 dBA @ 1 metre, with a sound power level of 59 dBA. The PUZ M140VKA A/C unit has a noise rating of 50 dBA @ 1 metre during its cooling function and 52 dBA @ 1 metre during its heating function. The quoted sound power level is 70 dBA.

The plant room at the rear of the building houses four gas boilers which have a combined flue which exhausts onto a flat roof adjacent to apartment No.25. The flue is located 5 metres from the nearest (non-opening) living room window of apartment No.25.

There is no published data for the noise output of the boiler flues so this was measured directly, under typical start-up and operating conditions, on the 19th November 2021

Figure 3 - extract from the PUZ M140VKA data sheet.



2.3 Source noise levels

The noise from the condenser units has proved to be very difficult to measure directly due to noise from road traffic, both day and night. An initial assessment was therefore carried out using a Cadna computer model, based on manufacturer's data, noting that only the larger unit, the PUZ M140VKA was assessed so as to provide a 'worst case' scenario.

The Cadna model suggested that the specific noise level at Flat 4 window was 43 dBA, with no corrections. An attempt to measure the condenser noise close-up, then apply a distance correction, according to Paragraph 7.3.5 of BS4142:2014, gave a specific level of 40 dBA. This data was, however, deemed unacceptable by Manchester city Council as only a direct measurement, with no further calculation, is considered appropriate for a 'verification' assessment and report.

This report will go on to show that the calculation procedure and the previous source measurements underestimated the specific noise by a significant amount so the Cadna data and the data from 'close-up' measurement of the condenser unit, are not included in this report.

The boiler flue was also difficult to measure due to the influence of road traffic, so the 'close-up' method of Paragraph 7.3.5 of BS4142:2014 was adopted. Measurements of the boiler flue were carried out by placing a microphone on the flat roof at a distance of 1 metre from the flue outlet and observing sound levels during start-up. Propagation is 'free-field' and follows the 'inverse-square law', so this method is considered sufficiently accurate for this assessment, in the professional judgement of the acoustic consultant. The four boilers were operated on a 'test' start-up cycle with the help of the M&E engineer.

2.4 Receptor Locations

The nearest noise-sensitive receptor affected by the heat pump and AC units is the ground floor apartment No.4, which has a small window (non-opening) to the living room which opens onto the undercroft parking area and the location of the condenser units.

The boiler flue is located 5 metres from the living room window (non-opening) of apartment 23, on the second floor.

The nearest off-site receptor location is the apartment building in an adjacent plot to the west of Oaklands House, a distance of about 30 metres from the source location.

Background and ambient sound levels were measured at Location A, outside a first floor bedroom window for a 24 hour period from 11.00 am on the 7th October to 11.00 am on the 8th October 2021. Noise levels at this location are free-field and are considered to be representative of the off-site receptor locations and apartment No.25, location C.

The dominant sound source at all locations is road traffic on Wilbraham Road.

A further background noise survey was carried out at Location A, overnight on the 19th November, to specifically assess background noise at apartment No.4.

Figure 4 - 24 hour noise record at Location A (15 minute samples).

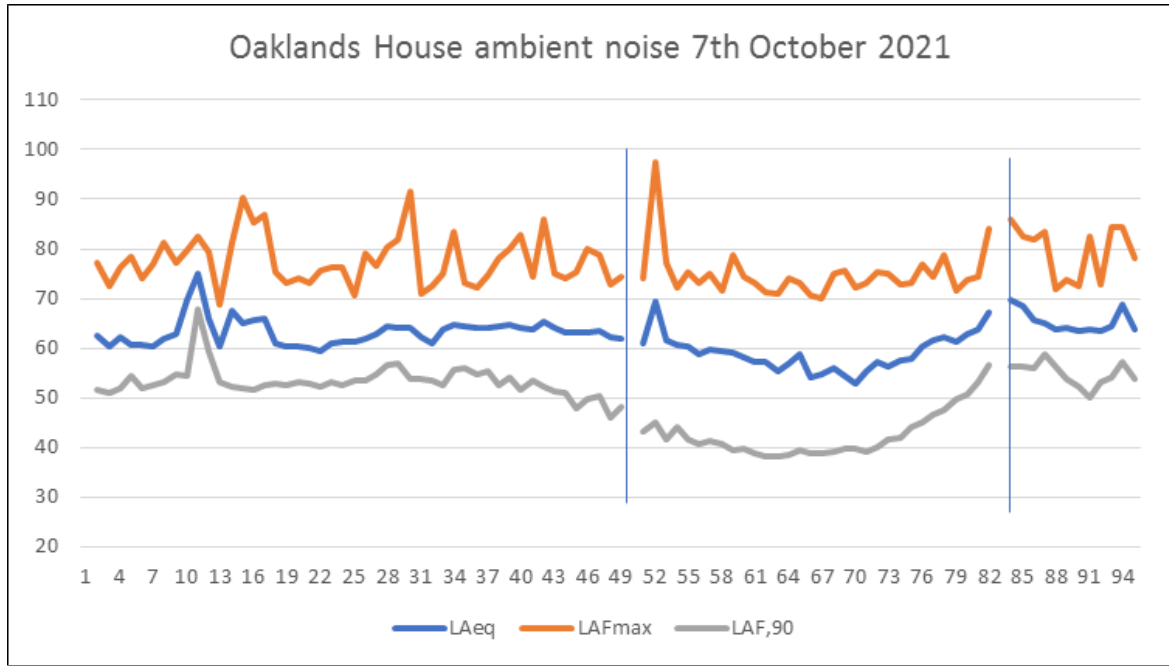
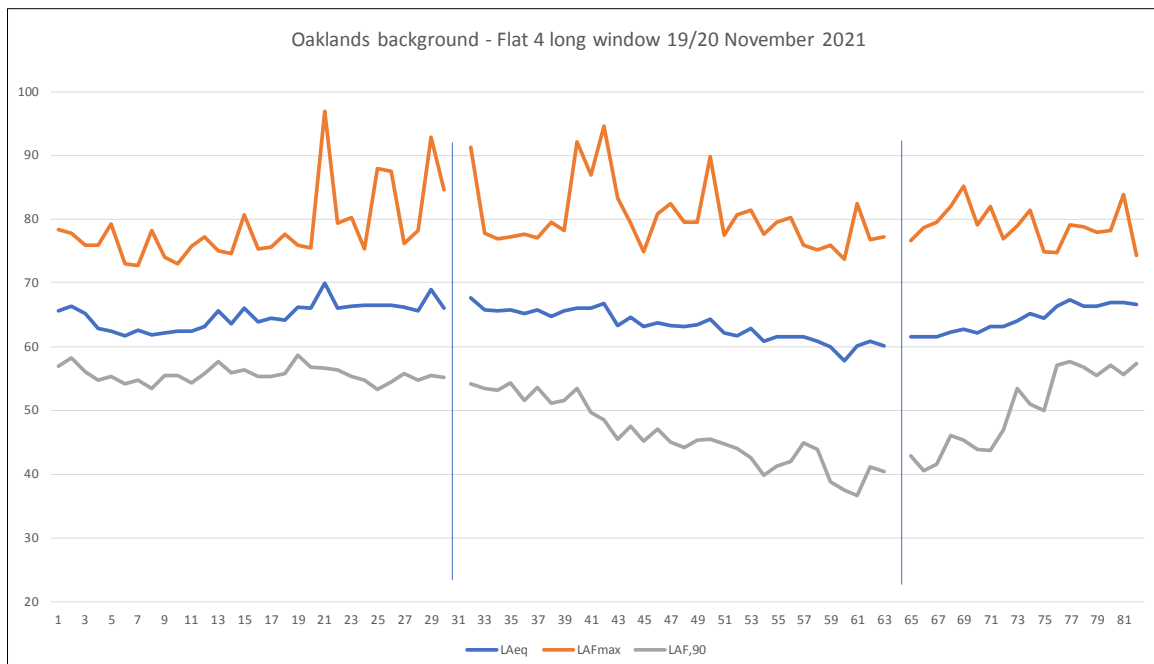


Figure 5 - 24 hour noise record at Location B (15 minute samples).



