

Assessment of noise emissions from mechanical services equipment associated with a proposed public house and hotel

Lowry House, 18-20 Fountain Street, Manchester



Client: Brewdog

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0. SUMMARY

- 0.1. Manchester City Council has granted planning consent for the change of use and amalgamation of an existing restaurant/bar (Class A3/A4) and betting shop (Sui Generis) to form a public house (Class A4) and a separate consent for the change of use of upper floor levels from office space (Class B1) to a hotel (Class C1) at 18-20 Fountain Street, Manchester, subject to various conditions.
- 0.2. ACA Acoustics have been commissioned by Brewdog Retail Limited to assess noise emissions from new mechanical services equipment to be installed serving the new bar and hotel. The assessment is required to demonstrate the development will comply with criteria set out in planning condition 6 of Decision Notice reference 125264/FO/2019 and condition 6a of Decision Notice 125900/FO/2020. This report presents results of the assessment.
- 0.3. ACA Acoustics have identified the closest non-associated residential properties as being new flats currently being developed on Sickle Street, around 36m from the plant location on the first-floor flat roof and 50m from the kitchen extract fan exhaust at top floor roof level. The plant will be screened from closest dwellings by intervening buildings and parapet wall around the roof.
- 0.4. A sound level survey was carried out over nominally a 24-hour period between 13th and 14th February 2020. Whilst on site, the author considered the sound climate during the daytime period to comprise primarily of traffic on nearby routes and construction activity on several building sites in the vicinity. At night, the acoustic climate comprised of traffic and pedestrian activity. The measured LA90 sound level during proposed operating times of the plant was 49dB.
- 0.5. Calculations using manufacturer's sound level data for the new equipment confirm that the rating level will be LAr 37dB outside the most-affected residential properties, when assessed in accordance with BS 4142:2014+A1:2019. This is at least 11dBA below the prevailing background sound level and fully complies with the City Council's planning consent criteria.
- 0.6. In conclusion, noise emissions from the proposed plant complies with the planning consent criteria and no further noise mitigation measures will be required. It is recommended that the City Council may approve the proposed scheme.

1. INTRODUCTION

Planning consent has been granted for the change of use and amalgamation of an existing restaurant/bar (Class A3/A4) and betting shop (Sui Generis) to form a public house (Class A4) and a separate consent for the change of use of upper floor levels from office space (Class B1) to a hotel (Class C1) at Lowry House, 20 Fountain Street, Manchester, subject to various conditions.

ACA Acoustics Limited has been commissioned by Brewdog to carry out an assessment of noise emissions from mechanical plant associated with the new bar and hotel and, where necessary, make recommendation to reduce sound levels to ensure that the amenity of nearby noise-sensitive properties is not compromised.

This report presents results of sound level surveys, computer modelling, and assessment.

2. ACOUSTIC CRITERIA

Manchester City Council has granted consent for the development, subject to various conditions.

Condition 6 of Decision Notice 125264/FO/2019 relates to noise emissions from the new mechanical plant:

6. 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 (LAeq) 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.

Condition 6a of Decision Notice 125900/FO/2020 is very similar to the above, and requires:

6a. Any 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 (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.

Before development commences on this element of the scheme, 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.

Although not specifically noted within the planning conditions, as both conditions refer to the 'rating level' it is anticipated that the assessment should be carried out in accordance with BS 4142:2014+A1:2019.

3. SOUND LEVEL SURVEY

Details of the sound level survey carried out by ACA Acoustics are provided below.

An unattended sound level survey was carried out using a single measurement position at roof level of the site, considered to likely provide a similar indication of the acoustic climate at the closest residential properties on Sickie Street.

The survey was conducted between 13th and 14th February 2020. The weather during the survey was primarily cold and dry and would not have adversely impacted the sound level survey results.

The author returned to the site at around midnight to take subjective observations of the acoustic climate at that time. Subjectively noise sources were noted to comprise primarily of traffic and pedestrian activity, which remained relatively high into the late evening/night-time period. There were some non-associated mechanical equipment items which were audible, particularly further down the street away from the site.