3. Further measurement survey at Oaklands House 9th March 2022

3.1 Overview.

Results of further noise measurements carried out at the request of Manchester Environmental Health and Planning, using direct measurement at the receptor location, rather than using close measurement and calculation. This follows paragraph 7.3.4 of BS4142:2014:

7.3.4 Where possible, determine the specific sound level by measurement of the ambient sound level and the residual sound level at the assessment location(s).

NOTE It might be appropriate to take measurements if there are periods of low residual sound (such as at night or at weekends) when the specific sound would not normally occur but might be turned on for measurement purposes. The specific sound ought as far as is practicable to be representative of typical operating Conditions.

In view of very high ambient sound levels, due to road traffic, it was necessary to carry out this latest survey between the hours of 3.00 am and 4.00 am, as the earlier background noise surveys showed this to be the quietest time of the night.

However, and notwithstanding the lower background sound level at this time, traffic noise still dominates the ambient noise climate and is typically 61 dB L_{Aeq} , even at this quieter time. Two methods were therefore used to estimate the specific sound level of the source, as follows:

Method 1 - measuring the specific sound during lulls in traffic (Example 3 in BS4142).

Method 2 - measuring the L_{A90} (no standard method for this)

A further change to the assessment follows new information about the intended operation of the condenser units, which is that they are intended for daytime summer cooling only. This means that a daytime assessment is appropriate and we will no longer consider this a night time operating condition.

The boiler flue assessment remains a night time assessment, (notwithstanding 'context'), but with the assessment now based on 'typical' boiler demand conditions, rather than an untypical 'worst case' demand condition.

3.2 Sound Sources

The A/C condenser unit.

The object of the assessment, the source, is a single A/C condenser unit, Mitsubishi PUZ M140VKA, which is intended to operate only in cooling mode, according to demand, for the main dining area. There are three smaller A/C condensers but they are of much lower noise rating, for cooling of office premises only, so also won't operate at night, and are therefore considered of low significance compared to the larger unit. The hours of operation are from 9 am until 8 pm during warm summer months as confirmed by Stephen Lindley of Larewood Construction, as per the following direct quote:

"the AC was only ever intended for **overheating mitigation**. They were never intended to be used for heating, which is provided by the wet heating systems in these areas. Therefore one can assume the units should only ever be used between say 9am and 8pm in the summer months. However it is ultimately down to the end user to decide on off times for these units."

We are currently in discussion with the client's M&E consultant to arrange for night time operation to be disabled.

Figure 6 - A/C condenser location relative to Flat 4 window.



For this survey, the unit was manually overridden to force operation in heating mode as the dining room was already fairly cool at 19°C. To force operation, the indoor thermostat had to be set to a max of 26°C. The manufacturer's data for the unit shows that noise when in cooling mode is 2 dB lower than when heating.

The problem with the manual override is that it forces the condenser unit to operate at full power, while the heat builds, or conversely, while it cools when in air-conditioning mode. This is untypical of normal operation as it would cycle on and off and run at reduced power, once the set temperature is reached. We are awaiting further detailed information regarding typical operational conditions but that information is not available at the time of writing this report. Consequently, there is a risk that we are now overestimating the noise levels for typical operation.

To obtain typical operating noise levels in cooling mode, by direct measurement only, would require warmer ambient weather conditions and a longer period of observation.

Notwithstanding these difficulties and to avoid further delays, the assessment is based on the measurements obtained on the 9th March.

The Boiler Flue.

Figure 7 - location of boiler flue.



The boiler flue noise was measured on the 19th November 2021 under controlled start-up. Again, great difficulty measuring this at the receptor location due to high levels of ambient noise, but it was possible, via the small kitchen window, to place a microphone, with a stand and extension cable, within a metre of the flue outlet.

With help from the M&E engineer, it was then possible to manually start each of the four boilers in turn, but only for a few minutes and after running off lots of hot water! Flue noise measurements at 1 metre were as follows:

All off = 50 dBA

1 boiler at 20% = 50 dBA

2 boilers at 100% = 55 dBA

4 boilers at 100% = 58 dBA

The measurements obtained on the 19th November 2021 are considered reliable and valid and were made in full accordance with BS4142:2014, under free-field conditions. However, we have now adopted a more typical demand condition, for the night time assessment, of 1 boiler at 20%, rather than a 'worst case' demand condition of 2 boilers at 100%, according to the following statement by Stephen Lindley:

"The boilers provide hot water and heating for the flats (indirectly via plate heat exchangers), communal hot water and communal heating. You are likely to get peak demand during the day time when people are showering and using their heating. Through the night demand will drop of to the levels you were seeing last week (1 at 20%).

The boilers are duty, assist, assist, standby, so one will ramp up to 100% (as demand increases) then a second will start, then a third (only at very high demand). You would not get 4 running at 20 percent, indeed you would never get all 4 running at once other than if the system was shut down for a period (it is never off in normal operation). More likely is at peak times you'd have max of 2 at 100%."

From the previous survey, 1 boiler operating at 20% demand measured 50 dBA @ 1 metre from the flue outlet. At a propagation distance of 5 metres, this equates to 36 dBA (free field) at the living room window of Flat 25.

3.3 The Receptors.

The receptor location for the A/C condenser is a living room window of Flat 4, part of the same development, located 7 metres from the sound source. The potential path for noise ingress is a single, non-opening window to the living room. This window has acoustic double glazing and is fitted with an acoustic trickle vent. Survey data (Figure 3) shows that this window currently provides approximately 30 dB of sound attenuation, while noting that the outer part of the acoustic trickle vent, which is the acoustic attenuating element, has broken off. The glass itself is rated at 35 dB R_w.

Both source and receptor are located in the undercroft area of the car park, to the front of the building.

The boiler flue is located 5 metres from the living room window (non-opening) of apartment 25, on the second floor to the rear of the building.

3.4 Weather conditions.

Weather conditions on the 9th March were dry but overcast, cold (5°C) and with light winds from the south west at less than 3 m/s.

3.5 Measurement locations and instrumentation.

Two, data logging, Class 1 sound level meters were used for this survey. Location A was external, in the undercroft, one metre from Flat 4 window and Location B was in the living room of Flat 4, to enable an inside/outside comparison.

For Location A, a Norsonic 140 sound level was used, serial number 1402728, due for recalibration in April 2023.

For Location B, a Norsonic 118 sound level meter was used, serial number 31512, due for recalibration in March 2023.