The following equipment was used during the survey; the sound level meter was calibrated before the survey and checked after with no deviation noted.

Equipment	Serial Number
NTi Audio Class 1 sound level meter type XL2, complete with weatherproof and lockable outdoor environmental kit	A2A-06294-E0
Svantek calibrator type SV33B. Compliant to IEC 60942-1:2003 (Calibrated to a reference traceable to NIST)	83826

Table 1: Equipment used

Measurement results are shown in Table 2 and Figure 1 below.

Assessment Period	Residual Sound Level LAeq, dB	Background Sound Level LA90, dB
Daytime – 07:00 to 23:00	63dB	50dB
Evening – 19:00 to 23:00	54dB	50dB
Night – 23:00 to 07:00	54dB	48dB
Daytime – 08:00 to 19:00	65dB	52dB
Night – 23:00 to 02:00	53dB	49dB

Table 2: Summary of sound level survey results

There is no significant reduction of sound levels later into the night-time period and measured sound levels remain relatively consistent throughout the evening and night.

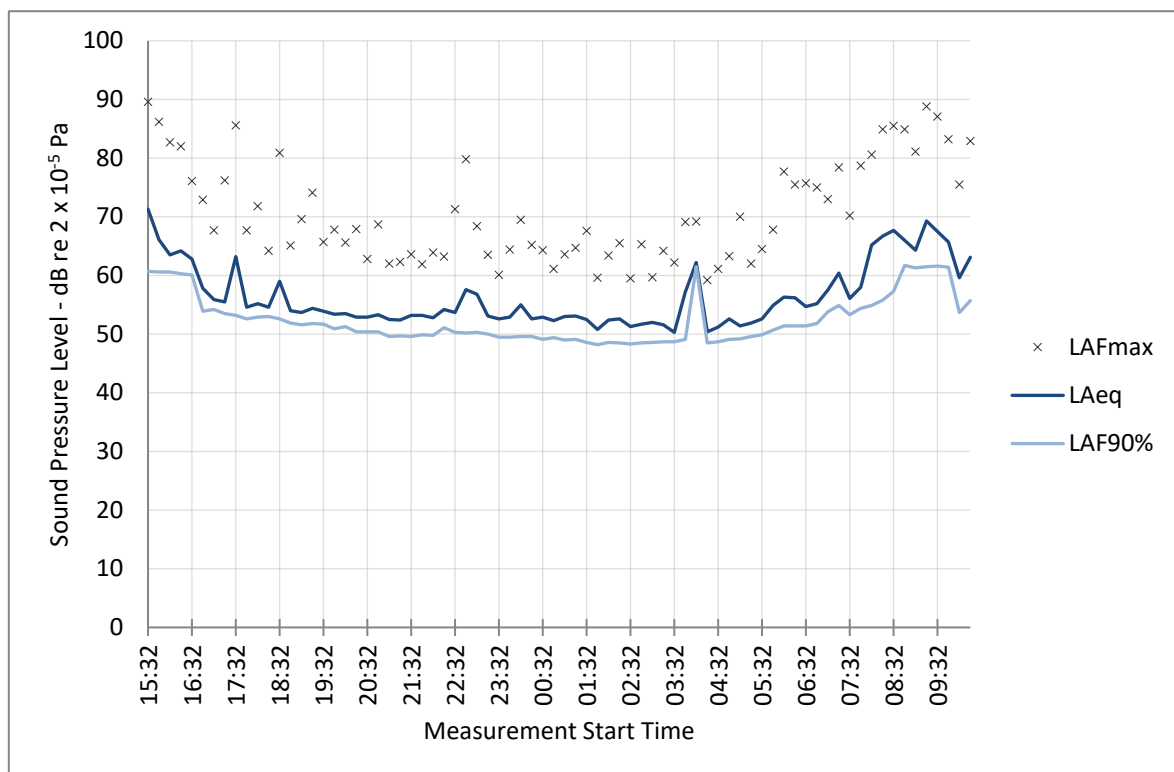


Figure 1: Sound level survey results – 13th to 14th February 2020

Plant serving the hotel has the potential to operate over a 24-hour period. Therefore, based on the measured sound levels and guidance within BS 4142:2014+A1:2019, the author considers that a level of LA90 48dB is representative of the night-time periods when the plant may operate and is appropriate to use as the baseline for this assessment to protect the amenity of nearby occupants. This is the lowest measured background sound level over the survey.

In accordance with the City Council's planning consent criteria, the cumulative rating level for new mechanical plant shall not exceed L_A 43dB outside the closest or most affected noise-sensitive windows.

4. ACOUSTIC ASSESSMENT OF MECHANICAL SERVICES EQUIPMENT

The development includes the installation of a new kitchen extract fan, air handling unit (AHU) and air conditioning condensers.

Confirmation of the equipment models and brief description of the equipment location is provided in the table below.

Reference	Equipment Model	Location/Description
KEF1 Kitchen Extract Fan	Systemair MUB 062 630EC	Fan installed internally within ground floor kitchen and ducted to discharge at roof level
Supply & Extract AHU	Systemair Geniox Air Handling Unit	First floor flat roof
CU1 Condenser	Daikin REYQ-10U	First floor flat roof
CU2 Condenser	Daikin REYQ-10U	First floor flat roof
CU3 Condenser	Daikin REYQ-18U	First floor flat roof

Table 3: Proposed new mechanical services equipment

Drawings showing proposed equipment locations have been provided by the client. Manufacturer's published sound power level spectra have been obtained for each item of equipment.

A computer model has been used to calculate the noise contribution from the proposed plant to outside the nearest noise-sensitive windows. The model for the extract fan and AHU determines corrections from the ductwork system in accordance with CIBSE Guide B4. Environmental corrections are calculated using the assessment method of ISO 9613-2:1996.

The computer model includes the benefit of silencers installed to the inlet and exhaust connections of the AHU. Insertion loss performance for the silencers is included in Appendix B.

The cumulative calculated specific sound level from the plant to outside the closest residential windows with all plant operating is shown in Table 4.

Receptor Location	Calculated Equipment Sound Level
Flats on Sickle Street	LAeq 37dB

Table 4: Calculated cumulative equipment sound level to 1m outside noise-sensitive windows

Assessment of the calculated specific sound levels in accordance with BS 4142:2014+A1:2019 is provided in Table 5.

Description	Dwelling on White Hart	Relevant Clause	Commentary
Calculated specific sound level to noise-sensitive windows	LAeq 37dB	7.1 7.3.6	All plant operating. Refer calculation sheets in Appendix A
Background sound level	LA90 48dB	8.1.3 8.3	Measured background sound level during operating times of the proposed plant
Acoustic feature correction	0dB	9.2	The calculated specific sound level does not indicate any tonal component and will be around 11dBA below the background sound level. No acoustic feature correction is applicable.
Rating level	LAr 37dB	9.2	
Excess of rating level over background sound level	-11dB	11	Assessment indicates negligible likelihood of adverse impact

Table 5: BS 4142:2014+A1:2019 Assessment

Table 5 shows that the cumulative rating level of the proposed new equipment will be around 11dBA below the representative background LA90 sound level to outside the closest noise-sensitive properties.

This fully complies with Manchester City Council's planning consent requirements and no further noise mitigation measures will be required.

5. CONCLUSION

Planning consent has been granted for the change of use of the site to form a new public house and hotel, subject to various conditions.

ACA Acoustics have undertaken a background sound level surveys in the vicinity.

Computer models have been set up to calculate noise emissions from proposed new mechanical services plant to outside the closest noise sensitive residential receptors.

The calculated rating level for the new plant, when assessed in accordance with BS 4142:2014+A1:2019 is L_Ar 37dB. This is around 11dBA below the representative background sound level to outside the closest receptors. At this level noise from the new plant will be low and should not be disturbing to occupants of the closest dwellings. Calculated levels fully comply with Manchester City Council's planning consent criteria.