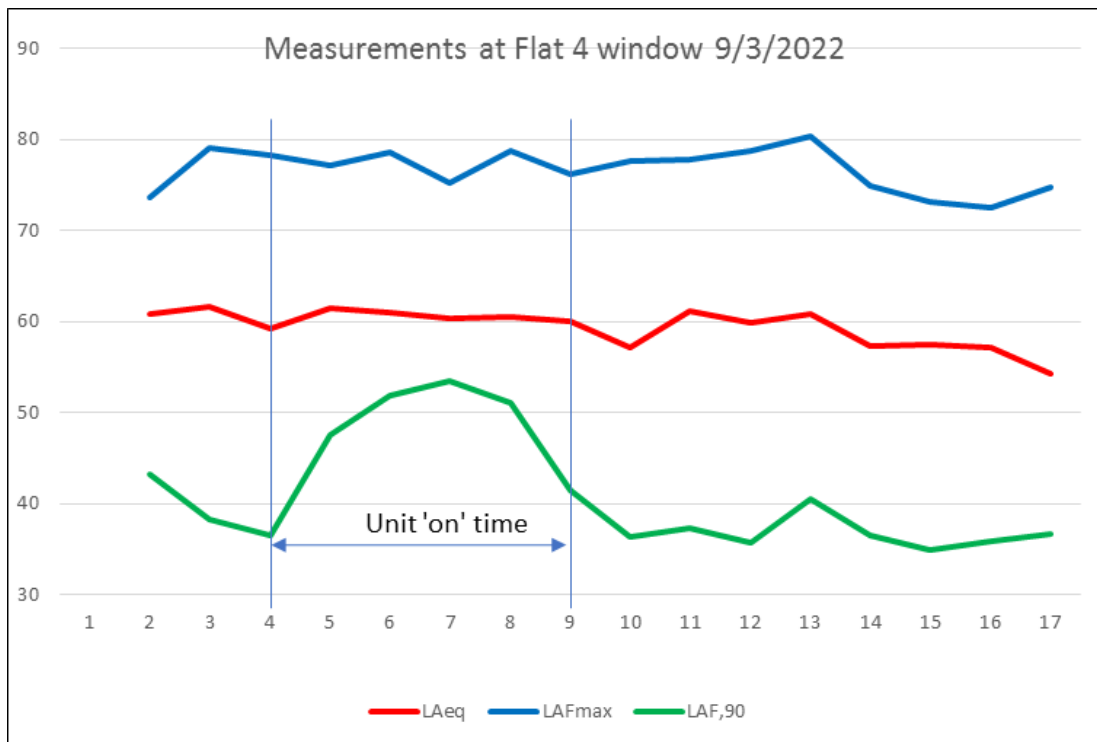
Both instruments were field-calibrated before and after the sequence of measurements and no drift was noted.

Calibration certificates for both meters are available for inspection upon request.

4. **Results of measurement survey 9th March 2022.**

The following data set was recorded between the hours of 3.08 am and 4.20 am. The condenser controls were set to full heating mode (26°C) and the unit was observed starting up at about 3.19 am. After a slow ramp up over the next 15 minutes or so, the unit started to ramp down and was shut off at about 3.45 am, a full cycle of about 25 minutes. The meter was left running just in case traffic noise would reduce further, but it remained essentially the same at about 60 dB_A with peaks at over 70 dB_A. The graph of Figure 1 shows the full measurement period, in 5 minute intervals, with the parameters L_{Aeq}, L_{A90} and L_{Amax}. L_{Amax} is not relevant to this assessment but serves to illustrate the intensity and severity of traffic noise at the measurement location.

It is clear from the graph that the L_{Aeq} is dominated by road traffic and is unaffected by the operation of the condenser unit. Only the L_{A90} curve shows the operation of the condenser as this is a statistical parameter which is largely unaffected by short duration events.

Figure 8 - level vs time at receptor location.

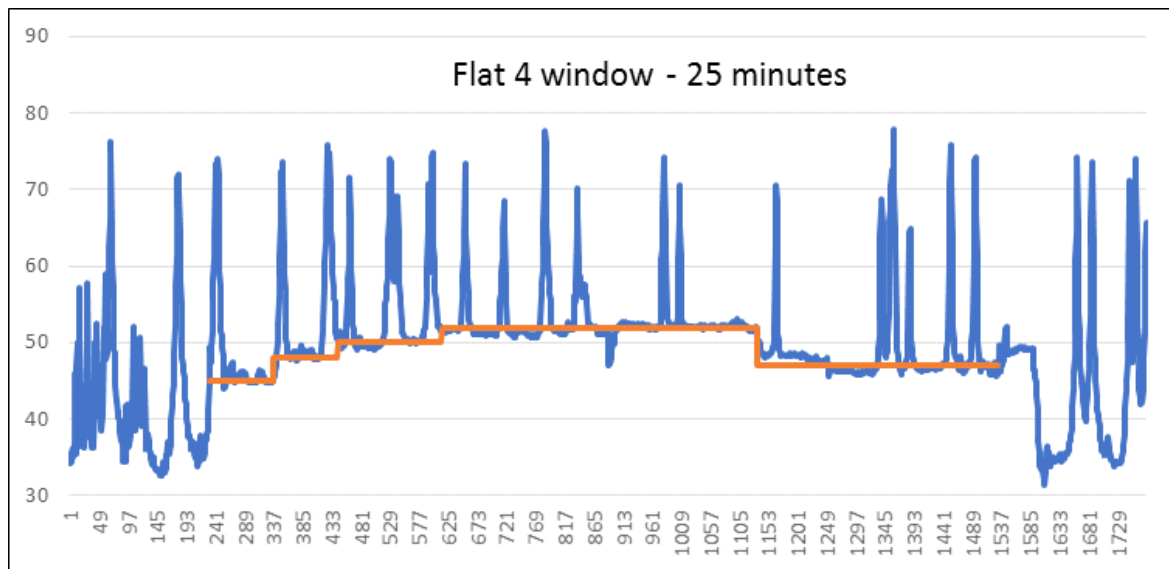
4.1 Determining the specific noise of the A/C condenser unit.

It is clear that the specific sound due to the condenser unit cannot be accurately determined from further analysis of the L_{Aeq} data, so two other methods have been adopted.

4.1.1 Method 1 - measuring the specific sound during lulls in traffic (Example 3 in BS4142).

Method 1 is based upon direct measurement at the receptor location and visual inspection of the one-second time history of the graph of Figure 9. This is probably the most reliable method as it allows the steady noise from the condenser to be observed during lulls in the traffic. This method is referenced in BS4142 as Example 3.

Figure 9 shows a 25 minute measurement period, based on L_{Aeq} , in 1 second intervals, in which the passing traffic is identified from 'peaks' in the L_{Aeq} time history. From this, it is evident that the plant ramps up from 45 dB to 52 dB in the first 5 to 10 minutes after start-up, levels off, then ramps down.

Figure 9 - 1 second time history condenser start-up and operation

A detailed calculation was made by representing the condenser sound levels in a series of steps (the orange trace on the graph) over the full period of operation, then taking the energy average of all the steps, taking account of the duration of each step, in seconds. This has an estimated uncertainty of ± 1 dB but effectively eliminates the effect of road traffic from the record.

The result of the calculation is a level of 49.9 dB_A which rounds to 50 dB_A for the assessment.

Note: Daytime operation is assessed over 1 hour and operation is likely to be cyclical with possibly up to 2 complete cycles in any hour, depending on how much heating (or cooling) is required.