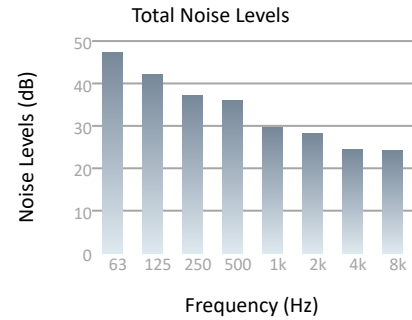
The assessment includes benefit of silencers to the AHU inlet and exhaust connections. Details of the silencers are provided in Appendix B.

It is the author's opinion that the acoustic impact of the proposed new equipment will be low. It is recommended that no further mitigation measures would be required and that the scheme may be approved by the City Council.

Appendix A

Acoustic Calculations

Project Name	Brewdog, Lowry House, Manchester
Project Reference	200208
Reference	Residential Flats - Mechanical
Description	Flats being developed on Sickle Street
Noise Limit	44
dBA	37



Noise Sources

Reference	Quantity	Noise Levels (dB)							
		63	125	250	500	1k	2k	4k	8k
AHU FAI	1	24	21	19	14	6	8	7	7
AHU Exhaust	1	26	28	25	25	21	23	20	23
AHU Casing Radiated	1	24	26	14	12	12	7	2	-12
CU1 Condenser	1	40	35	30	29	24	21	15	7
CU2 Condenser	1	40	35	30	29	24	21	15	7
CU3 Condenser	1	45	40	34	33	23	23	20	15

Calculation Sheet

EF1 Exhaust to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - EF1 Exhaust								
Noise Levels	90.0	88.0	81.0	78.0	78.0	75.0	73.0	67.0
Silencer								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bend Loss								
	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Bend Loss								
	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Bend Loss								
	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Rect Duct Losses								
	-2.4	-1.6	-1.2	-0.4	-0.4	-0.4	-0.4	-0.4
Bend Loss								
	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Bend Loss								
	-1.0	-2.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
Bend Loss								
	-1.0	-2.0	-3.0	-2.9	-3.0	-3.0	-3.0	-2.9
Rect Duct Losses								
	-3.6	-2.4	-1.8	-0.6	-0.6	-0.6	-0.6	-0.6
Bend Loss								
	-1.0	-2.0	-2.9	-2.9	-2.9	-2.9	-2.9	-2.9
Rect Duct Losses								
	-4.8	-3.2	-2.4	-0.8	-0.8	-0.8	-0.8	-0.8
Bend Loss								
	-1.0	-1.9	-2.6	-2.7	-2.8	-2.8	-2.8	-2.7
End Reflection								
	-8.1	-4.0	-1.5	-0.5	-0.1	0.0	0.0	0.0
External Grille Directivity								
	-1.0	-2.3	-4.7	-7.8	-11.1	-14.5	-15.0	-15.0

		Octave Band Centre Frequency (Hz)							
		63	125	250	500	1k	2k	4k	8k
ISO 9613 Environmental Corrections									
Horiz. Distance (m)	53.0								
Source Height (m)	12.0								
Receiver Height (m)	8.0								
Q Factor - Freefield									
		-42.5	-42.5	-42.6	-42.6	-42.7	-43.0	-44.3	-48.7
ISO 9613 Barrier Attenuation									
		-7.8	-7.9	-8.0	-8.1	-8.5	-9.1	-10.1	-11.6
External Receiver									
External Receiver - Residential Flats - Mechanical									
Sound Pressure, Lp:		11.9	8.2	-4.5	-6.2	-9.9	-17.0	-21.8	-33.6

Calculation Sheet

AHU FAI to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AHU FAI								
Sound Power Levels	73.0	70.0	70.0	68.0	60.0	56.0	53.0	53.0
Silencer								
	-4.0	-7.0	-11.0	-14.8	-17.1	-12.7	-10.7	-6.9
End Reflection								
	-5.1	-2.1	-0.7	-0.2	-0.1	0.0	0.0	0.0
External Grille Directivity								
	0.9	0.9	1.0	1.2	1.5	1.6	1.6	1.6
ISO 9613 Environmental Corrections								
	-33.2	-33.2	-33.2	-33.2	-33.3	-33.5	-34.3	-37.4
ISO 9613 Barrier Attenuation								
	-7.7	-7.5	-7.3	-6.8	-5.5	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Residential Flats - Mechanical								
Sound Pressure, Lp:	23.9	21.2	18.9	14.2	5.6	8.4	6.6	7.3