4.1.2 Method 2 - measuring the L_{A90} (no standard method exists for this)

The graph of Figure 8 shows the full 5-minute time history over the whole of the survey period. By looking at the L_{A90} curve (green), the operation of the plant can be clearly seen, but there is no discernible influence on the L_{Aeq} curve (red).

Method 2 is an attempt to measure the ambient sound as L_{A90} with the source operating and the residual sound, as L_{A90} with the source off. The residual sound is then subtracted from the ambient sound, on an energy basis. It should be noted that this is not a standard method but assumes that, for steady-state sound, L_{A90} is approximately equivalent to L_{Aeq} .

Using this method, I have calculated the 'average' sound level over the full 25 minute heating duty cycle to be 50.4 dB_A, which will be rounded to 50 dB_A for the assessment. The calculation is summarised in Table 1.

Table 1 - calculation of specific sound level using L_{A90} as a proxy for L_{Aeq} .

Period of operation	Unit status	Measured sound level dBA
1	on	47.5
2	on	51.9
3	on	53.4
4	on	51.1
5	on	41.5
6	off	36.6
7	off	37.3
8	off	35.7
9	off	40.5
10	off	36.5
Energy average unit 'on'		50.59
Energy average unit 'off'		37.64
Specific sound level (unit on minus unit off)		50.36

Subjectively, the dominant noise at the receptor location was due to road traffic on Wilbraham Road, in both directions. No other source of noise was significant at the receptor locations.

4.2 Background sound

The background sound levels were obtained at two locations on the 7th October and 19th November 2021 and have not been repeated. These were 24 hour unattended surveys.

At the window of Flat 4, the daytime background sound level (calculated according to MCC guidelines) was 56 dB L_{A90} . This is an uncorrected 'as measured' value with no attempt to apply a free-field correction due to the complex sound propagation conditions in the undercroft area.

At Flat 25, the night time background is assumed to be 43 dB L_{A90} , based upon a previous measurement on the other side of the building at a similar distance from the road.

The results of the 24 hour noise logging can be summarised by the graphs of Figures 4 and 5 and Table 2.

Table 2 - summary data Locations A and B

Location	Description	LAeq	LA90
A (October 2021)	Typical representative daytime sound level Location A	65 dBA	53 dBA
	Typical representative night time sound level. Location A	61 dBA	43 dBA
B (November 2021)	Typical representative daytime sound level Location A	63 dBA	56 dBA
	Typical representative night time sound level. Location A	61 dBA	46 dBA

4.3 Acoustic Feature correction.

The BS4142:2014 assessment procedure adds a ‘penalty’, or acoustic feature correction, to the specific noise level if the source noise is tonal and/or impulsive. This is normally a subjective assessment although the Standard does include two objective rating methods.

The condenser noise does not warrant a character correction as it is neither tonal nor impulsive and is inaudible inside the nearest dwelling. The start up of the unit is gradual and is indiscernible, subjectively, in the presence of daytime road traffic, which is typically 65 dBA, so a correction for ‘intermittency’ is not considered appropriate for a daytime assessment, in my professional judgement.

The acoustic feature correction is therefore 0 dB and the rating level of the source is taken to be 50 dB $L_{Aeq,1 \text{ hour}}$.

5. **Impact assessments to BS4142:2014**

5.1 Explanation.

BS4142:2014 assesses the significance of the impact of unwanted sound by comparing the free-field ‘rating level’ of a specific sound, measured as $L_{Aeq,T}$, with the underlying background sound, measured as $L_{A90,T}$ and taking account of the context in which the sound occurs. If the rating level exceeds the background by 10 dB or more then the Standard considers this an indication of ‘significant adverse impact’ depending on the context. A difference of around 5 dB is considered to be an indication of an ‘adverse impact’ depending on the context. Where the rating level does not exceed the background sound level this is an indication of a ‘low impact’, depending on the context.

For ‘daytime’ assessments, a 1 hour reference time period is used, while for ‘night time’ assessments a 15 minute reference time period is used.

Table 3 - BS4142:2014 Assessment of condensers, daytime, at Flat 4 window.

Measurement	Value	Comment
Specific sound level due to A/C condenser	50 dBA	Based on direct measurement, Method 1 and Method 2 without a free-field correction.
Residual sound level	n/a	Not possible to measure.
Background sound level (rounded)	56 dB LA90	Measured at reference location B November 2021 without a free-field correction.
Reference time interval	60 minutes	Assumes source operates at the measured level for one hour during the day, subject to confirmation.
Character correction	0 dB	Subjective observation by consultant, source is neither tonal nor impulsive
Rating Level	50 dBA	See section 4
Excess of rating level over background sound level	-6 dB	Indicates a low impact.
Context		This is likely to be inaudible in the presence of road traffic noise.
Uncertainty	+/- 3 dB	There is some uncertainty when attempting to measure source sound levels in the presence of high levels of ambient sound.

Table 4 - BS4142:2014 Assessment of boiler flue, night time at Apartment 25 window.

Measurement	Value	Comment
Measured sound level at 1 metre from flue with 1 boiler at 20%	36 dBA	Based on in-situ measurements 19th November 2021 and distance propagation calculation.
Residual sound level	n/a	Not applicable as source level is estimated during lulls in traffic
Background sound level (rounded)	43 dB LA90	Measured at reference location A October 2021
Reference time interval	15 minutes	Assumes source operates for at least 15 minutes at a time.
Character correction	0 dB	Noise is neither impulsive nor tonal.
Rating Level	36 dBA	See section 4
Excess of rating level over background sound level	-7 dB	Indicates low impact.
Context		This is likely to be inaudible in the presence of road traffic noise.
Uncertainty	+/- 3 dB	There is some uncertainty when predicting sound levels and when measuring background sound.

6. Assessment according to BS8233:2014

The fact that the receptor is a habitable room within a dwelling, with no outdoor area affected, means that it is worth considering an assessment of indoor ambient noise, in accordance with BS8233:2014 ‘Guidance on sound insulation and noise reduction for buildings’.

6.1 Noise Criteria

The indoor noise criteria are not specified in the planning condition but are assumed to be as recommended in British Standard BS8233:2014, which is concerned only with ‘average’ internal noise levels in bedrooms, dining rooms and living rooms, in dwellings, as summarised by the table below.

The levels recommended in the table are commensurate with low levels of annoyance and sleep disturbance.

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 $L_{Aeq,8hour}$

There is an additional, implicit requirement, which is not explicit in BS8233:2014, that “*individual noise events shall not normally exceed 45dB L_{Amax}* ”. This is commensurate with World Health Organisation Guidelines and is a limit recommended for restful sleep.

6.2 Internal measurements in Flat 4 on the 9th March 2022

The graph of Figure 10 shows the results of continuous measurements, in five minute periods, within the living room of Flat 4. For the first few periods, the room was opened and persons entered the room to check the meter readings so this has influenced the noise measurements during periods 1 to 5. Periods 6 to 14 were unaffected by persons entering the room and the measured noise levels are due only to external sources. The resulting L_{Aeq} does not exceed 30 dB $_A$ and the L_{Amax} does not exceed 45 dB $_A$. These measurements include the test measurements of the A/C condenser. The graph of Figure 11 shows the same data with the external A/C condenser measurements overlaid and time-synchronised to enable comparison.

It is clear that the indoor noise levels in the living room of Flat 4 fully comply with the requirements of BS8233:2014. This would also be the case even if this room was a bedroom. This also demonstrates that the operation of the A/C condenser has no effect on the indoor noise levels.

Figure 10 - internal noise levels Flat 4 living room

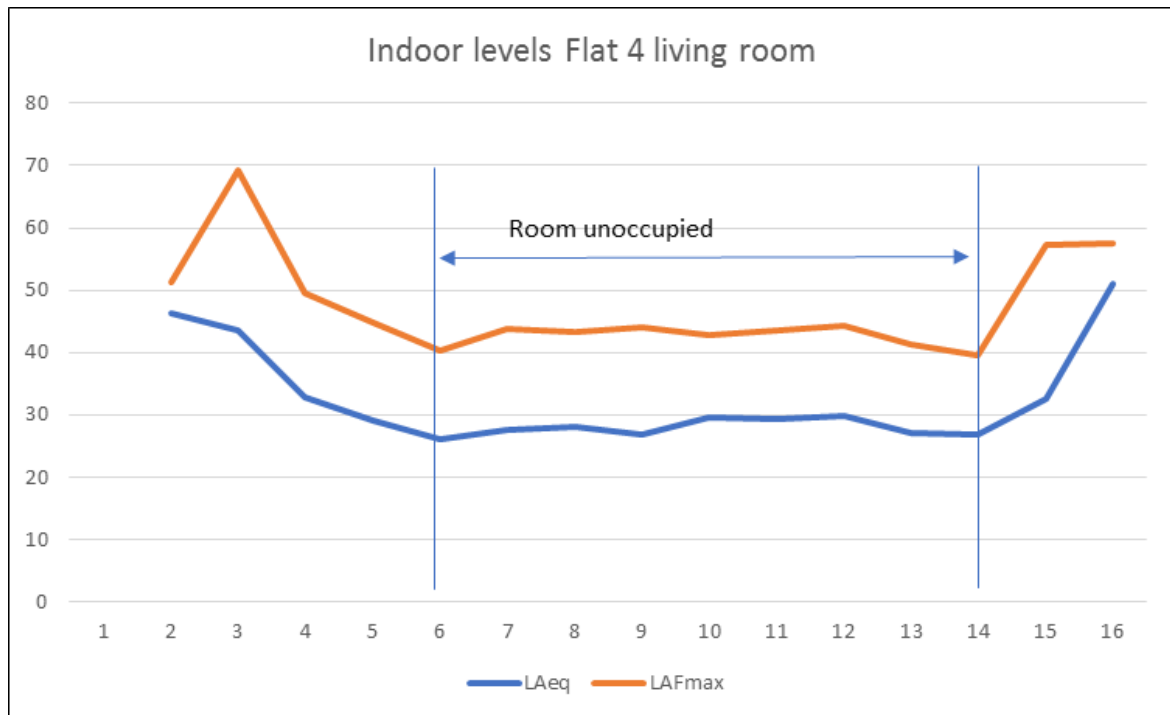
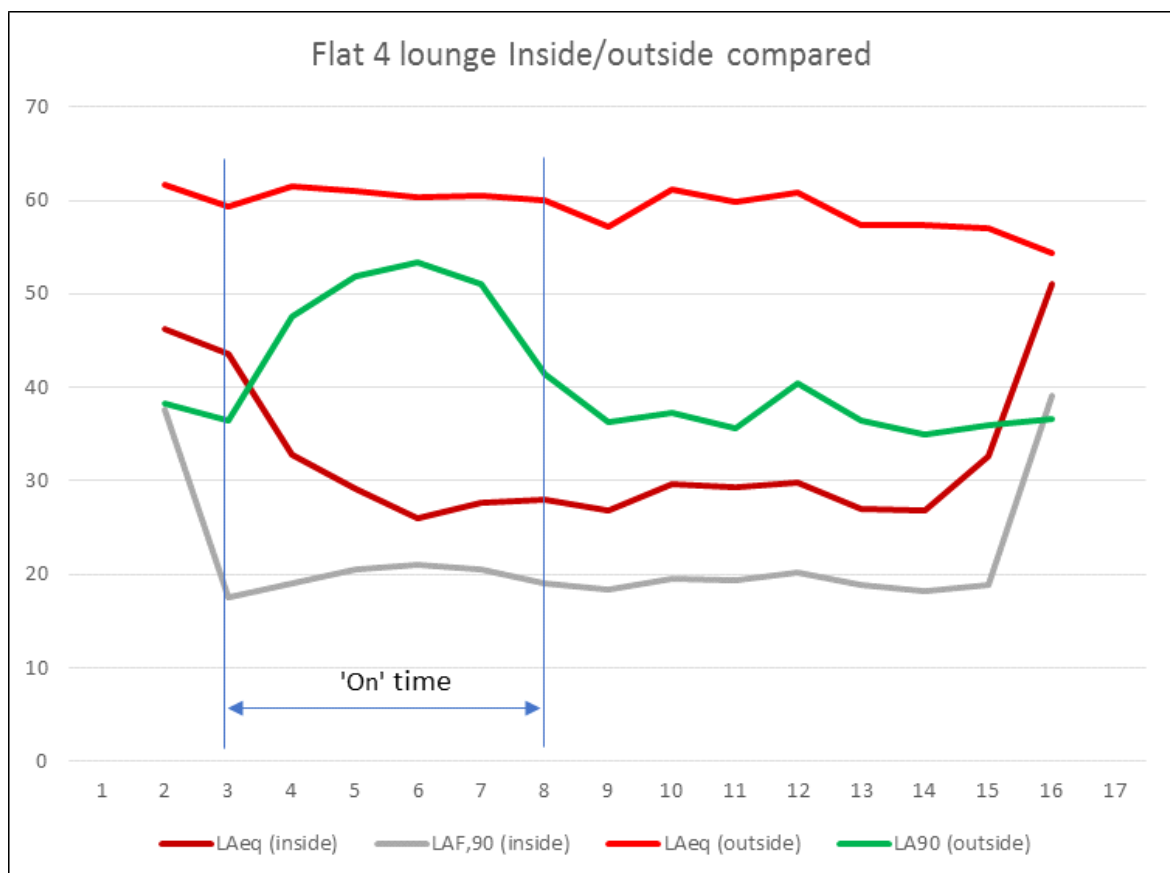


Figure 11 - internal and external noise levels compared over the identical time period.



Summary and Conclusions.

1. Background sound at Location B, Flat 4 window, is a daytime average of typically 56 dBL_{A90,1hour}. At night the average background was 46 dB L_{A90,15 minutes}. The source of this noise was traffic on Wilbraham Road and more distant locations.
2. Background noise at Locations B & C, including Flat 25 window, is a daytime average of typically 53 dBL_{A90 1 hour}. At night the average background was 43 dB L_{A90 15 minutes}. The source of this noise was traffic on Wilbraham Road and more distant locations.
3. Further information from the M&E team confirms that the operation of the A/C condenser units is “daytime only” i.e. “between the hours of 9 am and 8 pm”. The M&E team also confirms that the typical boiler operation, through the night, is one boiler at 20% demand.
4. It was difficult to measure both noise sources due to high levels of ambient noise, but it was possible to obtain accurate data for the A/C condenser, during a heating cycle, by observing lulls between individual traffic events during a quieter time of the night. The noise due to the boiler operation was measured at 1 metre from the flue and the level at the receptor calculated in full accordance with BS4142:2014.
5. A BS4142 daytime assessment for the A/C condenser at Flat 4 living room window shows a “low impact” when directly measured. The resulting rating level is 6 dB below the background noise measured at this location (Table 3)
6. A BS4142 night-time assessment for the boiler operation at the living room window of Apartment 25 shows a “low impact” based on measurements at 1 metre from the source. The resulting rating level is 7 dB below the background noise measured at this location (Table 4).
7. The planning condition has been achieved.
8. There are no recommendations for any further assessments or noise mitigation measures at this development.