Calculation Sheet

AHU Exhaust to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - AHU Exhaust								
Sound Power Levels	75.0	77.0	76.0	79.0	77.0	72.0	68.0	69.0
Silencer								
	-4.0	-7.0	-11.0	-15.0	-19.0	-14.0	-12.0	-7.0
End Reflection								
	-5.1	-2.1	-0.7	-0.2	-0.1	0.0	0.0	0.0
External Grille Directivity								
	0.9	0.9	1.0	1.2	1.5	1.6	1.6	1.6
ISO 9613 Environmental Corrections								
	-33.2	-33.2	-33.2	-33.2	-33.3	-33.5	-34.3	-37.4
ISO 9613 Barrier Attenuation								
	-7.7	-7.5	-7.3	-6.8	-5.5	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Residential Flats - Mechanical								
Sound Pressure, Lp:	25.9	28.1	24.9	25.1	20.7	23.1	20.3	23.2

Calculation Sheet

CU1 Condenser to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU1 Condenser								
Sound Power Levels	85.0	81.0	78.0	78.0	74.0	69.0	64.0	59.0
Noise Control Treatments								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dc - Condenser Directivity								
	1.9	0.5	-1.2	-3.0	-4.8	-5.6	-5.6	-5.6
Adiv - Geometrical Divergence								
	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	-0.1	-0.1	-0.4	-1.2	-4.2
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.7	-7.5	-7.3	-6.8	-5.5	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Residential Flats - Mechanical								
Sound Pressure, Lp:	40.1	34.8	30.3	29.0	24.4	20.8	15.0	7.0

Calculation Sheet

CU2 Condenser to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU2 Condenser								
Sound Power Levels	85.0	81.0	78.0	78.0	74.0	69.0	64.0	59.0
Noise Control Treatments								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dc - Condenser Directivity								
	1.9	0.5	-1.2	-3.0	-4.8	-5.6	-5.6	-5.6
Adiv - Geometrical Divergence								
	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	-0.1	-0.1	-0.4	-1.2	-4.2
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.7	-7.5	-7.3	-6.8	-5.5	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Residential Flats - Mechanical								
Sound Pressure, Lp:	40.1	34.8	30.3	29.0	24.4	20.8	15.0	7.0

Calculation Sheet

CU3 Condenser to Residential Flats - Mechanical

	Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Noise Source								
Noise Source - CU3 Condenser								
-	90.0	86.0	82.0	82.0	73.0	71.0	69.0	67.0
Noise Control Treatments								
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dc - Condenser Directivity								
	1.9	0.5	-1.2	-3.0	-4.8	-5.6	-5.6	-5.6
Adiv - Geometrical Divergence								
	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2	-42.2
Aatm - Atmospheric Absorption								
	0.0	0.0	0.0	-0.1	-0.1	-0.4	-1.2	-4.2
Agr - Ground Attenuation								
	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Abar - Barrier Attenuation								
	-7.7	-7.5	-7.3	-6.8	-5.5	-3.0	-3.0	-3.0
External Receiver								
External Receiver - Residential Flats - Mechanical								
Sound Pressure, Lp:	45.1	39.8	34.3	33.0	23.4	22.8	20.0	15.0

Appendix B

Noise Control Treatments

Attenuator Schedule

Reference	Location	Description	Insertion Losses (dB)							
			63	125	250	500	1k	2k	4k	8k
ATT1-AHU	AHU Inlet	600L 45% Free Area	4	7	11	15	19	14	12	7
ATT2-AHU	AHU Exhaust	600L 45% Free Area	4	7	11	15	19	14	12	7

Notes:

1. All dimensions in mm
2. Performance shown as static insertion loss. Dynamic insertion loss performance allowing for airflow generated noise is shown on the relevant calculation sheet.
3. Selections are nominal and the successful supplier should ensure their proposal achieves the minimum required static and dynamic insertion loss performance.