This concludes the report.

Signature/name of consultant....Iain Critchley MIOA
Date: 17th March 2022

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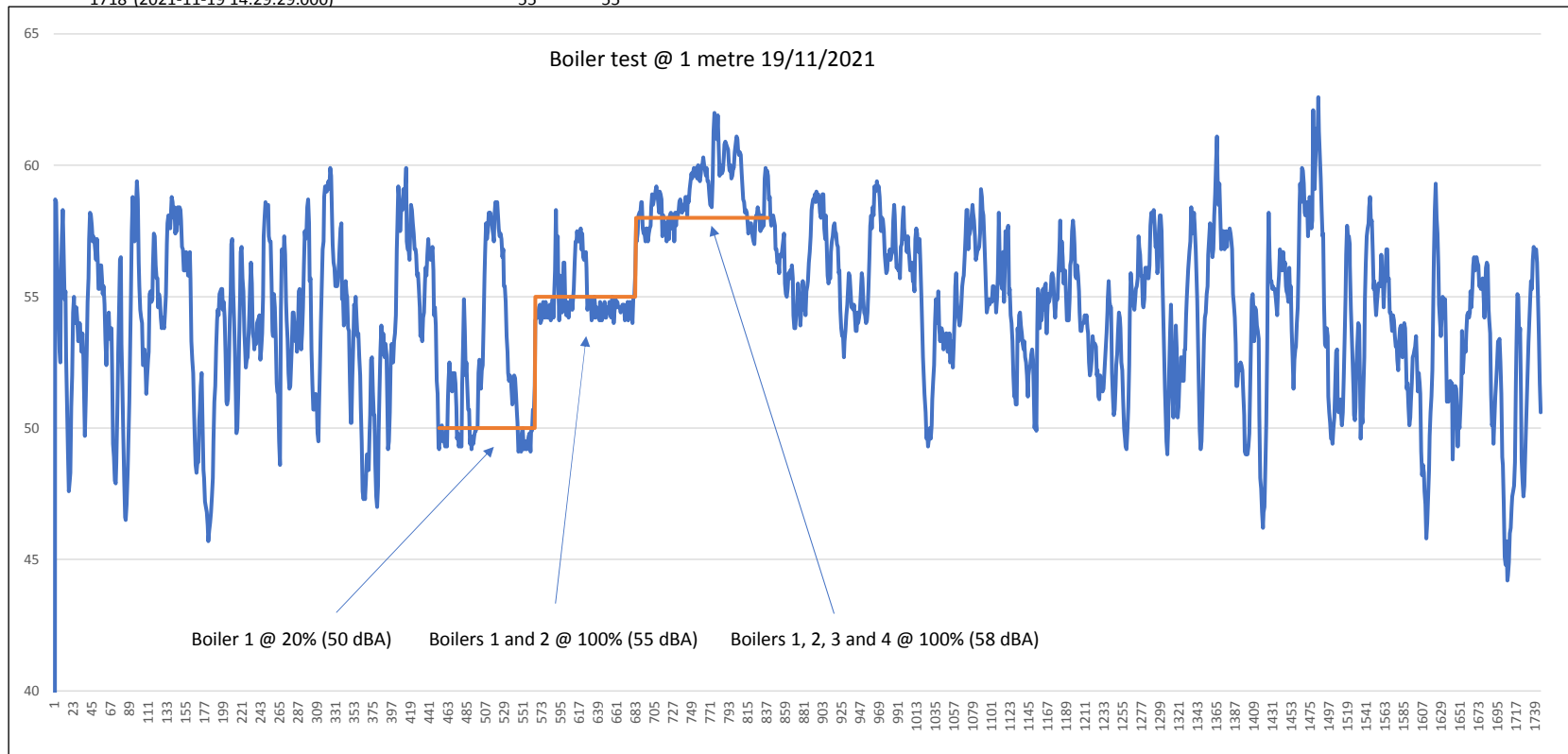
email: noise@peninsularacousticsltd.co.uk

Appendix A

Raw data and graphs, as referenced in the report

1711 (2021-11-19 14:29:22.000)	47.4	47.4
1712 (2021-11-19 14:29:23.000)	47.6	47.6
1713 (2021-11-19 14:29:24.000)	47.8	47.8
1714 (2021-11-19 14:29:25.000)	48.7	48.7
1715 (2021-11-19 14:29:26.000)	51.7	51.7
1716 (2021-11-19 14:29:27.000)	53.2	53.2
1717 (2021-11-19 14:29:28.000)	55.1	55.1
1718 (2021-11-19 14:29:29.000)	55	55

Boiler data

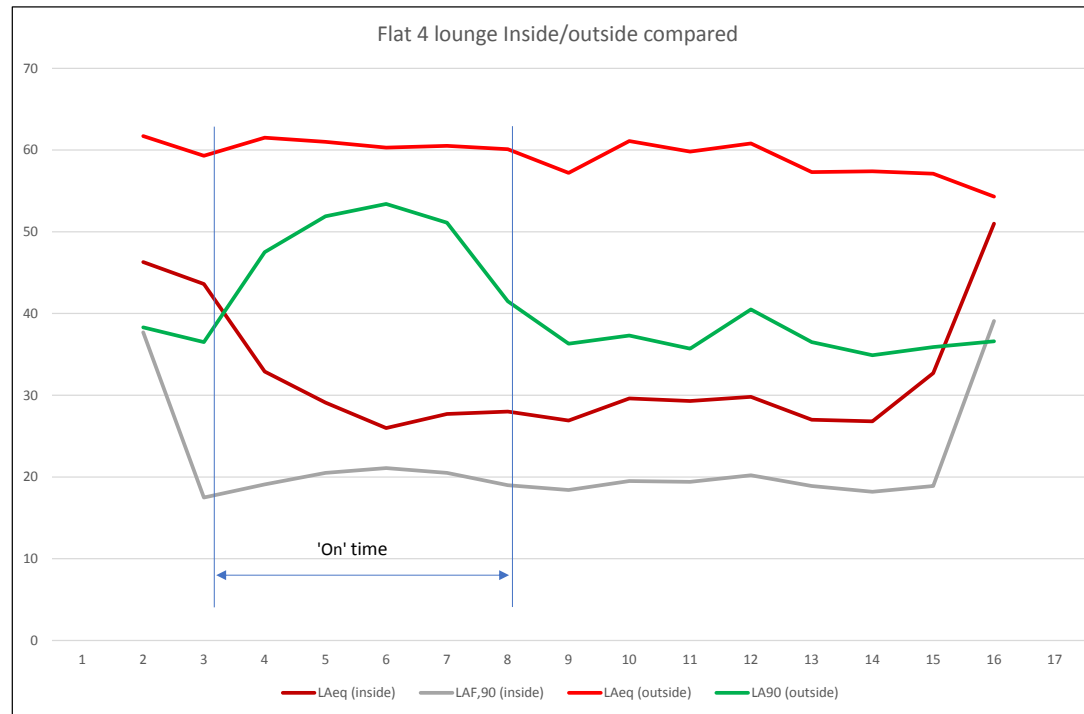


Directory:

C:\Acoustic data 2022\Nor 118 data (31512)\220309

File version v1.0/6.1.0.27

File	Date	Duration	Status	LAEq (inside)	LAF,90 (inside)	LAEq (outside)	LA90 (outside)
NOR118_6454709_220309_0001.NBF	(2022/03/09 03:14:49.00)	(0:0:8.0)	N/A	46.3	37.7	61.7	38.3
NOR118_6454709_220309_0002.NBF	(2022/03/09 03:15:00.00)	(0:4:58.0)	N/A	43.6	17.5	59.3	36.5
NOR118_6454709_220309_0003.NBF	(2022/03/09 03:20:00.00)	(0:4:58.0)	N/A	32.9	19.1	61.5	47.5
NOR118_6454709_220309_0004.NBF	(2022/03/09 03:25:00.00)	(0:4:58.0)	N/A	29.1	20.5	61	51.9
NOR118_6454709_220309_0005.NBF	(2022/03/09 03:30:00.00)	(0:4:58.0)	N/A	26	21.1	60.3	53.4
NOR118_6454709_220309_0006.NBF	(2022/03/09 03:35:00.00)	(0:4:58.0)	N/A	27.7	20.5	60.5	51.1
NOR118_6454709_220309_0007.NBF	(2022/03/09 03:39:59.00)	(0:4:58.0)	N/A	28	19	60.1	41.5
NOR118_6454709_220309_0008.NBF	(2022/03/09 03:45:00.00)	(0:4:58.0)	N/A	26.9	18.4	57.2	36.3
NOR118_6454709_220309_0009.NBF	(2022/03/09 03:49:59.00)	(0:4:58.0)	N/A	29.6	19.5	61.1	37.3
NOR118_6454709_220309_0010.NBF	(2022/03/09 03:55:00.00)	(0:4:58.0)	N/A	29.3	19.4	59.8	35.7
NOR118_6454709_220309_0011.NBF	(2022/03/09 04:00:00.00)	(0:4:58.0)	N/A	29.8	20.2	60.8	40.5
NOR118_6454709_220309_0012.NBF	(2022/03/09 04:05:00.00)	(0:4:58.0)	N/A	27	18.9	57.3	36.5
NOR118_6454709_220309_0013.NBF	(2022/03/09 04:10:00.00)	(0:4:58.0)	N/A	26.8	18.2	57.4	34.9
NOR118_6454709_220309_0014.NBF	(2022/03/09 04:15:00.00)	(0:4:58.0)	N/A	32.7	18.9	57.1	35.9
NOR118_6454709_220309_0015.NBF	(2022/03/09 04:19:59.00)	(0:0:7.0)	N/A	51	39.1	54.3	36.6

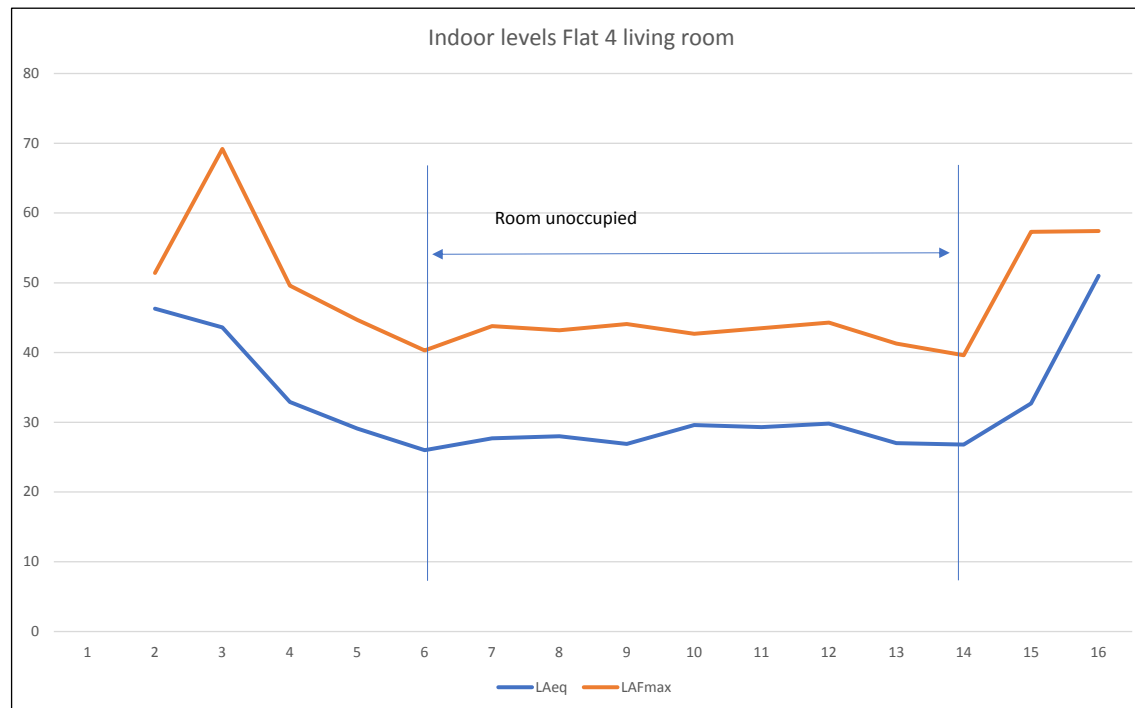


Directory:

C:\Acoustic data 2022\Nor 118 data (31512)\220309

File version v1.0/6.1.0.27

File	Date	Duration	Status	LAeq	LAFmax	LAF,Perc6	Lfeq				
							6.3 Hz	8.0 Hz	10 Hz	12.5 Hz	16 Hz
NOR118_6454709_220309_0001.NBF	(2022/03/09 03:14:49.00)	(0:0:8.0)	N/A	46.3	51.4	37.7	55.2	49.9	57.6	57.4	50.3
NOR118_6454709_220309_0002.NBF	(2022/03/09 03:15:00.00)	(0:4:58.0)	N/A	43.6	69.2	17.5	61.4	63.9	59.5	60.7	61.7
NOR118_6454709_220309_0003.NBF	(2022/03/09 03:20:00.00)	(0:4:58.0)	N/A	32.9	49.6	19.1	48.9	48.3	48	47.2	38.8
NOR118_6454709_220309_0004.NBF	(2022/03/09 03:25:00.00)	(0:4:58.0)	N/A	29.1	44.7	20.5	37.7	30.6	31.6	38.4	32.3
NOR118_6454709_220309_0005.NBF	(2022/03/09 03:30:00.00)	(0:4:58.0)	N/A	26	40.3	22.1	42	32.6	28	27.7	27.8
NOR118_6454709_220309_0006.NBF	(2022/03/09 03:35:00.00)	(0:4:58.0)	N/A	27.7	43.8	20.5	42.7	33	29	32.1	31.3
NOR118_6454709_220309_0007.NBF	(2022/03/09 03:39:59.00)	(0:4:58.0)	N/A	28	43.2	19	39.1	28.9	22.9	31.8	32.8
NOR118_6454709_220309_0008.NBF	(2022/03/09 03:45:00.00)	(0:4:58.0)	N/A	26.9	44.1	18.4	32.1	24.9	22	31	29.2
NOR118_6454709_220309_0009.NBF	(2022/03/09 03:49:59.00)	(0:4:58.0)	N/A	29.6	42.7	19.5	31.5	25.1	22	30.6	31.6
NOR118_6454709_220309_0010.NBF	(2022/03/09 03:55:00.00)	(0:4:58.0)	N/A	29.3	43.5	19.4	48.8	37.6	29.5	32.9	33.6
NOR118_6454709_220309_0011.NBF	(2022/03/09 04:00:00.00)	(0:4:58.0)	N/A	29.8	44.3	20.2	39.6	29.4	22.4	28.6	30.1
NOR118_6454709_220309_0012.NBF	(2022/03/09 04:05:00.00)	(0:4:58.0)	N/A	27	41.3	18.9	30.7	23.8	20.8	29.4	29.1
NOR118_6454709_220309_0013.NBF	(2022/03/09 04:10:00.00)	(0:4:58.0)	N/A	26.8	39.6	18.2	35.6	28.5	23	35.8	33.1
NOR118_6454709_220309_0014.NBF	(2022/03/09 04:15:00.00)	(0:4:58.0)	N/A	32.7	57.3	18.9	45.9	45.7	41.9	40.9	33.8
NOR118_6454709_220309_0015.NBF	(2022/03/09 04:19:59.00)	(0:0:7.0)	N/A	51	57.4	39.1	45.2	50.9	48.4	50.1	37.3



Directory: C:\Acoustic data 2022\Nor 140 data\220309 File version v1.0/6.1.0.27

File	Date	Duration	10 ⁴ (x/10) LAeq	10 ⁴ (x/10) LAF ₉₀	LAeq	LAF _{max}	LAF ₉₀	
NOR140_1662400_220309_0001.NBF	(2022/03/09 03:08:52.00)	(0:1:7.0)	1202264.435	21379.6209	60.8	73.7	43.3	
NOR140_1662400_220309_0002.NBF	(2022/03/09 03:10:04.00)	(0:4:55.0)	1479108.388	6760.829754	61.7	79	38.3	
NOR140_1662400_220309_0003.NBF	(2022/03/09 03:15:04.00)	(0:4:55.0)	851138.0382	4466.835922	59.3	78.2	36.5	
NOR140_1662400_220309_0004.NBF	(2022/03/09 03:20:04.00)	(0:4:55.0)	1	1412537.545	56234.13252	61.5	77.2	47.5
NOR140_1662400_220309_0005.NBF	(2022/03/09 03:25:04.00)	(0:4:55.0)	2	1258925.412	154881.6619	61	78.6	51.9
NOR140_1662400_220309_0006.NBF	(2022/03/09 03:30:04.00)	(0:4:55.0)	3	1071519.305	218776.1624	60.3	75.3	53.4
NOR140_1662400_220309_0007.NBF	(2022/03/09 03:35:05.00)	(0:4:54.0)	4	1122018.454	128824.9552	60.5	78.8	51.1
NOR140_1662400_220309_0008.NBF	(2022/03/09 03:40:04.00)	(0:4:55.0)	5	1023292.992	14125.37545	60.1	76.2	41.5
NOR140_1662400_220309_0009.NBF	(2022/03/09 03:45:04.00)	(0:4:55.0)	524807.4602	4265.795188	57.2	77.7	36.3	
NOR140_1662400_220309_0010.NBF	(2022/03/09 03:50:04.00)	(0:4:55.0)	1288249.552	5370.317964	61.1	77.8	37.3	
NOR140_1662400_220309_0011.NBF	(2022/03/09 03:55:04.00)	(0:4:55.0)	954992.586	3715.352291	59.8	78.8	35.7	
NOR140_1662400_220309_0012.NBF	(2022/03/09 04:00:04.00)	(0:4:55.0)	1202264.435	11220.18454	60.8	80.4	40.5	
NOR140_1662400_220309_0013.NBF	(2022/03/09 04:05:04.00)	(0:4:55.0)	537031.7964	4466.835922	57.3	74.9	36.5	
NOR140_1662400_220309_0014.NBF	(2022/03/09 04:10:04.00)	(0:4:55.0)	549540.8739	3090.295433	57.4	73.2	34.9	
NOR140_1662400_220309_0015.NBF	(2022/03/09 04:15:04.00)	(0:4:55.0)	512861.384	3890.45145	57.1	72.5	35.9	
NOR140_1662400_220309_0016.NBF	(2022/03/09 04:20:04.00)	(0:4:27.0)	269153.4804	4570.881896	54.3	74.8	36.6	

25 minute LAeq (unit on) 60.7101946 dBA

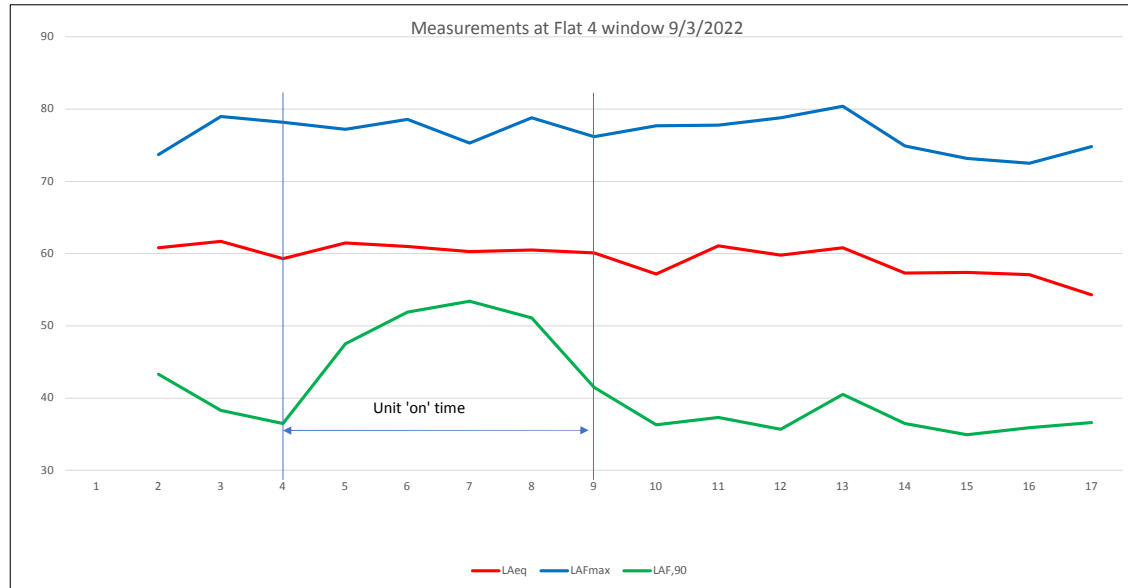
25 minute LAeq (unit off) 59.54950877

Specific noise (LAeq) 54.41207283

25 minute LA90 (unit on) 50.59065066

25 minute LA90 (unit off) 37.64003964

Specific noise (LA90) 50.36472235



Condenser Data external